User's Guide 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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| Part H | User's Guide for the program ELPLA-Boring |
| Part I | GEOTEC-Editor |

| Program authors: | M. El Gendy |
|------------------|-------------|
| | A. El Gendy |

GEOTEC: GEOTEC Software Inc. PO Box 14001 Richmond Road PO Calgary AB, Canada T3E 7Y7

> http://www.elpla.com geotec@elpla.com

Part A

Short description of the program package ELPLA



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1 Introduction

ELPLA (<u>ELASTIC PLATE</u>) is a program for analyzing raft foundations of arbitrary shape with the real subsoil model. The mathematical solution of the raft is based on the FE-Method. The program can analyze different types of subsoil models, especially the three-dimensional Continuum model that considers any number of irregular layers. A good advantage of this program is the capability to handle the three analyses of flexible, elastic and rigid foundations. In addition, the mesh of the rigid and flexible foundations can be constructed to be analogous to the finite elements mesh of the elastic foundation. Therefore the three analyses can be compared easily and correctly. ELPLA can also be used to represent the effect of external loads, neighboring foundations, tunneling and the influence of the temperature difference on the raft.

ELPLA is a 32-bit, graphical software product that operates under Microsoft Windows 9x/ NT/ ME/ XP. The common "what you see is what you get" of Windows applications makes it easy to learn how to use ELPLA, especially if you are already familiar with the Windows environment.

The program package ELPLA consists of 7 separate programs. These can run independently. The names and short descriptions of the separate programs are shown in Table A-1.

| 1 | |
|---------------|------------------------------------------------------|
| 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-Editor | Simple word processing program |

Table A-1Names and descriptions of ELPLA programs

2 Calculation methods

In ELPLA 9 different numerical methods with 3 soil models are considered for analyzing raft foundations as follows:

- 1) Linear contact pressure (Simple assumption model)
- 2) Constant modulus of subgrade reaction (*Winkler*'s model)
- 3) Variable modulus of subgrade reaction (*Winkler*'s model)
- 4) Modification of modulus of subgrade reaction by iteration (*Winkler*'s model/ Continuum model)
- 5) Modulus of compressibility method for elastic raft on half-space soil medium (Solving system of linear equations by elimination) (Isotropic elastic half-space soil medium - Continuum model)
- Modulus of compressibility method for elastic raft
 (Solving system of linear equations by iteration)
 (Isotropic elastic half-space soil medium and layered soil medium Continuum model)
- Modulus of compressibility method for elastic raft on layered soil medium (Solving system of linear equations by elimination) (Layered soil medium - Continuum model)
- 8) Modulus of compressibility method for rigid raft (Isotropic elastic half-space soil medium and layered soil medium - Continuum model)
- 9) Modulus of compressibility method for flexible raft (Isotropic elastic half-space soil medium and layered soil medium- Continuum model)

Beside the above 9 main methods ELPLA can also be used to analyze system of flexible, elastic or rigid foundations. Furthermore ELPLA can be used to analyze many other structural problems such as slab floors, grids, plane frame and plane stress.

3 Geometry and loads

It is possible to consider raft with any arbitrary shape including holes, Figure A-1. It is also possible to consider raft with variable thickness, Figure A-2. Loads on the raft can be applied independently on the mesh at any position. Loads may be defined in different types such as point loads, line loads and polygon uniform loads, Figure A-3.



Figure A-1 Arbitrary shape of raft with hole



Figure A-2 Variable slab thickness



Figure A-3 Arbitrary type of loads

4 Boundary conditions

It is possible to define elastic or fixed rotations and displacements on the raft, Figure A-4. Also translational or rotational springs may be defined.

5 Soil

The soil is defined by a number of borings; each boring has multi-layers with different soil materials, Figure A-5. Variable thickness and discontinuous soil strata can be considered, Figure A-6. Loading and reloading of the soil modulus can be taken into account by the analysis, Figure A-7. Three different methods are used to determine the flexibility coefficients or the modulus of subgrade reaction:

- 1 Hand-Division of boring logs to nodes
- 2 Subareas method
- 3 Interpolation method (Figure A-5)

It is possible to draw soil layers by different symbols according to the German Standard DIN 4023 for easy identification. Also the limit depth of soil layers can be determined. Variable foundation levels can be considered in the analysis (Figure A-6).







Figure A-5 The soil is defined by a number of borings



Figure A-6 Variable thickness soil strata

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| | Boring No.: 2 Name of boring: BPN2 Location of boring in global coordinates system [m]: Xb = 1, Yb = 9 |

Figure A-7 Loading and reloading soil modulus are considered

6 Design of the slab

The design of the slab for determining reinforcement and punching stress can be carried out according to the following design codes:

| - | EC 2 | European Committee for Standardization, Design of Concrete Structures Eurocode 2 |
|---|----------|-----------------------------------------------------------------------------------------|
| - | DIN 1045 | German Institute for Standardization, Design and Construction of Reinforced Concrete |
| - | ACI | American Concrete Institute Building Code Requirements for Structural Concrete |
| - | ECP | Egyptian Code of Practice for Design and Construction of Reinforced Concrete Structures |

7 Graphical drawing of data and results

You can display, plot and print data and results graphically using the sub program ELPLA-Graphic. It is possible to draw raft geometry, boring locations, soil profiles, loading, boundary conditions, settlement, deformation, contact pressure, moment, shear, modulus of subgrade reaction and reinforcement (Figure A-8 to Figure A-14).

The results and data can be presented graphically as follows:

- Data in the plan
- Data in isometric view
- Boring locations
- Boring logs
- Limit depth
- Arrangement of rafts including neighbor foundations
- Result values in the plan
- Distribution of results in the plan
- Results as contour lines
- Results in isometric view
- Results as circular diagrams
- Principal moments as streaks
- Support reactions as arrows
- Deformation
- Girders

The graphical drawing, if desired, can be saved as WMF-File, in which it can be exported into other Windows applications to prepare reports, slide presentations or add further information to the drawing.

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Figure A-8 Results can be tabulated on the mesh



Figure A-9 Results can be contoured



Figure A-10 Moment distribution on the raft can be plotted



Figure A-11 Principal moments as streaks



Figure A-12 Raft deformation can be plotted as a deformed mesh



Figure A-13 Results can be plotted in isometric shape

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Figure A-14 Results can be plotted as circular diagram

8 Drawing sections

Further more you can display, plot and print results at specified sections graphically using the sub program ELPLA-Section. It is possible to draw settlements, contact pressures, deformation, internal forces, modulus of subgrade reaction and reinforcement (Figure A-15 to Figure A-17). It is also possible to determine extreme values of the results from many load cases. The results can be presented graphically as follows:

- Section in x-direction
- Max./ Min. values in x-direction
- Overlapping in x-direction
- Section in y-direction
- Max./ Min. values in y-direction
- Overlapping in y-direction
- Arbitrary section

Also drawing sections, if desired, can be saved as WMF-Format files, in which they can be exported to other Windows applications to prepare reports, slide presentations or add further information.



Figure A-15 Results can be plotted at specified section



Figure A-16 Results from many projects can be plotted together



Figure A-17 Max. and Min. values can be calculated and plotted together

9 Tabulation of data and results

You can list data and results using the sub program ELPLA-List. Listing the data and results can be displayed first on the screen and then can be sent to the printer (Figure A-18 to Figure A-20). The results and data can be listed as follows:

- Display tables of data
- Print tables of data
- List tables of data through Text-Editor
- Display tables of results
- Print tables of results
- List tables of results through Text-Editor

The listed results and data, if desired, can be saved as ASCII-format Files, in which they can be exported to other Windows applications to prepare reports or add further information.

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Figure A-18 Data can be tabulated

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Figure A-19 Results can be tabulated

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Figure A-20 Data can be imported to other text editor applications

10 Typical applications of ELPLA

- * Soil-structure interaction problems
- * Analysis and design of rafts
- * Analysis of rigid rafts
- * Analysis of flexible foundations
- * Analysis and design of slab floors
- * Determining the consolidation settlements
- * Analysis and design of pile caps
- * Determining forces on piles due to structure loads
- * Settlement calculation of surface foundations
- * Determining the settlement due to surcharge fills or surcharge concentrated loads
- * Determining the surface settlement around rafts
- * Determining the constant or variable modulus of subgrade reaction
- * Effect of external loads or neighboring foundations
- * Effect of temperature difference
- * Effect of tunneling
- * Analysis of system of flexible, elastic or rigid foundations
- * Analysis of beams or grids by FE-Method
- * Simulation of excavations and construction of embankments
- * Determining the ultimate bearing capacity of the soil
- * Determining the limit depth
- * Eliminating negative contact pressure
- * Design of slabs according to codes ACI, EC 2, DIN 1045 and ECP
- * Determining the stress in soil

11 References

The program is a result of many extensive research works after many authors. Some of these references are:

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Part B

New features and enhancements in the program *ELPLA* 9.1



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

Version 9.2

Program authors: *M. El Gendy A. El Gendy*

GEOTEC: GEOTEC Software Inc. PO Box 14001 Richmond Road PO Calgary AB, Canada T3E 7Y7

Web site: http://www.elpla.com e-mail: geotec@elpla.com

ELPLA New features

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1 Enhancements in *ELPLA* 9.1 (MUI)

1.1 GEOTEC Office Applications with Multilingual User Interface

The new English-language versions of GEOTEC Office applications with Multilingual User Interface (MUI) are now available. The Multilingual User Interface Pack is a set of language XML resource files that can be added to the English version of GEOTEC Office applications. MUI Pack allows the user interface language to be changed according to the preferences of individual users to one of the available supported languages. MUI Pack provides a single version of GEOTEC Office applications to which users can add one or more MUI Packs providing local user interface and help files. Now, three languages are already available in *ELPLA* 9.1; English, German and Arabic.

The major benefits of the new MUI Pack are:

- Allows user interface switching between languages
- Easy to update with new languages
- Language-specific updates do not affect all languages
- Languages are XML based resources that make it easier to users to add their own languages.

1.2 GEOTEC Office Language Settings

Now the user can define the language of the user interface and help system used in GEOTEC Office applications. To select or change GEOTEC Office language setting, start "GEOTEC Office Language Settings" tool by clicking on the program icon in the Windows *Start-Menu*> *GEOTEC Office* > *GEOTEC Office Tools*. The language setting tool (Figure B-1) appears.

- In the "Display menus and dialog boxes in" list box, user can change the language of the menus and dialog boxes used in the GEOTEC Office applications. After selecting a new language, the user must quit and restart any Office applications he is currently using.

- In the "Display Help in" list box, the user can change the language of the Help system used in the GEOTEC Office applications.

ELPLA New features

| 🙀 GEOTEC | Office Language Settings | × | |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--|
| User Interfa | ce | | |
| F | You can change the language of the menus and dialog boxes used in the GEOTEC Office applications. After selecting a new language, you must quit and restart Office applications you are currently using. | | |
| | Display <u>m</u> enus and dialog boxes in: English | | |
| | You can change the language of the Help system used in the GEOTEC Office applications. | | |
| Display <u>H</u> elp in: | | | |
| | English | | |
| | | | |
| <u>S</u> ave | <u>Cancel</u> <u>H</u> elp | | |

Figure B-1 "GEOTEC Office Language Settings" Tools

1.3 ELPLA Quick Tour

When you starting *ELPLA* for the first time, the "*ELPLA* Quick Tour" program (Figure B-2) appears. The tour program gives a quick access to the main contents of the *ELPLA* package as shown in Table B-1.

| Contents | Description |
|--------------|----------------------------------------------------------------------------------------------------------|
| Tutorial | Taking the user step by step through some simple examples. |
| | These examples will help the user to become familiar with the most important functions of <i>ELPLA</i> . |
| Verification | Verify the mathematical models used in program ELPLA by comparing |
| Examples | ELPLA results with closed form or another published results. |
| | Illustrate how to use <i>ELPLA</i> for analyzing foundation by different subsoil models. |
| User's Guide | Display the complete User's Guide in a PDF-Format. |
| Start ELPLA | Start ELPLA to create a new project |

Table B-1ELPLA Quick Tour Contents

In the "Show this screen each time *ELPLA* starts" check box, you can choose whether you need to start the Quick Tour program each time when *ELPLA* starting or not. Also, you can start the "*ELPLA* Quick Tour" program any time by clicking on the program icon in the Windows *Start-Menu> GEOTEC Office> Welcome to ELPLA*.

| Nelcome to ELPLA | | × |
|---------------------------------|----------------------------------|---|
| ELPLA Analysis | and Design of Slab foundation | |
| CONTENTS | Welcome | |
| Verification Examples | Welcome to the ELPLA quick tour. | |
| 🗄 Start ELPLA | | |
| | | |
| Show this screen each time ELPI | A starts. | |

Figure B-2 "ELPLA Quick Tour" Program

1.4 Generating Circular Slab with Curved Element

A new template for generating second-order curved elements, Figure B-3, is now available for circular slab. As shown in Figure B-4, the new mesh refinement provides a better distribution of the results around the center of the circle, which reduces the local error in the elements around the center.

ELPLA New features



Figure B-3 Circular slab with curved elements



Figure B-4 Contour distribution for curved elements to the left and old elements to the right

1.5 Analysis of plane frame and plane stress

Besides the four different analyses available in the program *ELPLA* to analyze isolated raft, system of rafts, slab floors and grid, a new two analyses: Analysis of plane frame and plane stress are added (Figure B-5 and Figure B-6).



Figure B-5 Analysis of plane frame

ELPLA New features

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| -14712,3 KX/m2 x-SLresses Sight_n (kX/A2) Nen. Sight_n - TS244,4 eL node 80, Win. Sight_nTS950,5 eL node 2 | 1 |

Figure B-6Analysis of plane stress

2 Two-Dimensional Frame Problems

2.1 Introduction

The analysis of Two-Dimensional frame problems is now available in *ELPLA*. This section describes the frame modeling used for analysis this type of problems. It is recommended to read this section and to understand the procedures used by the program before starting to create any practical problem analysis.

2.2 Coordinate Systems

There are two different coordinates for Two-Dimensional frame problems; global coordinate system and local coordinate system (Figure B-7). Each of these coordinate systems is used to describe certain data such as the location of nodes or the direction of loads, displacements, internal forces and reactions. Understanding these different coordinate systems is essential for the user to define correctly the problem.



Figure B-7 System Coordinates

2.3 Element Loads

As shown in Figure B-8, *ELPLA* uses a different vertical direction for defining loads. The positive value of load means that it is a downward load. Nodal loads are applied on global coordinates while element loads are applied in three different cases as follow:

- a. Self weight: A vertical uniform load distributed along the length of the element.
- b. Snow load: A vertical uniform load distributed along the horizontal projection of the element.
- c. Wind load: A uniform load distributed along the length of the element with a direction perpendicular to the element (local x` axis).

ELPLA New features





2.4 Graphical output

The graphical output of results such as displacements, rotations and internal forces (bending moments, shear forces and normal forces) are drawn in locale coordinate.





I Introduction

GEOTEC Office is a package for geotechnical and design engineering. The package contains the following programs and tools:

| Program | Description |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ELPLA | Analyzing footings, rafts, piled rafts, pile groups and foundation groups. ELPLA considers different soil models, especially the three dimensional continuum model that considers any number of irregular layers. The program is able to handle the three solutions of flexible, elastic and rigid foundations. ELPLA can also be used to represent the effect of external loads, neighboring foundations, tunneling and the influence of temperature change on the slab. |
| BOHR | the German specification code DIN 4023. |
| | Analyzing single piles, pile walls, simple problems of rigid pile groups and rigid piled rafts. |
| GeoTools | Analyzing different problems in geotechnical engineering. |
| Self-Adaptive Mesh Wizard | Generating finite element mesh with better element/ node distributions. |
| GEOTEC-Editor | A simple word processing program for editing GEOTEC Office output. |

II Installing GEOTEC Office

GEOTEC Office is distributed on a CD-ROM. The CD-ROM contains an installer program that installs the GEOTEC Office software on your computer.

To install GEOTEC Office, 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 GEOTEC Office on your computer.



Figure 1 GEOTEC Office Installer form

- Click "Next" button in the form of Figure 1 to install GEOTEC Office on your computer.

GEOTEC Office Installer program begins execution. Follow the instructions given by the GEOTEC Office Installer program, Figure 2.

- Click "Next" button in the form Figure 2 to install GEOTEC Office software to the specified destination folder.

You can specify the folder for GEOTEC Office files. By default, GEOTEC Office suggests the (...\Program Files\GEOTEC Office). However, you can indicate a different folder name. GEOTEC Office creates the folder name you specify.

| 景 GEOTEC Office 9.2 | - 0 🗙 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Select Installation Folder | Office |
| The installer will install GEOTEC Office 9.2 in the following folder. To install in this folder, click "Next". To install to a different new or existing f below or click "Browse". | older, enter one |
| Eolder: E:\Program Files\GEOTEC Office\ You can install the software on the following drives: | <u>B</u> rowse |
| Volume C: D: (III) | Disk A 3 1 T |
| <u>C</u> ancel <u>P</u> revious | Disk Cost |

Figure 2 "Select Installation Folder" form

After select the installation folder, GEOTEC Office Installer program will be ready to install GEOTEC Office software on your program (Figure 3).

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

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

| ₿ GEOTEC Office 9.2 | | | |
|-----------------------------------------|----------------------|-----------|------------------|
| Confirm Installation | | | GEOTEC Office |
| The installer is ready to install GEOTE | C Office 9.2 on your | computer. | |
| Click "Next" to start the installation. | | | |
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Figure 3 "Confirm installation" form

| BEOTEC Office 9.2 | |
|---------------------------------------|-----------------------|
| Installing GEOTEC Office 9.2 | |
| | Öffice |
| GEOTEC Office 9.2 is being installed. | |
| Copying new files | |
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| Cancel | Previous <u>N</u> ext |

Figure 4 "Installing GEOTEC Office" form

GEOTEC Office installation will be completed and a message appears to inform you that the GEOTEC Office Installer was completed successfully (Figure 5).

| BEOTEC Office 9.2 | |
|---------------------------------------------------|----------------|
| Installation Complete | GEOTEC |
| | ✓ Office |
| GEOTEC Office 9.2 has been sucessfully installed. | |
| Click "Close" to exit. | |
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| <u>C</u> ancel | Previous Close |

Figure 5 Final Installer message

Note:

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

Part B

New features and enhancements in the program ELPLA



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

Version 9.2

Program authors: M. El Gendy A. El Gendy

GEOTEC: GEOTEC Software Inc. PO Box 14001 Richmond Road PO Calgary AB, Canada T3E 7Y7

> http://www.elpla.com geotec@elpla.com
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1 Preface

The program ELPLA is a part of the program group GEOTEC. The original program ELPLA 4.0 was developed first under the operating system MS DOS and then it was new revised for the operating system MS Windows 95 in order to use the possibilities of the user interface offered in it. The program runs also under Windows XP/ Vista/ 7/8.

ELPLA has a significant enhancement. The new features and enhancements are the result of feedback from users over the last years. The major enhancement in Version 9.0 is the ability to carry out a consolidation analysis beside elastic settlement analysis using the different calculation methods that are available in ELPLA. The program ELPLA also uses different types of finite elements, allowing the user to analyze any irregular shape of slabs with arc boundaries. Many improvements have been carried out in the generation of the flexibility matrix to allow the user solving large size problems faster.

The most important enhancements in ELPLA of versions 8.0 and 9.0 are explained in the next paragraphs.

2 Enhancements in version ELPLA 9.0

2.1 Design for punching

It is possible to design the slab floor or raft foundation for punching due to concentrated loads and reactions from columns, piles or supports. The design for punching is carried out according to 4 different codes: ACI, DIN 1054, EC2 and ECP.

2.2 Soil models

Now both layered soil model and isotropic elastic half-space soil model are available for all calculation methods. The isotropic elastic half-space soil model is added for the following methods:

- Method 4: Modification of Variable Modulus of Subgrade Reaction
- Method 6: Modulus of Compressibility (Iteration)
- Method 8: Modulus of Compressibility for rigid raft, Figure B-1
- Method 9: Modulus of Compressibility for flexible foundation

| ELPLA-Data - [Example] File Data View Main data Help I Graphic List Section Solver I C C IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII | | |
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| Calculation methods: Claiculation methods: 1 - Linear Contact Pressure 2/3 - Constant/ Variable Modulus of Subgrade Reaction 4 - Modification of Modulus of Subgrade Reaction 5 - Isotropic Elastic Half Space 6 - Modulus of Compressibility (Iteration) 7 - Modulus of Compressibility (Iteration) 8 - Rigid stabi 9 - Flexible foundation Subsoil model: Clayered soil model Help Save As Cancel < Back | Save | |
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Figure B-1 Menu "Calculation method"

2.3 Bearing capacity factors

The bearing capacity factors used to determine the ultimate bearing capacity can optionally be defined according to different codes and authors. These factors are required to carry out the nonlinear analysis of the soil. The bearing capacity factors are defined according to Figure B-2:

- German Standard DIN 1054
- Euro Code EC 7
- Egyptian code ECP
- Terzaghi
- Meyerhof

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Figure B-2 Menu "Bearing capacity factors"

2.4 Flexibility coefficients for interior nodes

For rigid and elastic rafts it is convenient to determine the flexibility coefficient of interior node at the characteristic point of the loaded area on that node. While for flexible foundation it is real to determine the flexibility coefficient of interior node at that node.

Now it is possible to determine the flexibility coefficient of the interior node due to a uniform load at that node, Figure B-3:

- at the characteristic point of the loaded area, where rigid settlement is equal to flexible settlement
- at the midpoint of the loaded area, where maximum settlement occurs
- at the interior node on the loaded area

2.5 Flexibility coefficients for exterior nodes

Earlier versions of ELPLA determine flexibility coefficients for both interior and exterior nodes by assuming uniform loaded areas on these nodes. This assumption needs to use the principle of superposition for determining the flexibility coefficients. Now it is possible, optionally to convert the loaded areas on exterior nodes to point loads (Figure B-3). By this way the program doesn't need to use the principle of superposition in the analysis, making it much faster than the old analysis. The new way of analysis is consequently faster and more efficient for problems that contain a large finite element mesh.

2.6 Limit distance

If the distance between two nodes is too large, the settlement of a node due to a load on the other will be small enough to be neglected. To reduce the time required for determining the flexibility coefficients for great rafts, a limit distance between node i and j for determining the flexibility coefficient c(i, j) may be defined (Figure B-3).

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| Main soil data | |
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| Soil properties Laiculation parameters of flexibility coefficients. Bearing capacity factors | |
| Flexibility coefficient c(i, i): | |
| The flexibility coefficient c(i, i) of the node i due to uniform load at that node is determined at: | |
| the characteristic point of the loaded area, where rigid settlement equal to flexible settlement | |
| C the midpoint of the loaded area, where maximum settlement occurs | |
| C the node i on the loaded area | |
| Flaubilly coefficient of the | |
| The flexibility coefficient of i i) of the node i is determined from: | |
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Figure B-3 Menu "Flexibility coefficients"

2.7 Soil properties

Elastic settlement and consolidation settlement can be determined using their actual properties, where the soil properties of the individual layers are defined by:

- Modulus of Compressibility Es (1/mv)
- Modulus of Elasticity E
- Compression Index Cc

This option enables ELPLA to analyze rafts on consolidated clay deposits by the different calculation methods that are available in ELPLA (Figure B-4). Also the user doesn't need to convert a soil parameter to another. When defining soil properties by the Modulus of Elasticity E, the *Poisson*'s ratio v_s can be different for every layer.

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| Boing log No. 1 from 1 boring logs: Layer No. 1 from 1 layers: Soil and rock symbols: Main soil type 1 S, Sand Main soil type 2 Submain soil 1 No symbole Submain soil 2 Soil properties are defined by Modulus of Compressibility Es (1/mv) Soil properties are defined by Modulus of Elasticity E Soil properties are defined by Modulus of Elasticity E Soil properties are defined by Modulus of Elasticity E Soil properties are defined by Modulus of Elasticity E Soil properties are defined by Modulus of Elasticity E Soil properties are defined by Modulus of Elasticity E Soil properties are defined by Compression Index Cc Ws [kN/m2] 10000 Gam [kN/m3] 18 Layer depth under the ground surface [m] 10,00 | |
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Figure B-4 Menu "Soil data"

2.8 FE-Net

Different element types are developed to generate the FE-Net of the slab according to Grid-based approach for both triangular and rectangular elements and according to *Delaunay*'s triangular generation for triangular elements.

A user-friendly embedded program for mesh generation is developed. The essential features in this embedded program are:

- generating the FE-Net for square, rectangular and irregular slabs using 6 different types of nets, Figure B-5
- generating the FE-Net for circular and ring slabs using 8 different types of nets, Figure B-6
- It can represent an irregular slab with openings and arc boundaries using a refine mesh, Figure B-7
- It is possible to use combined rectangular, quadratic and triangular finite elements at the same time for the slab, Figure B-8
- It is possible to define reference points and lines on the slab, Figure B-9. Reference points and lines are used to define the positions of girders, supports, piles, etc on the slab. Each time that the user generates the mesh, nodes of the FE-Net are passed automatically through these references. This provides the flexibility to make changes in the finite element mesh without having to redefine the positions of girders, supports, piles, etc

- You can refine the mesh in a specified region such as around supports to present the concentration of stress, moment and settlement in this region, Figure B-10
- It is possible to optimize the dimension of FE-Net by making all elements having nearly the same area using the option "smoothing the mesh"
- FE-Net can be displayed in separated elements, Figure B-11

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Figure B-5 Generation type for square, rectangular and irregular slabs



Figure B-6 Generation type for circular and ring slabs



Figure B-7 Irregular slab with triangular finite elements





Figure B-8 Irregular slab with combined rectangular, quadratic and triangular finite elements



Figure B-9 Reference points and lines on the FE-Net



Figure B-10 Refining the mesh around a specified node



Figure B-11 FE-Net in separated elements

2.9 Unit systems

It is possible to set different unit systems such as SI-system or English-system without changing the real value of any previously defined data, Figure B-12.

| ELPLA-Data - [Example] | | | _ 8 × | |
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| | | meter, [m] | | |
| | Force (1) | kilonewton, [kN] | | |
| | Force (2) | kilonewton, [kN] | | |
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Figure B-12 Menu "Setting unit system"

2.10 Creating tasks through Wizard assistance

Simple step-by-step Wizard assistance in different tasks is possible, such as creating input data, redefining existing data or generating the net of finite elements. The Wizard assistance simplifies the process of creating and redefining the data using the standard and familiar "wizard" interface. A Wizard is a series of forms in a special window helping you through a task. The Wizard is used throughout Windows and by many Windows applications. The Wizard interface is ideal if you want to know as little about the task as possible. With the Wizard you simply click the "Next" button few times to carry out the task. Figure B-13 shows an example for Wizard assistance when defining the calculation method.

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Figure B-13 Menu "Calculation methods" through Wizard assistance

2.11 Undo and Redo of commands

It is possible to undo and redo all commands in ELPLA-Data when defining a project. You may wish to undo the effects of a selected command and return to a previous state, Figure B-14.



Figure B-14 Undo and redo the commands when defining FE-Net

2.12 Compressing data files into one file

The files of input data, intermediate results or final results for a project can now optionally be stored in one compressed file. Instead of storing hundreds of data files, you can now have one automatically compressed file for each project. This makes it easier to send projects to other persons or simply manage your own files. It also reduces the amount of disk space required to store all of your data files. The compressed file is ZIP-compatible, allowing you to manually extract the data files using WinZip or other data compression tools if you wish, Figure B-15.



Figure B-15 Menu "Compressed project files"

2.13 Floating toolbars and icon menus

Many menu items and toolbars have been modified to make the commands easier to use:

- New toolbars have been added to ELPLA for quicker access to commonly used commands. These toolbars can be placed anywhere in ELPLA-window or can be hidden from view, Figure B-16
- Most of Menus and Popup-Menus in ELPLA have icons to easy identify the command, Figure B-17



Figure B-16 Toolbars can be placed anywhere in the ELPLA-window



Figure B-17 Menu "Graphic" with icons

2.14 Graphic output

- Line formats setting for ELPLA-Data and ELPLA-Graphic are the same, Figure B-18
- Max. ordinates setting for ELPLA-Data and ELPLA-Graphic are the same, Figure B-19
- Fill colors setting for ELPLA-Data and ELPLA-Graphic are the same, Figure B-20
- The boundaries between contour regions are improved to be very smooth, Figure B-21
- It is possible to draw girders in isometric view with actual size, Figure B-22
- Each girder type has a specific color to easy identify the girder system, Figure B-22



Figure B-18 Line formats for Data and Graphic are the same setting



Figure B-19 Max. Ordinates for Data and Graphic are the same setting



Figure B-20 Fill colors for Data and Graphic are the same setting



Figure B-21 Boundaries between contour regions are very smooth



Figure B-22 Girder system in isometric view with actual size

2.15 Diagrams

- It is easy to define the required section where a plan of the raft with the chosen section is displayed when defining that section, Figure B-23
- It can be drawn with the diagram, a legend shows the plan of FE-Net with line indicating the chosen section, Figure B-24
- It is possible to plot a diagram at any section of the raft, Figure B-24
- It is possible to export diagrams from ELPLA-Section to MS Excel
- It is possible to define a diagram in ELPLA-Graphic by Mouse and to send it to ELPLA-Section, Figure B-26



Figure B-23 Menu "Section in x-direction"



Figure B-24 Diagram with a legend showing a plan of FE-Net



Figure B-26 Defining a diagram in ELPLA-Graphic

2.16 Loads

- It is possible to define a polygon load with variable ordinates to represent dam or embankment loads, Figure B-27
- It is possible to define a line moment to represent moments from walls or line supports, Figure B-27
- Point load is never applied in reality. If a point load represents a column load on a mesh of refine finite elements, the moment under the column will be higher than the real moment. To take the effect of the load distribution through the slab thickness, the column load must be distributed outward at 45 [°] from the column face until reaching the center line of the slab. Now it is possible, to overcome this problem by converting the point load to an equivalent uniform load over an appropriate area, Figure B-28



Figure B-27 Polygon load with variable ordinates and line moment



Figure B-28 Distributing the column point load over an appropriate area

2.17 Column cross-section and punching area

- It is possible to define column dimensions that are used to design columns for punching and to convert column concentrated load to equivalent distributed load, Figure B-29
- Column cross-section can be drawn with column load, Figure B-29
- It is possible to draw column cross-sections in colored groups to easy identify the column capacity, Figure B-30
- Area of punching can be displayed according to the specified code of design with column cross-section, Figure B-31



Figure B-29 Column cross-sections with column loads



Figure B-30 Column cross-sections in colored groups



Figure B-31 Punching areas according to ACI with column cross-sections

2.18 Output list

- It is possible to open many projects at the same time in one view in the program ELPLA-List to compare between their results, Figure B-32

Figure B-32 Two projects are opened at the same time in the program ELPLA-List

3 Enhancements in version ELPLA 8.1

3.1 Analysis of grid

Besides the three different analyses available in the program ELPLA to analyze foundations and slab floors, a new analysis "Analysis of grid" is added (Figures B-33 and B-34).



Figure B-33 Menu "Analysis type"



Figure B-34 Beam-Moments

3.2 Determining stresses, strains and displacements in soil

You can determine the stresses, strains and displacements in soil under the foundation in a net in z-direction (Figures B-35 to B-38).

ELPLA can display results of stresses, strains and displacements in different forms such as:

- Soil deformation as deformed mesh, Figure B-39
- Soil deformation as vectors, Figure B-40
- Principal soil stresses as streaks, Figure B-41
- Principal soil strains as streaks, Figure B-42



Figure B-35 Menu "Net of soil elements in z-direction"



Figure B-36 Z-Stresses Sigma_z



Figure B-37 Z-Strains Epsilon_z



Figure B-38 Z-Displacements w



Figure B-39 Soil deformation as deformed mesh



Figure B-40 Soil deformation as vectors



Figure B-41 Principal soil stresses as streaks



Figure B-42 Principal soil strains as streaks

3.3 Language of the help

You can define the language of the help system used in ELPLA applications. The three languages are English, German and Arabic (Figures B-43 to B-46).



Figure B-43 Menu "Help language settings"



Figure B-44 Help language in German





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Figure B-46 Help language in Arabic

3.4 Converting Loads

Contact pressures on nodes or reactions may be converted to applied loads on these nodes, Figure B-47.

3.5 Displaying axis arrows

You can display axis arrows in x-, y- and z-directions, Figure B-48.



Figure B-47 Contact pressures on nodes as applied loads



Figure B-48 Raft with x- and y-axis arrows

3.6 Boring logs

The display of soil properties C and Phi is optional. This option allows displaying more borings together, Figure B-49.

Soil colors according to German Standard DIN 4023 are considered automatically, if desired, in the drawing of boring logs, Figure B-50.



Figure B-49 Many borings together



Figure B-50 Boring log with soil colors according to German Standard DIN 4023

4 Enhancements in version ELPLA 8.0

4.1 Calculation methods

- Besides the eight different calculation methods available in ELPLA to analyze foundations, a new method "Flexible foundation (method 9)" is added. This method can be used for settlement calculations of flexible foundations such as embankments, dams or direct loads on the ground, Figure B-51
- You can analyze system of flexible, elastic and rigid foundations together, Figure B-52
- You can determine the influence of flexible neighbor foundations or external loads of different arts on the examined foundation. Until now only the influence of elastic or rigid neighbor foundations could be considered, Figure B-53







Figure B-52 System of flexible, rigid and elastic foundations



Figure B-53 Influence of flexible neighbor foundations

- You can introduce translational or rotational spring stiffness on nodes for the rigid slab (method 8). Until now, it was possible only for methods 1 to 7. The springs can be used for analysis of rigid pile caps, Figure B-54
- Negative contact pressure can be eliminated for methods 1 to 8, if it appears on the bottom of the foundation. Until now, elimination of negative contact pressures was available for methods 4, 6 and 8, Figure B-55

4.2 Soil

- Not only bilinear but also nonlinear soil deformations can be taken into account, as example for plastic deformations at heavy loading, Figure B-56
- For all nodes the bearing capacity of foundation on a variable soil can be determined through interpolation, Figure B-57


Figure B-54 Rigid raft with translational and rotational spring

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Figure B-55 Elimination of negative contact pressure



Figure B-56 Nonlinear soil deformation



Figure B-57 Bearing capacity for variable soil

4.3 Plot parameters

- Line formats can be defined and saved, Figure B-58
- The fill color can be defined and saved, Figure B-59
- Font format (size, type ...) can be defined and saved, Figure B-60
- You can define and save the maximum ordinate, length, side or diameter of symbols for the drawing, Figure B-61

4.4 Input data

- The menus are extended by some explanation figures, Figure B-62
- The values of data, if desired, can be displayed on the FE-Net, Figure B-63
- The additional settlement can be defined graphically, Figure B-64
- Boring fields can be defined graphically, Figure B-65
- Boring logs can be inserted from a file, Figure B-66
- Besides the definition of girder section by moment of inertia and torsion moment of inertia, the section can be also defined by its width and height, Figure B-67



Figure B-58 Line formats





Figure B-60 Font







Figure B-62 Menu with explanation figure







Figure B-64 Defining additional settlements



Figure B-65 Defining boring fields

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Figure B-66 Inserting the boring log from file

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Figure B-67 Defining the girder section by width and height

- The stiffness of girders those have T/ L-section can be simulated on the slab by using additional beam elements. The stiffness of the girder can be obtained through a replacement beam arranged in the center plan of the slab. The dimensions of the replacement beam can be determined as in DIN 1075 or EC 2, Figure B-68
- When defining a set of data (for example FE-Net), another data with this set can be displayed for example FE-Net with loads and boring locations, Figure B-69
- The date can be defined from the computer calendar, Figure B-70
- When all data sets are defined and saved, changes are carried out to one set, the data that are affected by these changes can be automatically fixed (for example the data those are set outside the FE-Net), Figure B-71
- It is possible to import or export data to MS Excel, Figure B-72



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Figure B-68 Defining the girder of T/L-section



Figure B-69 View grouping data

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Figure B-70 Defining the date from computer calendar



Figure B-71 Fixing data outside FE-Net

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Figure B-72 Exporting and importing data to MS Excel

4.5 File list

- Not only all project data can be deleted but also intermediate results or final results can be separately deleted, Figure B-73
- Deleted files by ELPLA are sent to the recycle pin, Figure B-74
- It is possible to sort ELPLA-files according to project identification data (file name, description, date and project), Figure B-75

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Figure B-73 Deleting intermediate and finial results



Figure B-74 Sending deleted files to recycle pin

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Figure B-75 Sorting ELPLA-files

4.6 Templates

- Templates for different types of FE-Net are available, Figure B-76



Figure B-76 Templates for different types of FE-Net

4.7 Graphic

- The limit depth can be drawn, if desired, beside its corresponding boring log, Figure B-77
- When drawing a group of boring logs or limit depths in one presentation, the user has the possibility to choose the sequence of boring logs or limit depths (for example boring 6 at the left, boring 1 at the right next to it, boring 3 at the right next to boring 1 etc.). So the user can draw subsoil sections, Figure B-78
- The intensity of numbers on the contour lines can be decided through a writing factor, Figure B-79
- Legend for the maximum ordinate is inserted for results in isometric view, distribution of results in the plan, results as circular diagrams, deformation and principal moments as streaks, Figure B-80
- When studying the effect of neighbor foundations, all foundations can be drawn with data or results in one representation, Figure B-81



Figure B-77 Limit depth beside boring log



Figure B-78 Choosing the sequence of boring logs in the drawing



Figure B-79 Writing factor for contour lines



Figure B-80 Legend for maximum ordinate



Figure B-81 Drawing a group of foundations with data

- You can draw a group of data with results or a group of data together in one presentation (for example contour lines of settlements with loads and slab thickness, or loads with boring locations), Figure B-82
- When defining view angles about x-, y- and z-axis for a drawing in three-dimensional, the drawing is previewed on a small menu before displaying it on the screen, Figure B-83
- New expressed symbols for boundary conditions and supports are presented, Figure B-84
- If the system is symmetrical, the symbols of symmetry will be automatically drawn, Figure B-85
- The graphical drawing can be copied in Metafile-Format to Clipboard and then inserted directly to other Windows-programs, Figure B-86



Figure B-82 Drawing data and results in one presentation







Figure B-84 New expressed symbols for boundary conditions



Figure B-85 Drawing symbols of symmetry



Figure B-86 Copying the drawing to clipboard

4.8 List

- It is possible to export results to MS Excel, Figure B-87
- It is possible to export results to MS Word, Figure B-88
- A new user interface for the program ELPLA-List is developed. The user can deal with different results in different windows at the same time, Figure B-89
- With project Explorer it is possible to swap between data and results easily, Figure B-90

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Figure B-87 Export results to MS Excel

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Figure B-88 Export results to MS Word



Figure B-89 Many windows of data and results in ELPLA-List

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Figure B-90 Swapping between data and results

4.9 Languages

ELPLA is available in three languages: English, German and Arabic. An exchange of data for the three versions is possible with full compatibility .

4.10 Boring log

The new separate program ELPLA-Boring is developed. By the program the user can define boring logs graphically and draw limit depths, Figure B-94.



Figure B-94 ELPLA-Boring

4.11 ELPLA-Editor

A new separate program ELPLA-Editor is developed. The program is a simple editor program and can deal with text files that are created by ELPLA, Figure B-95.

| 🗮 ELPLA-Editor - [| untitled1 (Mo | odified)] | | | | | | _ 8 × |
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| Calculati | on method: | | | | | | | |
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| Modulus o | f Compressi | ibility for | r Rigid Sla | b | | | | |
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| No. of no No. of el | des ements | NR = 25 Ne = 16 | | | | | | |
| | | 10 | | | | | | |
| | | | | | | | | |
| Node coor | dinates: | | | | | | | |
| Node | Node- | Node- | X-coord. | Y-coord. | Node type | Art | | |
| | row | column | | | | | | |
| No. | No. | No. | [m] | [m] | | No. | | |
| , | | | | | Cornor | | | |
| 2 | 1 | 2 | 0.50 | 0.00 | Edge | 4 | | |
| 3 | 1 | 3 | 1.00 | 0.00 | Edge | 4 | | |
| 4 | 1 | 4 | 1.50 | 0.00 | Edge | 4 | | |
| 5 | 1 | 5 | 2.00 | 0.00 | Corner | 2 | | |
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4.12 Group functions

- The 7 separate programs ELPLA-Data, ELPLA-Solver, ELPLA-Graphic, ELPLA-Section, ELPLA-List, ELPLA-Boring and ELPLA-Editor can run independently of each other or as a group, Figure B-96
- All program menus are represented also by icons (Toolbar), Figure B-97
- Page setup (portrait format, landscape format, printer, ...) is saved separately for each of the programs ELPLA-Graphic, ELPLA-List, ELPLA-Section, ELPLA-Boring and ELPLA-Editor, Figure B-98
- The user can connect directly through ELPLA with ELPLA-Website in Internet, Figure B-99



Figure B-96 ELPLA-Graphic alone



Figure B-98 Page setup for each program

| I • [| | C 2 |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Infor | Analysis of slab foundation Version 8.0 | |
| Cast | skulation method: ethod (7) odukus of Compressibility (Elimination) | |
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| co Th plo | ordinates x/y, numbering of slab, boring locations, atrangement of external slabs) can be displayed. The drawing of the results and data can be displayed first on the screen, then can be sent to the printer or state. | |
| Pro | ogram aufrors | |
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Figure B-99 The user can connect to internet through ELPLA

- The computer knows the files of the ELPLA-project automatically. Running the program can be carried out by clicking on the icons of the files *.PO1, *.PO2 or *.BAU, Figure B-100

| 💐 Exploring - Temp | | | | | _ 🗆 × |
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| All Folders | Contents of 'Temp' | | | | |
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| 🖻 🖳 My Computer | 🔜 📴 un1 | 5KB | Boring Log | 7/14/98 1:47 PM | |
| 🕀 😴 3½ Floppy (A:) | Un2 | 5KB | Boring Log | 7/14/98 2:00 PM | |
| 🕀 📆 System (C:) | 🛄 🚟 un 3 | 5KB | Boring Log | 7/14/98 1:49 PM | |
| | 🚟 Un4 | 5KB | Boring Log | 7/14/98 1:47 PM | |
| I IIII IIII IIIII IIIIIIIIIIIIIIIIIII | Un1 | 1KB | ELPLA Project | 3/6/01 1:56 PM | |
| 🗄 📥 Asm | 🕂 Un2 | 1KB | ELPLA Project | 3/6/01 1:57 PM | |
| | Un3 | 1KB | ELPLA Project | 3/6/01 1:58 PM | |
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| D700 | I <mark>≋[#] ste</mark> | 1KB | ELPLA system of foundations | 7/15/98 9:56 PM | - |
| 12 object(s) | 1.39MB (Disk free space: 116MB) | | | | |

Figure B-100 Running ELPLA by clicking on project icon

4.13 Help file

- The help file in HTML-Format contains the text of the user's guide, Figure B-101



Figure B-101 Help file in HTML-Format

ELPLA Tools

Self-Adaptive Mesh Wizard



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

Version 9.2

Program authors:

M. El Gendy A. El Gendy

GEOTEC: GEOTEC Software Inc. PO Box 14001 Richmond Road PO Calgary AB, Canada T3E 7Y7

Web site: http://www.elpla.com e-mail: geotec@elpla.com

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Page

The Self-Adaptive Mesh Wizard is a tool that helps the user for generating finite element mesh with better element/ node distributions. The wizard is used to regenerate the finite element mesh for slab floor and raft problems. The new mesh will be generated based on the strain energy distribution. The self-adaptive technique used in this wizard reduces general system error besides enhances stress distributions. Adaptive mesh is generated either by using Delaunay generation or by using Grid-based generation (Figure 1).

Although the Self-Adaptive Mesh Wizard works with ELPLA Limit Edition, it is recommended to be used with ELPLA professional edition because the adapted mesh resulted from this wizard always has more than 300 nodes.

Note:

This wizard does not analyze any project. The project must be analyzed before running this wizard. Also the adapted project must be analyzed again after running the wizard.



Figure 1 Two types of adaptive mesh generation: Delaunay generation and Grid-based generation

Figure 2 shows the first form in the wizard which contains the following options:

Open Project

Displays the name and path of the selected project. You may type in the name and path of a project or choose a project using the "Browse" button.

Browse

Displays a dialog box you can use to browse to a project.

Recalculate Mesh Boundary

The Self-Adaptive Mesh Wizard can not detect any change made to the mesh boundary after generating mesh. For example, removing node from mesh will produce opening that can not be detected from the original mesh boundary. In this case, the "Recalculate Mesh Boundary" check box must be selected to ignore the original mesh boundary and create a new mesh boundary according to the last mesh modification.

Help

Displays the help topic for this step. Also pressing F1, gives the same action.

Cancel

Cancels previous actions and closes the Application Wizard.

Back

Moves to the previous step.

Next

Moves to the next step.

Finish

Accepts any selections that have been entered and the defaults for the remaining steps, then creates the adaptive mesh.



Figure 2 "Project" Form

The next form of the wizard is the "Generation Type" form. There are two types of mesh generation: Delaunay and Grid-based. Mesh optimization options are only available for Delaunay generation.

Smoothing mesh

By the "Smoothing mesh" option, the dimension of FE-Net can be optimized by making all element sides around each node having nearly the same length.

Directing border elements

By the "Directing border elements" option, all elements on the slab borders can be directed and arranged (see ELPLA-Data User's Guide for more details). This command is useful to present contact pressures at raft edges in good manner when analyzing the raft by Continuum model in which the contact pressure at raft edges are higher than that at the middle.

Element dimension parameters defined in the next wizard form depends on the generation type as follow:

Delaunay Generation

In the Delaunay generation (Figure 4), the minimum angle, element circumradius and minimum element circumradius are required to define.

Grid-Based Generation

In the Grid-based generation (Figure 5), the element size (length/width) and minimum element size (length/width) are required to define.

| Self-Adaptive Mesh Wizard | × |
|---------------------------|------------------------------------------------------------------|
| | Mesh optimization Smoothing mesh Directing border elements |
| | ack <u>N</u> ext > <u>F</u> inish |

Figure 3 "Generation Type" Form

| Self-Adaptive Mesh Wizard | | X |
|---------------------------|----------------|----------------|
| Generation parameters | | |
| Min. angle | theta [*] | 30 |
| Element circumradius | r [m] | 1 |
| Min. element circumradius | rmin [m] | 0.25 |
| | | |
| | | |
| Help Cancel < Back | <u>N</u> ext > | <u>F</u> inish |

Figure 4 Delaunay generation parameters

| Self-Adaptive Mesh Wizard | | × |
|-----------------------------------|------------|----------------|
| Generation parameters | | |
| Element size (length/ width) | a/b [m] | 1 |
| Min. element size (length/ width) | a/bmin [m] | 0.25 |
| | | |
| | | |
| | | |
| <u>H</u> elpCancel< <u>B</u> ack | Next> | <u>F</u> inish |

Figure 5 Grid based generation parameters

Adaptive Project

The last wizard form shown in Figure 6 displays the name and path of the output project. For selected project name, e.g. *ProjectName*, the wizard automatically displays an output name, e.g. *ProjectName_Adaptive*. You may type in the file name and path of the output project. You can also use the "Browse" button to navigate to the location where you want to save the project.



Figure 6 Grid based generation parameters

2 Samples for adaptive mesh

For the mesh of Example1 (Page 1), page 2 shows the adaptive mesh using Delaunay generation while page 3 shows the adaptive mesh using Grid-based generation.

Part C

User's Guide for the program ELPLA-Data



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

Version 9.2

Program authors: M. El Gendy A. El Gendy

GEOTEC: GEOTEC Software Inc. PO Box 14001 Richmond Road PO Calgary AB, Canada T3E 7Y7

> http://www.elpla.com geotec@elpla.com

ELPLA-Data

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1 An overview of ELPLA-Data

ELPLA-Data is used to define the FE-Net, calculation methods, boundary conditions, soil properties, slab properties, project identification, boring fields, etc. for a new problem. The program may also be used to modify the data of a problem that already exists.

The input project data can be defined through ELPLA-Data in the following steps:

- Calculation methods
- Project identification
- FE-Net data
- Girders
- Spring supports
- Supports/ Boundary conditions
- Piles
- Soil properties
- Net of soil elements in z-direction
- Limit depth
- Foundation (or slab) properties
- Reinforcement
- Boring fields
- Loads
- Neighboring foundations
- Temperature change
- Additional settlements

2 Description of ELPLA-Data

ELPLA-Data is a 32-bit, graphical software product that operates under Microsoft Windows XP/ Vista/ 7/ 8. The common "what you see is what you get" of Windows applications makes it easy to learn how to use ELPLA-Data, especially if you are already familiar with the Windows environment.

The program package ELPLA consists of 7 separate programs. The programs can run independently. The name and short description of the seven separate programs are given in Table C-1.

The usage of the program is typically such that first data files are created describing a certain problem by ELPLA-Data, then the project problem is analyzed by using ELPLA-Solver. Finally, the results can be presented as graphical drawing, graphs and tables using the five separate programs ELPLA-Graphic, ELPLA-Section, ELPLA-List, ELPLA-Boring and GEOTEC-Editor.

| 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-Editor | A simple text editor program | | |

 Table C-1
 Names and descriptions of the seven separate programs

Table C-2 gives a list of files, which are read or created by ELPLA-Data. The files can be classified in three groups.

| Table C-2 | Names of file groups |
|-----------|----------------------|
|-----------|----------------------|

| Gr | oup | Saved from the program |
|----|--------------------|------------------------|
| Α | Main data files | ELPLA-Data |
| В | Data files (*.DAT) | ELPLA-Data |
| C | Project data files | ELPLA-Data |

Further more, Table C-3 shows the filenames, contents and groups of all files that may be read or created by ELPLA-Data.

Table C-3Names and contents of files

| Α | Main | data | files |
|---|------|------|-------|
| | | | |

| 121 | |
|--------------|-----------------------------------------------------|
| Filename | Contents |
| FIRMA | Firm header |
| STEU | Default directory for files that are saved by ELPLA |
| NOFORMAT | Number formats |
| RFT | Design code parameters |
| UNITS | System of units |
| PREFEREN.DAT | FE-Net and calculation preferences |

B Data files

| Filename | Contents |
|---------------|------------------------|
| PLOTPAR. DAT | Plot parameters |
| FONT.DAT | Font data |
| NODISPLA.DAT | Data of display values |
| LINEFORM. GRA | Line formats |
| PAINT.GRA | Fill color data |
| ORDINATE.GRA | Max. ordinate data |

| C Project data fil | les |
|--------------------|---------------------------------------------------------|
| Filename | Contents |
| * .PO1 | System data (Analysis of isolated raft) |
| * .PO2 | System data (Analysis of system of rafts) |
| *. AUF | Project identification |
| *. BAU | Soil properties |
| *. LDH | Data of the limit depth |
| *. PC1 | Load data for slab and grid |
| *. PCF | Load data for plane frame |
| *. PCW | Load data for plane stress |
| *. PL6 | Node coordinates and element connectivity |
| *. PL8 | Slab boundary |
| *. GL1 | Girder data (Part 1) |
| *. GL2 | Girder data (Part 2) |
| *. P21 | Data of slab properties/ levels/ coordinates |
| *. P23 | Reinforcement data |
| *. P31 | Data of supports/ boundary conditions for slab and grid |
| *. P61 | Data of supports/ boundary conditions for plane frame |
| *. P71 | Data of supports/ boundary conditions for plane stress |
| *. P35 | Data of spring supports for slab and grid |
| *. P81 | Data of spring supports for plane frame |
| *. P91 | Data of spring supports for plane stress |
| *. P41 | File of boring fields |
| *. PT1 | Data of temperature change |
| *. PP1 | File of neighboring foundations |
| *. PV1 | Data of additional soil settlements |
| *. DSS | FE-Net in z-direction |
| *. PIL | Pile properties |

The asterisk (*) matches any filename with the specified extension.

The next paragraphs describe the purpose and function of each ELPLA-Data command.

3 Starting ELPLA-Data

Start ELPLA-Data by clicking the program icon in the Windows "Start"-Menu. The introduction screen (Figure C-1) appears.



Figure C-1 Introduction screen of the program ELPLA-Data

The menu head of Figure C-1 contains the following five commands:

- File
- Data
- View
- Main data
- Help

After clicking one of the five menu commands, other sub-commands or options become available, which are presented and described in the following paragraphs 4 to 11.

4 File Menu

The File Menu commands are:

- New project
- Open project
- Save project as
- File list
- Files 1, 2, 3, 4
- Exit

4.1 File Menu –"New project" command

By the "New Project" command the current project is closed, if one is loaded, and a new project is initialized for starting a new problem definition. "New project" command has the same action as quitting ELPLA-Data and then restarting ELPLA-Data. After clicking this command, the following Wizard assistance in Figure C-2 appears. This wizard will help the user to define the analysis type and the calculation method of the problem through a series of forms. The first form of "Calculation methods" Wizard is the "Analysis type" Form.



Figure C-2 "Analysis type" Form

ELPLA is used to analyze not only isolated raft but also slab floor, grid, plane frame, plane stress and system of rafts. In the "Analysis type" Dialog box (Figure C-2) choose one of the six analyses.

4.2 File Menu –"Open project" command

By the "Open project" command the current project is closed, if one is loaded, and an existing project is opened. Figure C-3 shows the "Open" Dialog box used to open a specified project. Because ELPLA is used to analyze an isolated raft and system of rafts, ELPLA can read two types of filenames. One has the extension of PO1, which represents the isolated raft and the other has the extension of PO2, which represents the system of rafts.

| Open | | | ? X |
|------------------------|------------------|-----------------------------|--------------|
| Look jn: 🔂 Ex | ample9 | 🗾 🖻 💆 | |
| Name | Size | Туре | Modif |
| 🔢 ^{#*} H12 | 1KB | ELPLA system of foundations | 01/01 |
| 🚛 ha1 | 1KB | ELPLA Project | 01/01 |
| Ha2 | 1KB | ELPLA Project | 01/01 |
| <u>دا</u> | | | Þ |
| File <u>n</u> ame: h | al | | <u>O</u> pen |
| Files of <u>type</u> : | LPLA-files (*.P(| 01,*.P02) | Cancel |

Figure C-3 "Open project" Dialog box

In case of one of the data files is not found, the following Message box appears (Figure C-4). This menu shows the project data that are not found. These data are important for the analysis.

| Open project - [gb6] | × |
|-------------------------------------------------------|--------------|
| Open project: The following data not found: | |
| Soil data Slab properties File of boring fields | |
| <u>k</u> | <u>H</u> elp |

Figure C-4 "Open project" Message box

4.3 File Menu –"Save project as" command

By this command the current project is saved under a new file name. Figure C-5 shows the "Save as" Dialog box used to save the project.

| Save As | | | | ? × |
|-----------------------|----------------------------------------|------------|-----|-------------|
| Save jn: 🔂 | Verification of grid foundation | E 💆 | 1 🖻 | |
| gr1 gr2 test | | | | |
| | | | | |
| j File name: | | | - | Cauca 1 |
| r lie <u>H</u> ame. | | | | <u>Jave</u> |
| Save as <u>type</u> : | Isolated slab foundation-files (*.P01) | • |] | Cancel |

Figure C-5 "Save as" Dialog box

4.4 File Menu –''File list'' command

By the "File list" command the user can delete, compress or extract projects, intermediate results, final results or print file lists of projects (Figure C-6). It is possible to sort ELPLA-files according to project identification data (file name, title, date and project).

| ELPLA file lis | t | | × |
|----------------|----------------------------------------|-----------|-------------------------|
| Look in: | | | |
| H:\ | | | |
| <u> </u> | | | <u>R</u> efresh |
| | | | Ston |
| File | Title | Date | 2.00 |
| gb1 | An irregular raft on irregular subsoil | 13.07.199 | Delete project |
| gb2 | An irregular raft on irregular subsoil | 13.07.199 | |
| gb3 | An irregular raft on irregular subsoil | 13.07.199 | Communicated 1 |
| gb4 | An irregular raft on irregular subsoil | 13.07.199 | Compless project |
| gb5 | An irregular raft on irregular subsoil | 13.07.199 | |
| ab6 | An irregular raft on irregular subsoil | 13.07.199 | Extract project |
| ab7 | An irregular raft on irregular subsoil | 13.07.199 | 1 |
| gb8 | An irregular raft on irregular subsoil | 13.07.199 | <u>H</u> elp |
| | | | Print file <u>l</u> ist |
| | | Þ | Close |

Figure C-6 "ELPLA File list" Dialog box

When the user chooses to delete a project, a Message box will appear (Figure C-7). Not only all project data can be deleted but also intermediate results or final results can be separately deleted.

Note

Deleted files by ELPLA go to the recycled pin.

| × |
|---|
| |
| |
| 3 |
| |
|) |

Figure C-7 "Delete project" Message box

4.5 File Menu –''Files 1, 2, 3, 4'' command

By the "Files 1, 2, 3, 4" command the user can open one of the last four loaded projects.

4.6 File Menu –''Exit'' command

By the "Exit" command the current project is closed and ELPLA-Data is quitted, Figure C-8.

| Program end | × |
|--------------|-----------|
| ? Program ex | ait! |
| ОК | Abbrechen |

Figure C-8 "Exit" Message box

In case of one of the project data is not defined, the following Message box in Figure C-9 appears. This menu shows the project data that are not defined. These data are important for the analysis.

| Close project - [gb6] | × |
|-------------------------------|--------------|
| Close project: | |
| The following data not found: | |
| Slab properties Load data | |
| L Cancel | <u>H</u> elp |

Figure C-9 "Close project" Message box

5 Data Menu

The Data Menu is the main menu, which is used to define the problem. The Data Menu commands are:

- Calculation methods
- Project identification
- FE-Net data
- Girders
- Spring supports
- Supports/ Boundary conditions
- Piles
- Soil properties
- Net of soil elements in z-direction
- Limit depth
- Foundation (or slab) properties
- Reinforcement data
- Boring fields
- Loads
- Neighboring foundations
- Temperature change
- Additional settlements

5.1 Data Menu–"Calculation methods" command

By this command the analysis method of the project is defined. When choosing the "Calculation method" command, the "Calculation methods" Wizard in Figure C-2 appears with the "Analysis type" Form. In this Form define the analysis type of the problem from different structural systems that are available in ELPLA. After selecting the structural system, click "Next" button to go to the next Form.

Calculation methods for an isolated slab foundation

Nine different numerical calculation methods are considered for the analysis of rafts according to Figure C-10. Choose one of the methods No. 1 to 9.

| Calculation methods | |
|--------------------------------------------------------------------------------|--|
| Calculation methods: | |
| O 1- Linear Contact Pressure | |
| 2/3- Constant/ Variable Modulus of Subgrade Reaction | |
| O 4- Modification of Modulus of Subgrade Reaction by Iteration | |
| ○ 5- Isotropic Elastic Half Space | |
| O 6- Modulus of Compressibility (Iteration) | |
| O 7- Modulus of Compressibility (Elimination) | |
| 🔿 8- Rigid slab | |
| ○ 9- Flexible foundation | |
| Determining modulus of subgrade reaction: | |
| Modulus is defined by the user | |
| O Modulus is calculated from Half Space | |
| O Modulus is calculated from soil layers | |
| | |
| Help Save As Cancel < Back Next > Save | |

Figure C-10 "Calculation methods" Dialog box

System symmetry

The next Form is the "System symmetry" Form, Figure C-11. In this form select system symmetry and click "Next" button to go to the next Form.

| Calculation methods | |
|---------------------------------|-----------------------------------|
| System symmetry: | |
| Unsymmetrical system | |
| | |
| Symmetrical system about x-axis | Double-symmetrical system |
| | × |
| Symmetrical system about y-axis | Anti-symmetrical system in x-axis |
| | |
| Help Save <u>A</u> s Cancel | <u>Next>S</u> ave |

Figure C-11 "System symmetry" Form

By using the system symmetry, if the problem is symmetrical in loading, shape and soil about xor y-axis, the computational time and computer storage can be considerably reduced. By defining the project data for simple symmetrical or antisymmetrical slab system the data are defined according to Figure C-12, in which only the lower half slab is considered for symmetry about x-axis while only the left half slab is considered for symmetry about y-axis.



Figure C-12 Simple symmetrical slab system

By defining the project data for double symmetrical slab system the data are defined according to Figure C-13. Only the left lower quarter of the slab is considered.



Figure C-13 Double symmetrical loaded slab

If the slab is symmetrical in shape and unsymmetrical in loading, it is also possible to divide this general case of loading into two cases having symmetrical and antisymmetrical loading, Figure C-14.



Figure C-14 General case of loading by symmetrical and antisymmetrical loading

The symmetrical cases are available for all calculation methods 1 to 9. The antisymmetrical case is only possible for calculation methods 4 to 8.

Determination of modulus of subgrade reactions

In ELPLA it is possible to analyze the raft by modulus of subgrade reaction method in which the modulus can be determined by three ways:

- a) Modulus is defined by the user
- b) Modulus is calculated from Half-space
- c) Modulus is calculated from soil layers

In item a) the user can define a constant modulus for the entire raft (Method 2) or a variable modulus at nodes (Method 3).

In items b) and c) the modulus is calculated through the settlement calculation of the soil depending on boring logs and soil properties.

By the modulus of subgrade reaction method, specify the way for determining the modulus of subgrade reaction by selecting one of the available three options in Figure C-2.

Options

Some options are available in ELPLA such as concrete design of sections, additional springs, supports, girders and piles, determining the limit depth, nonlinear subsoil model, determining displacements, stresses and strains and in soil. Also, ELPLA can study some external influences on the raft such as temperature change, additional settlements or neighboring foundations. In the menu of Figure C-15 check the options that you want to consider in the analysis.

| Calculation methods |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Options: |
| Slab with girders ▲ Additional springs ▲ Supports/Boundary conditions Piled raft foundation Determining limit depth Concrete design Nonlinear subsoil model Determining stresses in soil Determining stresses in soil Determining stresses in soil Image: Stresse in soil Determining strains in soil Image: Stresse in soil I |
| Help Save As Cancel < Back Mext > Save |

Figure C-15 "Options" Check box

Analysis of system of many slab foundations

In the "Analysis type" Form (Figure C-2), if the option "Analysis of system of many slab foundations" is chosen, the following Dialog box in Figure C-16 appears. Three different numerical calculation methods are considered for the analysis of system of slab foundations, flexible, elastic or rigid. For the analysis of system of many slab foundations the project filenames (slab foundations) are required.

| | - | | | | |
|-----|--------|---------------|-----------|-----------|-----|
| No. | | Filename of P | Project | Slab type | |
| 1 | Raft1 | | | elastic | |
| 2 | Raft2 | | | elastic | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| hbA | nniect | 1 Bemovi | e project | | New |

Figure C-16 "Analysis of system of many slab foundations" Dialog box

Analysis of a slab floor, plane frame or plane stress

By choosing the analysis of a slab floor, plane frame or plane stress only the "System symmetry" Form and "Options" Check box will appear.

5.2 Data Menu–"Project identification" command

By the "Project identification" command the information to identify the problem can be specified, Figure C-17. This information is required for printing and plotting the data and results. The date can be defined from the computer calendar, Figure C-18.

| Proj | ect ide | ntifica | tion | | | | | | | × |
|------------------|--------------|-----------|------------------|---------|--------------|---|--------------|---|-----------------|---|
| _[Pro | oject ider | ntificati | on: | | | | | | | |
| Ti | tle | Analy | sis of system of | footing | 9 | | | | | 1 |
| Da | ate | Mono | ly, June 11,200 | 1 | | | | | • | Ĩ |
| Pr | oject | Footi | ng 1[| _ | | _ | | _ | | 1 |
| | | | | | | | | | | |
| | <u>S</u> ave | | <u>C</u> ancel | | <u>H</u> elp | | <u>L</u> oad | | Save <u>A</u> s | |

Figure C-17 "Project identification" Dialog box

| HELPLA-Data - [untitled] File Data View Main data Help D Control | <u>G</u> raphic | ₽_× List <u>S</u> ection Sol <u>v</u> er |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| Image: Constraint of the second se | June 2001 ue Wed Thu Frii 9 30 31 1 5 6 7 8 2 13 14 15 9 20 21 22 8 4 5 6 10/10/01 | • Sat 2 9 16 23 30 7 1255 PM |
| | 10/10/01 | 12.301 M |

Figure C-18 Input Date information

5.3 Data Menu–"FE-Net data" command

By the "FE-Net data" command the net of the finite elements is defined. When the "FE-Net data" command is chosen, the following embedded program appears (Figure C-19).



Figure C-19 "FE-Net" embedded program

The menu head of Figure C-19 contains the following nine menus:

- File
- View
- Graphically
- FE-Net Generation
- In table
- Options
- Format
- Window
- Help

After clicking one of the nine menus other sub-menus or commands become available. The following paragraph presents and describes the nine menu commands and their sub-commands.

5.3.1 File Menu

This menu contains the following commands:

- New FE-Net
- Open FE-Net
- Save FE-Net
- Save FE-Net as
- Close FE-Net

File Menu–''New FE-Net'' command

A new FE-Net is created. When choosing this command, the following templates for different types of FE-Net appear (Figure C-20).

| FE-Net generation | | | |
|----------------------------|----------------|----------------|--------|
| Slab type | | | |
| | | | 0 |
| Rectangular slab: | | | |
| Length of rectangular slab | | L [m] | 20.00 |
| Width of rectangular slab | | B [m] | 14,00 |
| | | | |
| Cancel | < <u>B</u> ack | <u>N</u> ext > | Einish |

Figure C-20 Templates for different types of FE-Net

File Menu-"Open FE-Net" command

Loads are saved as FE-Net again. Then the loaded FE-Net, if desired, can be redefined.

File Menu-"Save FE-Net" command

The command saves the active FE-Net under the available name.

File Menu-"Save FE-Net as" command

The active FE-Net is saved under a new name.

File Menu-"Close FE-Net" command

Closes the FE-Net embedded program and returns to ELPLA-Data.

5.3.2 View Menu

The View Menu command is Tool bars.

View Menu-"Tool bars" command

The "Tool bars" command displays tool bars located just below the menu head. Tool bars contain icons of program menus.

5.3.3 Graphically Menu

This menu contains the following commands:

- Undo
- Redo
- Select nodes
- Remove nodes
- Add nodes
- Slab corners by Mouse
- Add opening
- Add reference points
- Add reference lines
- Cartesian grid

Graphically Menu-"Undo" command

This command is used to undo the effects of a selected command and return to a previous state.

Graphically Menu-"Redo" command

This command is used to redo the last action of "Undo" command.

Graphically Menu-"Select nodes" command

The function of "Select nodes" command is to provide a method for deleting nodes. When "Select nodes" command is chosen, the cursor will change from an arrow to a cross hair. The commands "Remove nodes" in the menu "Graphically" will be enabled, indicating the mode in which is being operated. The desired nodes are selected by clicking on each node individually or selecting a group of nodes as shown in Figure C-21. A group of nodes can be selected by holding the left mouse button down at the corner of the region and 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.

| 븕 E | LPLA | -D ata | a - [Ex | ampl | e] - [| FE-N | et] | | | | | | | | | | | | | | | | | _ 8 × |
|------|------|----------|---------------|--------|--------|---------------|-------------|----------|---------------|------|-------------|-------|-------------|------|---------------|------------|------|---|---|---|-----|-----|----|------------|
| ₿ Ei | e ⊻i | iew | <u>G</u> raph | ically | FE- | <u>N</u> et C | ienera | ation | <u>I</u> n ta | able | <u>O</u> pl | tions | Form | at_∖ | <u>M</u> indo | w <u>I</u> | Help | | _ | | | | | * <u>×</u> |
| ĒD | È | H | <u> </u> | | 行 | ∜∕ | 5 | • | = | 2 | ÷ | A | ، () | ् | € | Q | 100 | • | Q | • | ≥ 6 | ۵ 🛍 | ۲Ų | |
| ŝ | Cil | - | * | • • | | | | | # | # | | • | | | 1 | 4 | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
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| ŀ | | + | | | | | | | + | | | | | + | -+- | | | | - | | | | | |
| l | | L | | | | | | | | | | | | | | | | | _ | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| ŀ | | + | | | | | | | + | -+- | | | | + | -+- | | | | - | | | | | |
| | | + | | | | 3 1 | - -1 | | - | | 6 | J | | + | -+- | | | | - | | | | | |
| L | | | | | | | | | _ | _ | | | | | | | | | | | | | | |
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| ŀ | | + | | | 6 | 3 1 | | İ | + | | | | <u>+</u> | + | - +- | | | | - | | | | | |
| ···· | | + | | | | 3 1 | ģ | | + | -+- | | | ÷ | + | -+- | + | | | - | | | | | |
| L | | <u> </u> | | | | B 1 | | | 1 | | | | | 1 | | | | | _ | | | | | |
| | | | | | | | Ī | | | | | | | | | | | | | | | | | |
| ···· | | + | | | | | | | + | -+- | | | | + | -+- | | | | - | | | | | |
| ŀ | | ÷ | ÷ | | | | | | ÷ | | | | ÷ | ÷ | -+- | | | | - | | | | | |
| ŀ | | + | | | | | | | + | | | | | + | -+- | | | | - | | | | | |
| ŀ | | + | | | | | | | + | +- | | | | | - | | | | - | | | | | |
| ŀ | | + | ÷ | | | | | | ÷ | -+ | | | | | | | | | - | | | | | |
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| ┛ | | | | | | | | | | | | | | | | | | | | | | | | |

Figure C-21 Select nodes to be removed

Graphically Menu-"Remove nodes" command

"Remove nodes" command is used to remove the selected nodes. Any elements bonded the deleted nodes are also deleted (Figure C-22).



Figure C-22 Selected nodes were removed

Graphically Menu-"Add nodes" command

By the "Add nodes" command nodes can be added at anywhere to the FE-Net. Clicking by Mouse inside the required element adds a new node in the element (Figure C-23).



Figure C-23 Selected nodes were added

Graphically Menu-"Slab corners by Mouse" command

In ELPLA there are two alternative possibilities to define slab corners either by Mouse or by editing in a table. "Slab Corners by Mouse" Command is used to define corners of irregular slab by Mouse. The coordinates of corner positions (x, y) are related to the left bottom corner of the corresponding slab. Corners are set as a polyline, which is a connected sequence of lines or arc segments created as a single object.

To draw a slab polyline containing a line and arc combination by Mouse (Figure C-27):

- Choose the "Slab Corners by Mouse" Command from the "Graphically" Menu. The cursor will change from an arrow to a cross hair
- Click the left mouse button on the position of the start point of the first line segment and drag the mouse until the position of the end point of this segment. Then click on the end point position to consider the first line segment (Figure C-24)

- Press "A" key to switch to arc segment mode. The first point of the arc is the endpoint of the previous segment. As you drag the mouse, ELPLA draws an arc connected to the previous line segment and extended to the mouse position, Figure C-25. For drawing the arc segment the rotation direction and the radius of the arc segment is required to define. There are four cases concerning the rotation direction and the radius as shown in Figure C-26. Two of these cases are related to the position of the arc center relative to the line connected the arc points (Figure C-26a). The other two cases are related to the direction of the arc rotation starting from the first point of the arc to the second point, Figure C-26b. The arc can be drawn clockwise or anticlockwise
- Press "R" key to switch between the two possibilities of the arc center position
- Press "C" key to switch between the arc clockwise and anticlockwise directions
- Click the left mouse button on the position of the end point of the arc to consider the arc segment
- Press "A" key again to switch to line segment mode
- Repeat the previous steps for drawing arc or line segment whenever is applicable until finishing the polyline
- Double click the left mouse button on the position of the endpoint of the last segment to finish the "Slab Corners by Mouse", Figure C-27



Figure C-24 Drawing the first line segment



Figure C-26 Four cases for drawing arc segments



Graphically Menu-"Add opening" command

To define an opening in the slab (Figure C-28), the position (x, y) of the opening corners must be entered by Mouse. The coordinates of corner positions (x, y) are related to the left bottom corner of the corresponding mesh. To draw an opening with arc segments, consider the same steps in drawing slab corners with arc segments.



Figure C-28 Defining opening corners in the slab by Mouse

Graphically Menu-"Add reference points" command

By this option it is possible to define reference points on the slab by Mouse, Figure C-29. Reference points are used to define the positions of boundary points such as supports, springs, piles on the slab. Each time that the user generates the mesh, nodes of the FE-Net are passed automatically through these references. This provides the flexibility to make changes in the finite element mesh without having to redefine the positions of the boundary points.



Figure C-29 Reference points on the FE-Net

Graphically Menu-"Add reference lines" command

By the option "Add reference lines" it is possible to define reference lines on the slab by Mouse, Figure C-30. Reference lines are used to define the positions of boundary lines such as girders on the slab. Each time the user generates the mesh, nodes of the FE-Net are passed automatically through these references. This provides the flexibility to make changes in the finite element mesh without having to redefine the positions of the boundary lines.



Figure C-30 Reference lines on the FE-Net

Graphically Menu-"Cartesian grid" command

The Dialog box in Figure C-31 appears to define a Cartesian grid, which is a background grid of points to assist in drawing the finite element mesh. These points can be 'Snapped to' when creating the mesh geometry in order to create nodes and elements with exact coordinates.



Figure C-31 "Cartesian grid" Dialog box

5.3.4 FE–Net Generation Menu

This menu contains the following commands:

- Generation type
- New generation
- Generating FE-Net
- Smoothing the mesh
- Directing border elements
- Refining the mesh

FE-Net Generation Menu-"Generation type" command

By the option "Generation type" the following Menu in Figure C-32 appears to define the type of FE-Net. There are 6 different element types to generate the FE-Net of the slab. The generation is carried out according to Grid-based approach for both triangular and rectangular elements and according to Delaunay's triangular generation for triangular elements.



Figure C-32 Generation type for square, rectangular and irregular slabs

When generating circular and ring slabs for the first time, the Menu of Figure C-33 appears with 8 different types of nets.



Figure C-33 Generation type for circular and ring slabs

FE-Net Generation Menu-"New generation" command

When FE-Net is defined, a new generation with new dimensions of elements or even slab can be carried out using "New generation" command.

FE-Net Generation Menu-"Generating FE-Net" command

After defining the slab corners, element dimensions and type of FE-Net the generation of the FE-Net can be created automatically by choosing the option "Generating FE-Net".

FE-Net Generation Menu-"Smoothing the mesh" command

By the option "Smoothing the mesh" it is possible to optimize the dimension of FE-Net by making all elements having nearly the same area as possible as.

FE-Net Generation Menu-"Directing border elements" command

It is possible to direct and arrange all elements on the slab borders (Figure C-34). This option is useful to present contact pressures at raft edges in good manner when analyzing the raft by Continuum model, in which the contact pressure at raft edges are higher than that at the middle.



Figure C-34 Directing border elements

FE-Net Generation Menu-"Refining the mesh" command

It is possible to refine the mesh in a specified region such as around supports, springs and piles to present the concentration of stress, moment and settlement in this region (Figure C-35).



Figure C-35 Refining the mesh around a specified node

5.3.5 In table Menu

This menu contains the following commands:

- Slab corners
- Opening corners
- Reference points
- Reference lines
- Node coordinates
- Connectivity nodes

In table Menu -"Slab corners" command

By the option "Slab corners" the position (x, y) of the slab corners can be defined (Figure C-36). The coordinates of corner positions (x, y) are related to the left bottom corner of the corresponding slab.

| egment No. 1 from 4 Segment data Start position | Segments: | [m] [0.00 | |
|-------------------------------------------------------|--------------|-----------|----------------------|
| | от у1 | [m] [0,00 | |
| End position | ж2 | [m] 12,00 | |
| · | y2 | [m] 0,00 | |
| Use arc data: | | | |
| Arc radius | R | [m] 0,00 | |
| Min. arc radius | Rmin | [m] 6,00 | Segment <u>c</u> opy |
| 🗖 Reverse rotati | on direction | | Segment insert |
| 🗖 Reverse radiu | s position | | Segment delete |
| | | | |

Figure C-36 Defining slab corners in a table

In table Menu–"Opening corners" command

Openings in the slab can be defined, Figure C-37. To define an opening in the slab, the position (x, y) of the opening corners must be entered in the Menu of Figure C-37. The coordinates of corner positions (x, y) are related to the left bottom corner of the corresponding mesh.

| Start position | x1 v1 | [m] 10,00 | | |
|-------------------|--------------|-----------|------------------------|----------|
| End position | x2 | [m] 12,00 | | |
| | y2 | [m] 2,00 | | |
| 🗖 Use arc data: | | | | |
| Arc radius | R | [m] 0,00 | | |
| Min. arc radius | Bmin | [m] 1,00 | Segment <u>c</u> opy | |
| 🔲 Reverse rotatio | on direction | | Segment insert | |
| Reverse radius | : position | | Segment <u>d</u> elete | _ |

Figure C-37 Defining opening corners in a table

In table Menu-"Reference points" command

By this option it is possible to define reference points on the slab in Table, Figure C-38. Reference points are used to define the positions of boundary points such as supports, springs, piles on the slab. Each time the user generates the mesh, nodes of the FE-Net are passed automatically through these references. This provides the flexibility to make changes in the finite element mesh without having to redefine the positions of the boundary points.

| R | eferenc | e points | | × |
|---|-----------------|------------------------|------------------------|----------------|
| | No. [•] | x-position x [m] | y-position y [m] | |
| | 1 | 3,00 | 5,00 | |
| | 2 | 8,00 | 9,00 | Insert |
| | 3 | 9,00 | 3,00 | |
| | | | | <u>C</u> opy |
| | | | | <u>D</u> elete |
| | | | | New |
| | | | | Help |
| | | | | Excel |

Figure C-38 Defining reference points in Table

In table Menu-"Reference lines" command

By the option "Reference lines" it is possible to define reference lines on the slab in Table, Figure C-39. Reference lines are used to define the positions of boundary lines such as girders on the slab. Each time that the user generates the mesh, nodes of the FE-Net are passed automatically through these references. This provides the flexibility to make changes in the finite element mesh without having to redefine the positions of the boundary lines.

| F | eferenc | e lines | | | | × |
|---|-----------------|-------------------------|-------------------------|-----------------------|-----------------------|----------------|
| | No. I [•] | Line start x1 [m] | Line start y1 [m] | Line end x2 [m] | Line end y2 [m] | <u>O</u> k |
| | 1 2 | 5,00 3,00 | 5,00 2,00 | 8,00 9,00 | 9,00 3,00 | <u>I</u> nsert |
| | | | | | | <u></u> ору |
| | | | | | | <u>D</u> elete |
| | | | | | | New |
| | | | | | | <u>H</u> elp |
| | | | | | | Excel |

Figure C-39 Defining reference lines in a table

In table Menu-"Node coordinates" command

After choosing the option "Node coordinates" the following Table in Figure C-40 appears to define node coordinates of FE-Net.

| Nod | le coa | rdinates | | | X |
|-----|-------------|---------------------|---------------------|----------|----------------|
| M | lode No. | x-coordinate [m] | y-coordinate [m] | ^ | <u>0</u> k |
| | I | | | | <u>C</u> ancel |
| | 1 | 0,00 | 0,00 | | |
| | 2 | 0,50 | 0,00 | | <u>I</u> nsert |
| | 3 | 1,00 | 0,00 | | |
| | 4 | 1,50 | 0,00 | | <u>C</u> opy |
| | 5 | 2,00 | 0,00 | | |
| | 6 | 2,50 | 0,00 | | <u>D</u> elete |
| | 7 | 3,00 | 0,00 | | |
| | 8 | 3,50 | 0,00 | | <u>N</u> ew |
| | 9 | 4,00 | 0,00 | | |
| | 10 | 4,50 | 0,00 | | <u>H</u> elp |
| | 11 | 5,00 | 0,00 | | |
| | 12 | 5,50 | 0,00 | - | Excel |

Figure C-40 Table "Node coordinate"

In table Menu–"Connectivity nodes" command

After choosing this option the following Table in Figure C-41 appears to define connectivity nodes of the elements.

| C | onnectiv | vity nodes | | | | x |
|---|---------------------|------------|--------|--------|--------|-----------------------------|
| | Element No. I | 1.Node | 2.Node | 3.Node | 4.Node | Dk <u>D</u> k <u>Cancel</u> |
| | 1 | 263 | 129 | 128 | | |
| | 2 | 260 | 135 | 136 | | <u>I</u> nsert |
| | 3 | 351 | 129 | 130 | | |
| | 4 | 335 | 189 | 261 | | <u>С</u> ору |
| | 5 | 285 | 82 | 83 | | |
| | 6 | 380 | 281 | 374 | | <u>D</u> elete |
| | 7 | 162 | 53 | 54 | | |
| | 8 | 407 | 272 | 332 | | <u>N</u> ew |
| | 9 | 399 | 165 | 305 | | |
| | 10 | 237 | 159 | 195 | | <u>H</u> elp |
| | 11 | 290 | 102 | 101 | | |
| | 12 | 291 | 42 | 43 | | Excel |

Figure C-41 Table "Net of finite elements"

5.3.6 Options Menu

The Options Menu has the following commands:

- Plot parameters
- Display values
- View grouping

Options Menu-"Plot parameters" command

Plot parameters may be set as default values by the program, or may be fully specified by the user. By this command the following plot parameters can be specified, Figure C-42:

- Display node numbering
- Display coordinates x, y
- Display element numbering
- Display Column types
- Display FE-Net in separated elements

- Color girders
- Draw girder thickness
- Display Cartesian grid
- Grid over entire area
- Color element groups and slab thickness
- Display boring subareas boundary
- Color boring subareas
- Mark boring subareas
- Snap to grid or node

| Plot parameters: | × |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| General plot parameters Soil plot parameters | Girder systems |
| Display node numbering Display coordinates x/y Display element numbering Display column types Display FE-Net in separated elements | Color girders Draw girder thickness Cartesian grid Display cartesian grid Grid over entire area |
| Element groups: Color element groups and slab thickness | Snap: © Don't snap © Snap to cartesian grid © Snap to <u>n</u> ode |
| Ok Save | <u>C</u> ancel <u>H</u> elp |

Figure C-42 "Plot parameters" Dialog box

Display Item

Turns on and off the display of the item on the drawing

Snap to grid

This command turns on and off the capability to snap to the grid when creating the mesh geometry.

Options Menu-"Display values" command

The values of the following items can be displayed, if desired, on the drawing (Figure C-43):

- Loads
- Boundary conditions
- Spring supports
- Element groups
- Girder system
- Piles
- Additional settlements



Figure C-43 "Display values" Dialog box

Options Menu-''View grouping'' command

By the "View grouping" command you can draw a group of data together in one presentation (for example supports with loads and girders), Figure C-44.



Figure C-44 Group of data together

5.3.7 Format Menu

The Format Menu has the following commands:

- Line formats
- Fill color
- Max. ordinate
- Font
- Grid

Format Menu-"Line formats" command

By the "Line formats" command the color, style and thickness of drawing lines can be defined, Figure C-45. The way a line is drawn depends on the setting of the color and style properties. There are 15 different colors and 5 styles available for line formats. The following list shows the available lines, which can be formatted:

- Slab boundary
- Elements
- Isometric view
- Distribution drawing
- Contour lines
- Legends
- Circular diagrams
- Arrows of support reactions
- Page boundary
- Identification box
- Streaks of principal moments (+ve)
- Streaks of principal moments (-ve)
- Slab dimensions
- Loads
- Boundary conditions
- Boring logs
- Slab thickness
- Axes of symmetry
- Beam elements
- Spring supports
- Axes of symmetry
- Symbol of symmetry
- Vectors of soil deformation
- Deformed mesh of soil deformation
- Axis arrows
- Girder axes
- Piles in plan
- Pile length
- Pile hatching
- Additional settlements
- Reference points and lines
- Columns
- Cartesian grid
- Punching shear
- Borders of block elements

| Line formats | | | × |
|---------------|--------------|----------------|-------|
| Lines | | Color | Style |
| Slab boundary | • | | |
| | | | [] |
| | | | |
| | | | |
| | | | |
| <u>0</u> k | <u>S</u> ave | | |
| Cancel | <u>H</u> elp | Thickness [mm] | 0,3 + |

Figure C-45 "Line formats" Dialog box

Format Menu-"Fill color" command

By the "Fill color" command the fill color of drawing can be defined (Figure C-46).

The following list shows the available items, which can be filled with a specified color:

- Loads
- Boundary conditions
- Springs
- Zone type I: Bilinear interpolation among three boring logs
- Zone type II: Linear interpolation between two boring logs
- Zone type III: Node corresponds to boring
- Circle of boring
- Additional settlements
- (+ve) Circular diagrams
- (-ve) Circular diagrams
- Punching shear
- Material No.
- Girder group No.
- Sub area of boring No.
- Pile group No.
- Column group No.

| Fill color | | | | | × |
|------------|-------|--------------|----------------|---------------|--------------|
| Fill color | | | | | |
| Color | | | | Se <u>t</u> c | olor |
| Item | Loads | | | | • |
| <u>k</u> | | <u>S</u> ave | <u>C</u> ancel | | <u>H</u> elp |

Figure C-46 "Fill color" Dialog box

Format Menu-"Max. ordinate" command

By "Max. ordinate" command the maximum ordinate, maximum diameter, maximum side, maximum width and maximum length for the drawing can be defined, Figure C-47.

| Max. ordinate | | | × |
|---------------------------------------|-------------|------|-----------------------------|
| Max. ordinate: | | | · |
| Max. length for rotational boundaries | | • | <u> <u>U</u>k </u> |
| | | | <u>S</u> ave |
| | Size factor | 10 🗧 | <u>C</u> ancel |
| | | | Help |

Figure C-47 "Max. ordinate" Dialog box

Format Menu-"Font" command

Here the font size (Figure C-48) and font type (Figure C-49) for the drawing can be defined.

| Font | × |
|---------------------|--------------|
| Size factor of font | |
| Item Data Size | 3 + |
| Sample | Eont type |
| AaBbYyZz | Courier New |
| | <u>H</u> elp |

Figure C-48 "Font size" Dialog box

| Font | | ? × |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|--------------|
| Eont: Arial T Arabic Transparent T Arial T Arial Black T Arial Narrow T Bold Italic Art T Book Antiqua T Bookman Old Style | Font style: Regular Italic Bold Bold Italic | OK Cancel |
| Effects Strikseout Underline Color: Black This is a TrueType font. This sar your printer and your screen. | Sample AaBbYyZz Script: | |

Figure C-49 "Font type" Dialog box

5.3.8 Window Menu

The Window menu has the following commands:

- Zoom in
- Zoom out
- Zoom window
- Zoom %
- Original size

Window Menu-"Zoom in" command

By the "Zoom in" command the size of the drawing on the screen can be reduced.

Window Menu-"Zoom out" command

By the "Zoom out" command the size of the drawing on the screen can be increased.

Window Menu-"Zoom window" command

By the "Zoom window" command the size of the drawing on a specified area can be increased.

Window Menu-"Zoom %" command

When you choose "Zoom %" command the following Dialog box appears, Figure C-50.

| Zoom | < |
|----------------------------------------|---|
| - Zoom % | 1 |
| ○ 50 % ○ 75 % ○ 125 % ○ 150 % ○ 175 % | |
| • Another 100 | |
| <u>O</u> k <u>C</u> ancel <u>H</u> elp | |

Figure C-50 "Zoom %" Dialog box

By the "Zoom %" command the size of drawing on the screen can be specified. Choosing "Zoom %" allows you to increase or decrease the size at which the drawing is displayed. Choosing "100%" displays the drawing at its original size. Clicking on the percentage changes the drawing size to the specified percentage. The drawing can be displayed at any size by typing the desired percentage in the specified Edit box.

Window Menu-"Original size" command

The commands "Zoom in", "Zoom out" and "Zoom %" can change the size of drawing on the screen. The drawing can be displayed in its original size again using the "Original size" command.

5.3.9 Help Menu

The Help Menu commands are:

- Contents
- Short description of ELPLA
- New in ELPLA
- About ELPLA-Data

Help Menu-"Contents" command

The "Contents" command displays a help file in HTML-Format containing the complete ELPLA User's Guide (Figure C-51).


Figure C-51 Menu "Contents"

Help Menu-"Short description of ELPLA" command

The "Short description of ELPLA" command gives a short description of ELPLA package.

Help Menu-"New in ELPLA" command

The "New in ELPLA" command summarizes the new features and enhancements in ELPLA.

Help Menu-"About ELPLA-Data" command

Clicking the command "About ELPLA-Data" displays the information form of ELPLA-Data as shown in Figure C-52, which gives information about ELPLA-Data and the calculation method of the loaded project.

| Information | — | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--|--|--|--|
| Analysis of slab foundation Professional, Version 9.3 | | | | | |
| Calculation method Method (6) (Layered soil model) Modulus of Compressibility (Iteration) | | | | | |
| ELPLA-Data is used to define the data of: | | | | | |
| calculation methods, FE-Net, project identification, boundary conditions, supports, soil properties, slab properties, loads, boring fields, reinforcement, neighboring foundations, temperature change, additional settlements, etc. | | | | | |
| ELPLA-Data may also be used to modify the data of a problem already existed. | | | | | |
| | | | | | |
| Program authors | <u>O</u> k | | | | |
| Prof. M. El Gendy Dr. A. El Gendy | System-Info | | | | |
| GEOTEC Software | Online Support | | | | |

Figure C-52 Information form of program ELPLA-Data

5.3.10 Important notes

Element size

Sometimes edge moments $M \neq 0$ appear on the slab, this means the element sizes are not optimal for the analysis. Therefore, if the moments of the slab are required, the length or width of the elements must be not longer than three times of slab thickness. Further more, the size of the middle element must be not more than three times the size of neighboring elements.

Change or modification of FE-Net

If the FE-Net of the slab is changed or modified for a new analysis, the input data of girders, boundary conditions, spring supports, slab properties, boring fields, etc. must be renewed. When closing a modified FE-Net, a Dialog box will appear (Figure C-53). This Dialog box shows the data that are set outside the FE-Net. To select the data to fix, check the boxes of these data.

| List of data that are set outside the FE-Net 🛛 🛛 | | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|--|--|--|--|--|
| Select the data to fix: | | | | | | |
| Supports/ Boundary conditions Spring supports Girders Foundation properties Boring fields | <u>O</u> k <u>C</u> ancel | | | | | |
| Additional settlements | <u>H</u> elp | | | | | |
| | 🔽 Select <u>A</u> ll | | | | | |

Figure C-53 Select the data to fix Dialog box

5.4 Data Menu–"Girders" command

In ELPLA beam elements are considered to represent the girder action in the slab. When the "Girders" command is chosen, the following embedded program appears, Figure C-54.



Figure C-54 "Girders" embedded program

The menu head of Figure C-54 contains the following commands:

- File
- View
- Graphically
- In table
- Options
- Format
- Window
- Help

The following paragraph presents and describes the menu commands and their sub-commands.

5.4.1 File Menu

This menu contains five commands:

- New girders
- Open girders
- Save girders
- Save girders as
- Close girders

File Menu-"New girders" command

New girders are defined.

File Menu-"Open girders" command

Existing girders-file are opened again. Then the girders, if desired, can be redefined.

File Menu-"Save girders" command

Saves the active girders under the available name

File Menu-"Save girders as" command

Saves the active girders under a new name

File Menu-"Close girders" command

Closes the Girders-embedded program and returns to ELPLA-Data.

5.4.2 View Menu (See paragraph 5.3.2)

5.4.3 Graphically Menu

The menu "Graphically" contains the following commands:

- Undo
- Redo
- Remove girders
- Add girders
- Edit girders
- Cartesian grid

Graphically Menu-"Undo" command

This command is used to undo the effects of a selected command and return to a previous state.

Graphically Menu-"Redo" command

This command is used to redo the last action of "Undo" command.

Graphically Menu-"Remove girders" command

When "Remove girders" command is chosen, the cursor is changed from an arrow to a cross hair. The desired girder is deleted by double clicking on it.

Graphically Menu-"Add girders" command

"Add girders" command is used to define and add a new girder. To add a girder, click the left mouse button on the start node of the girder and drag the mouse until the end node of the girder, then click on the end node.

Graphically Menu-"Edit girders" command

The main function of "Edit girders" command is to provide a method for redefining girders. When "Edit girders" command is chosen, the cursor is changed from an arrow to a cross hair. The desired girder is redefined by double clicking on it. Then, the following Dialog box of Figure C-55 appears.

| Girder elements | × |
|--------------------------|--------------|
| Girder elements: | |
| Group No. | · 1 |
| Start from node No. | [·] 77 |
| End at node No. | [·] 87 |
| | |
| <u>Qk</u> <u>C</u> ancel | <u>H</u> elp |

Figure C-55 "Girder elements" Dialog box

Graphically Menu–''Cartesian grid'' command See paragraph 5.3.3

5.4.4 In table Menu

In ELPLA there are two alternative possibilities to define girders on the slab, graphically or numerically (in a table). The menu "In table" contains the following commands:

- Girder groups
- Girders

In table Menu-"Girder groups" command

When "Girder groups" command is chosen, the following Dialog box in Figure C-56 appears first to chose the option of cross section definition.

| Cross section definition | × |
|--------------------------------------------|------------|
| Cross section definition: | <u>0</u> k |
| C Rectangular cross section | Cancel |
| General cross section | |
| C Create a new element group as T/L-girder | Help |

Figure C-56 "Cross section definition" Dialog box

In the "Cross section definition" Dialog box (Figure C-56) choose the option to define the girder cross section. The three alternative possibilities to define the girder groups are:

- Rectangular cross sections (Figure C-57)
- General cross sections (Figure C-58)
- T/L-Girders (Figure C-59)

| G | irder groups (with the same properties) | | | | | | × | |
|---|-----------------------------------------|----------------------------------------|--------------------------------------|---------------------------------|--------------------------------|----------------------------------|---|----------------|
| | Group No. | E-Modulus of girder E [kN/m2] | G-Modul of girder G [kN/m2] | Height of girder h [m] | Width of girder b [m] | Girder weight pb [kN/m] | | k |
| | 1 | 2E+07 | 8000000 | 0,50 | 0,20 | 12,0 | | <u>I</u> nsert |
| | | | | | | | | <u>С</u> ору |
| | | | | | | | | <u>D</u> elete |
| | | | | | | | | <u>N</u> ew |
| | | | | | | | | <u>H</u> elp |
| | | | | | | | | Excel |



| G | Girder groups (with the same properties) | | | | | | | × |
|---|------------------------------------------|------------------------|----------------------|----------------------|----------------------|------------------|--|----------------|
| | Group No. | E-Modulus of girder | G-Modul of girder | Moment of inertia | Torsional inertia | Girder weight | | <u> </u> |
| | | Ē [kN/m2] | G [kN/m2] | l [m4] | J [m4] | pb [kN/m] | | <u>C</u> ancel |
| | 1 | 2E+07 | 8000000 | 0,002083 | 0,00099748 | 12,0 | | <u>I</u> nsert |
| | | | | | | | | <u>С</u> ору |
| | | | | | | | | <u>D</u> elete |
| | | | | | | | | <u>N</u> ew |
| | | | | | | | | <u>H</u> elp |
| | | | | | | | | Excel |

Figure C-58 "Defining girder groups – General cross section" Dialog box



Figure C-59 "Defining girder groups – T/L-Girder" Dialog box

In the Dialog boxes of Figure C-57 and Figure C-58 E-Modulus, G-Modulus, girder section and girder weight for each group are required to define. Girder group is defined as a group of beam elements that have the same properties.

In the Dialog box of Figure C-59 the stiffness of girders that have T/L-section can be simulated in the slab by using additional beam elements. The stiffness of the girder can be obtained through a replacement beam arranged in the center plan of the slab. The dimensions of the replacement beam can be taken as in DIN 1075 or EC 2.

In table Menu-"Girders" command

Girder as beam element is defined through start and end nodes that at them the girder starts and ends (Figure C-60).

| G | iirders | | | | × |
|---|----------|-------------------------|-----------------------|--------------|----------------|
| | No. T | Start at node No. | End at node No. | Group No. | <u>Ok</u> |
| | 1 | 241 | 87 | 1 | |
| | 2 | 231 | 77 | 1 | Insert |
| | 3 | 77 | 87 | 1 | |
| | 4 | 231 | 87 | 1 | Сору |
| | 5 | 241 | 77 | 1 | |
| | 6 | 231 | 241 | 1 | <u>D</u> elete |
| | | | | | |
| | | | | | <u>N</u> ew |
| | | | | | Help |
| ļ | | | | | Excel |

Figure C-60 "Girders in x-direction" Dialog box

- **5.4.5 Options Menu** (See paragraph 5.3.6)
- **5.4.6** Format Menu (See paragraph 5.3.7)
- **5.4.7 Window Menu** (See paragraph 5.3.8)
- **5.4.8 Help Menu** (See paragraph 5.3.9)

5.5 Data Menu–"Spring supports" command

By the "Spring supports" command elastic support or node stiffness on the slab is defined. When the command is chosen, the following embedded program appears (Figure C-61).



Figure C-61 "Spring supports" embedded program

Treatment of spring supports

The following types of spring supports are possible:

- Vertical spring k_z
- Rotational spring about x-direction k_{tx}
- Rotational spring about y-direction k_{ty}

Figure C-61 and the Dialog box of Figure C-63 show some samples of spring supports that may be used in ELPLA.

The menu head of Figure C-61 contains the following eight commands:

- File
- View
- Graphically
- In table
- Options
- Format
- Window
- Help

After clicking one of the eight commands (options) other sub-commands or options become available. The following paragraph presents and describes the eight menu commands and their sub-commands.

5.5.1 File Menu

This menu contains five commands:

- New spring supports
- Open spring supports
- Save spring supports
- Save spring supports as
- Close spring supports

File Menu–"New spring supports" command

Defines new spring supports.

File Menu-"Open spring supports" command

Opens existing spring supports-file again. Then the spring supports, if desired, can be redefined.

File Menu-"Save spring supports" command

Saves the active spring supports under the available name.

File Menu–"Save spring supports as" command

Saves the active spring supports under a new name.

File Menu-"Close spring supports" command

Closes the spring supports-embedded program and returns to ELPLA-Data

5.5.2 View Menu (See paragraph 5.3.2)

5.5.3 Graphically Menu

This menu contains the following commands:

- Undo
- Redo
- Select nodes
- Add spring supports
- Remove spring supports
- Cartesian grid

Graphically Menu-"Undo" command

This command is used to undo the effects of a selected command and return to a previous state.

Graphically Menu-"Redo" command

This command is used to redo the last action of "Undo" command.

Graphically Menu-"Select nodes" command

The main function of "Select nodes" command is to provide a method for removing or adding elastic nodes. When "Select nodes" command is chosen, the cursor is changed from an arrow to a cross hair. In this case, "Add spring supports" and also "Remove spring supports" will be enabled, indicating the modes in which are being operated. The desired 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 and 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.

Graphically Menu-"Remove spring supports" command

This command is used to make the selected nodes free from spring supports.

Graphically Menu-"Add spring supports" command

It is used to define the stiffness for the selected nodes. Any old spring supports of the selected nodes will be replaced by the new editing. When "Add spring supports" command is chosen, the following Dialog box of Figure C-62 appears to define springs and column type.

| Spring supports | | | | × |
|-------------------|----------------|--------------|------------|-----------------|
| - Spring supports | | | | |
| Column types | | | [·] | 1 💌 |
| Vertical spring | kz | | [kN/m] | 1000 |
| Rotational spr | ing ktx | | [kN.m/Rad] | 0 |
| Rotational spr | ing kty | | [kN.m/Rad] | 0 |
| <u>0</u> k | <u>C</u> ancel | <u>H</u> elp | | << <u>L</u> ess |
| | | | | |

Figure C-62 "Add spring supports" Dialog box

Graphically Menu–''Cartesian grid'' command See paragraph 5.3.3

5.5.4 In table Menu

This menu contains the following commands:

- Column types
- Spring supports

In table Menu-"Column types" command

When the "Column types" command is chosen, the following Table in Figure C-63 appears to define the column dimensions. Column dimensions are required for design of the slab for punching shear.

| C | olumn ty | pes | | × |
|---|--------------|-------------------------|-------------------------|----------------|
| | Group No. | Column side a [m] | Column side b [m] | <u>Ok</u> |
| | 1 | 0,50 | 0,50 | |
| | | | | <u>I</u> nsert |
| | | | | <u>С</u> ору |
| | | | | <u>D</u> elete |
| | | | | New |
| | | | | <u>H</u> elp |
| | | | | Excel |

Figure C-63 Defining column dimensions

In table Menu-"Spring supports" command

When this command is chosen, the following Table in Figure C-64 appears. In this Table the elastic support is described by spring stiffness.

| S | pring su | pports | | | | × |
|---|----------|-------------|--------------------------|---------------------------------|----------------------------------------|------------------------------|
| | No. I | Node No. | Column types I [-] | Vertical spring kz [kN/m] | Rotational spring ktx [kN.m/Rad] | <u>O</u> k <u>C</u> ancel |
| | 1 | 133 | 1 | 0 | 0 | Insert |
| | 2 | 147 | 1 | 0 | 0 | |
| | 3 | 161 | 1 | 0 | 0 | Conv |
| | 4 | 175 | 1 | 0 | 0 | |
| | 5 | 189 | 1 | 0 | 0 | Delete |
| | 6 | 203 | 1 | 0 | 0 | |
| | 7 | 169 | 1 | 0 | 1000 | New |
| | 8 | 170 | 1 | 0 | 1000 | |
| | 9 | 171 | 1 | 0 | 1000 | Halp |
| | 10 | 172 | 1 | 0 | 1000 🖵 | |
| | • | 70 | - | 1000 | ► ► | Excel |

Figure C-64 Defining spring stiffness in a table

- **5.5.5 Options Menu** (See paragraph 5.3.6)
- **5.5.6** Format Menu (See paragraph 5.3.7)
- **5.5.7 Window Menu** (See paragraph 5.3.8)
- 5.5.8 Help Menu (See paragraph 5.3.9)

5.6 Data Menu–''Supports/ Boundary conditions'' command

By this command supports or boundary conditions on the slab are defined. When this command is chosen, the following embedded program appears (Figure C-65).



Figure C-65 "Supports/ Boundary conditions" embedded program

Treatment of rigid or elastic supports

Rigid or elastic nodes may represent the point and line supports. The following types of supports or boundary conditions are possible:

- Elastic or rigid displacements w
- Elastic or rigid rotations about x-direction θ_x
- Elastic or rigid rotations about y-direction θ_y

Figure C-65 and the Dialog box of Figure C-68 show some samples of supports and boundary conditions that may be used in ELPLA.

Illustrative example for point and line supports

The following example is used to describe point and line supports. The problem is an arbitrary slab foundation with variable type of supports as shown in Figure C-65 and the Dialog box of Figure C-68. The supports are:

- Support 1 is a line support in x-direction. All nodes are fixed against vertical displacement. No rotation is permissible about y-axis and the rotation about x-axis is free
- Support 2 is a line support in y-direction. All nodes have w = 2 [cm] vertical displacement. No rotation is permissible about y-axis and the rotation about x-axis is $\theta_x = 0.00005$

- Support 3 is a point support. This point is fixed against vertical displacement and the rotations about x- and y-axis are free
- Support 4 is a group of point supports (inclined line support). All nodes are fixed against vertical displacement and the rotations about x- and y-axis are free

The menu head of Figure C-65 contains the following eight commands:

- File
- View
- Graphically
- In table
- Options
- Format
- Window
- Help

After clicking one of the eight commands (options) other sub-commands or options become available. The following paragraph presents and describes the eight menu commands and their sub-commands.

5.6.1 File Menu

This menu contains five commands:

- New supports/ boundary conditions
- Open supports/ boundary conditions
- Save supports/ boundary conditions
- Save supports/ boundary conditions as
- Close supports/ boundary conditions

File Menu-"New supports/ boundary conditions" command

Defines new supports/ boundary conditions

File Menu-"Open supports/ boundary conditions" command

Opens existing supports/ boundary conditions-file again on the screen. Then the supports/ boundary conditions, if desired, can be redefined.

File Menu–"Save supports/ boundary conditions" command

Saves the active supports/ boundary conditions under the available name

File Menu-"Save supports/ boundary conditions as" command

Saves the active supports/ boundary conditions under a new name

File Menu-"Close supports/ boundary conditions" command

Closes the supports/ boundary conditions embedded program and returns to ELPLA-Data

5.6.2 View Menu (See paragraph 5.3.2)

5.6.3 Graphically Menu

This menu contains the following commands:

- Undo
- Redo
- Select nodes
- Add boundaries
- Remove boundaries
- Cartesian grid

Graphically Menu-"Undo" command

This command is used to undo the effects of a selected command and return to a previous state.

Graphically Menu-"Redo" command

This command is used to redo the last action of "Undo" command.

Graphically Menu-"Select nodes" command

The main function of "Select nodes" command is to provide a method for removing or adding restrains to nodes. When "Select nodes" command is chosen, the cursor is changed from an arrow to a cross hair. In this case "Add boundaries" and also "Remove boundaries" will be enabled, indicating the modes in which are being operated. The desired 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 and 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.

Graphically Menu-"Remove boundaries" command

"Remove boundaries" command is used to make the selected nodes free from restraints.

Graphically Menu-"Add boundary" command

"Add boundary" command is used to define the restraints for the selected nodes. Any old restraints of the selected nodes will be replaced by the new editing. When "Add boundary" command is chosen, the following Dialog box of Figure C-66 appears to define supports, boundary conditions and column types.



Figure C-66 Defining node restraints

The following input characters in the Dialog box of Figure C-66 mean:

- "0" means rigid support
- "F" means free displacement or rotation
- "0<or>0" means the value of elastic support

Graphically Menu-"Cartesian grid" command

See paragraph 5.3.3

5.6.4 In table Menu

This menu contains the following commands:

- Column types
- Node restraints

In table Menu-"Column types" command

When this command is chosen, the following Table in Figure C-67 appears to define the column dimensions. Column dimensions are required for design of the slab for punching shear.



Figure C-67 Defining column dimensions

In table Menu-"Node restraints" command

When the "Node restraints" command is chosen, the following Table in Figure C-68 appears. In this Table define the node restraints and column types.

| N | ode resi | traints | | | | | X |
|---|----------|-------------|--------------------------|--------------------------|----------------------------|-----------------------------|----------------|
| | No. I | Node No. | Column types I [·] | Displacement w [m] | Rotation Theta x [-] | Rotation <a>Theta y [-] | <u>D</u> k |
| | 3 | 50 | 1 | 0 | F | F | Lancei |
| | 4 | 62 | 1 | 0 | F | F | Insert |
| | 5 | 71 | 1 | 0 | F | F | |
| | 6 | 21 | 1 | 0 | F | | Сору |
| | 7 | 22 | 1 | 0 | F | | |
| | 8 | 23 | 1 | 0 | F | | <u>D</u> elete |
| | 9 | 24 | 1 | 0 | F | | |
| | 10 | 25 | 1 | 0 | F | | New |
| | 11 | 26 | 1 | 0 | F | | |
| | 12 | 45 | 1 | 0,02 | 0,00005 | | <u>H</u> elp |
| | 13 | 56 | 1 | 0,02 | 0,00005 | | |
| | • | | | | | <u> </u> | Excel |

Figure C-68 Defining node restraints in a table

- **5.6.5 Options Menu** (See paragraph 5.3.6)
- **5.6.6 Format Menu** (See paragraph 5.3.7)
- **5.6.7** Window Menu (See paragraph 5.3.8)
- **5.6.8 Help Menu** (See paragraph 5.3.9)

5.7 Data Menu–"Piles" command

By the "Piles" command piles on the slab are defined. When the "Piles" command is chosen, the following embedded program appears (Figure C-69).



Figure C-69 "Piles" embedded program

The menu head of Figure C-69 contains the following eight commands:

- File
- View
- Graphically
- In table
- Options
- Format
- Window
- Help

The following paragraph presents and describes the menu commands and their sub-commands.

5.7.1 File Menu

This menu contains five commands:

- New piles
- Open piles
- Save piles
- Save piles
- Close piles

File Menu–''New piles'' command Defines new piles

File Menu-"Open piles" command

Opens existing piles-file again. Then the piles, if desired, can be redefined.

File Menu-"Save piles" command

Saves the active piles under the available name

File Menu–"Save piles as" command

Saves the active piles under a new name

File Menu-"Close piles" command

Closes the piles-embedded program and returns to ELPLA-Data

5.7.2 View Menu (See paragraph 5.3.2)

5.7.3 Graphically Menu

This menu contains the following commands:

- Undo
- Redo
- Select nodes
- Add spring supports
- Remove spring supports
- Cartesian grid

Graphically Menu-"Undo" command

This command is used to undo the effects of a selected command and return to a previous state.

Graphically Menu-"Redo" command

This command is used to redo the last action of "Undo" command.

Graphically Menu-"Select nodes" command

The main function of this command is to provide a method for removing or adding piles. When "Select nodes" command is chosen, the cursor is changed from an arrow to a cross hair. In this case "Add piles" and also "Remove piles" will be enabled, indicating the modes in which are being operated. The desired 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 and 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.

Graphically Menu-"Remove piles" command

"Remove piles" command is used to make the selected nodes free from piles.

Graphically Menu-"Add piles" command

"Add piles" command is used to add piles at the chosen nodes and to define the pile group No. for these piles. Any old piles of the selected nodes will be replaced by the new editing. When "Add piles" command is chosen, the following Dialog box of Figure C-70 appears.

| Pile groups | × |
|----------------|-------|
| Pile groups: | |
| Pile group No. | [-] 1 |
| kCancel | Help |

Figure C-70 "Add piles" Dialog box

Graphically Menu–''Cartesian grid'' command See paragraph 5.3.3

5.7.4 In table Menu

This menu contains the following commands:

- Pile groups
- Pile location and groups
- Pile material

In table Menu–"Pile groups" command

In ELPLA there are different calculation methods to analyze the raft on piles. Therefore the pile groups for each method are required to define according to the used soil model as described in the next paragraphs.

Pile groups for Simple Assumption Model

In this model all forces acting on the raft will be transmit linearly on the piles. When the "Pile groups" command is chosen for this model, the following Table in Figure C-71 appears to define the pile diameter. Pile diameter is required for design of the slab for punching shear.

| Pile groups | | × |
|--------------|---------------------------|----------------|
| Group No. | Pile diameter D [m] | |
| 1 | 0,9 | <u>L</u> ancel |
| | | Insert |
| | | <u>С</u> ору |
| | | <u>D</u> elete |
| | | New |
| | | <u>H</u> elp |
| | | Excel |

Figure C-71 Defining pile groups for Simple Assumption Model

Pile groups for *Winkler's* Model

For the two methods of Constant and Variable Modulus of Subgrade Reaction (methods 2 and 3), when the modulus of subgrade reaction is required to define by the user, pile groups in this case will be the pile diameter and the pile stiffness (Figure C-72).

| P | ile groups | | | × |
|---|--------------|---------------------------|--------------------------------|----------------|
| | Group No. | Pile diameter D [m] | Pile stiffness kz [kN/m] | |
| | 1 | 0,9 | 30000 | |
| | | | | Insert |
| | | | | <u>С</u> ору |
| | | | | <u>D</u> elete |
| | | | | New |
| | | | | <u>H</u> elp |
| | | | | Excel |

Figure C-72 Defining pile groups for *Winkler*'s Model

Pile groups for Isotropic Elastic Half-Space and Layered soil Models

When pile groups are required to define for one of these two soil models, the following Dialog box of Figure C-73 appears. The soil data around and under the pile are required to define. Soil data are used to determine the pile stiffness due to the soil type by ELPLA.

| fining pile groups | | | | |
|------------------------------------------------------------------------|----------------------|------------------------|-------------------|---------------|
| Pile group No. 1 from 1 pile groups: - Laver No. 1 from 3 lavers: | | | | <u>0</u> k |
| Geotechnical data of | Canaal | | | |
| Layer <u>c</u> opy | table 4 or 5 from DI | N 4014 are taken into | account | |
| Layer insert Layer thickness | | L1 | [m] 3 | Send to Excel |
| Skin friction | | Tau | [MN/m2] 0 | New |
| C Penetration resista | ance | qs | [MN/m2] 0 | Halp |
| Undrainage cohes | ion | Cu | [MN/m2] 0,1 | |
| Pile tip resistance (s/Df = 0.02) Pile tip resistance (s/Df = 0.03) | Sig Sig1 | [MN/m2] 0 [MN/m2] 0 | Pile group insert | |
| Pile tip resistance (s/Df = 0.10) | Siglár | | _ | |
| Penetration resistance under the pile tip | qs | [MN/m2] [17,5 | _ | |
| O Undrainage cohesion under the pile tip | | | | |
| Pile diameter D [m] | 0,9 | | | |
| Pile toe diameter Df [m] | 0,9 | | | |
| Description of Pile groups | P1 | | | |
| | | | • | |

Figure C-73 Defining pile groups for Half-Space and Layered soil Models

In table Menu-"Pile locations and groups" command

When this command is chosen, the following Table in Figure C-74 appears. In this Table define the pile locations and their groups. Pile group is a group that has the same dimension and soil properties.

| Ρ | Pile locations and groups | | | | | | |
|---|---------------------------|-------------|--------------|--|----------------|--|--|
| | No. T | Node No. | Group No. | | <u>k</u> | | |
| | 1 | 181 | 1 | | <u>C</u> ancel | | |
| | 2 | 192 | 1 | | | | |
| | З | 82 | 1 | | Insert | | |
| | 4 | 27 | 1 | | | | |
| | 5 | 115 | 1 | | <u>С</u> ору | | |
| | 6 | 134 | 1 | | | | |
| | 7 | 34 | 1 | | <u>D</u> elete | | |
| | 8 | 79 | 1 | | | | |
| | 9 | 31 | 1 | | New | | |
| | 10 | 189 | 1 | | | | |
| | 11 | 185 | 1 | | <u>H</u> elp | | |
| | | | | | | | |
| l | | | | | Excel | | |

Figure C-74 Defining pile locations and groups in a table

In table Menu–"Pile material" command

When "Pile material" command is chosen, the following Dialog box in Figure C-75 appears. In this dialog box E-Modulus of the pile and the unit weight of the pile material are defined. Pile material are used to determine the pile stiffness due to its material type.

| F | ile material | | | × |
|---|-------------------------------|----------------|---------|--------------|
| | Pile material: | | | |
| | Unit weight of pile concrete | Gp | [kN/m3] | 25 |
| | Modulus of elasticity of pile | Ep | [kN/m2] | 3E+07 |
| | <u>O</u> k | <u>C</u> ancel | | <u>H</u> elp |

Figure C-75 "Defining element groups" Dialog box

- **5.7.5 Options Menu** (See paragraph 5.3.6)
- **5.7.6** Format Menu (See paragraph 5.3.7)
- **5.7.7 Window Menu** (See paragraph 5.3.8)
- 5.7.8 Help Menu (See paragraph 5.3.9)

5.8 Data Menu-"Soil properties" command

In ELPLA there are nine different calculation methods with different subsoil models. Therefore the soil properties for each method are required to define according to the used soil model as described in the next paragraphs.

Soil properties for Simple Assumption Model

There is no interaction between the subsoil and the foundation for Simple Assumption model (Linear Contact Pressure method - method 1). Therefore the soil data are not required in this method (only groundwater G_w and foundation level T_f are required). When soil properties are required to define for the calculation methods 1 (Linear Contact Pressure method), the following Dialog box of Figure C-76 appears.

If the water table is located above the foundation, the foundation will be exposed to an additional negative pressure. In the Dialog box of Figure C-76 define the groundwater depth under the ground surface G_w in order to take the effect of groundwater pressure in the analysis.

| Soil properties | | | | × |
|----------------------------------|---------------------|--------------|--------------|-----------------|
| Groundwater: — Groundwater de | pth under the grour | nd surface | Gw (m) | 1,50 |
| <u>S</u> ave | <u>C</u> ancel | <u>H</u> elp | <u>L</u> oad | Save <u>A</u> s |

Figure C-76 "Soil properties" Dialog box (method 1)

Soil properties for *Winkler's* Model

For the two methods of Constant and Variable Modulus of Subgrade Reaction (methods 2 and 3), when the modulus of subgrade reaction is required to define by the user, soil properties in this case will be the modulus of subgrade reaction k_s besides its coordinates (x, y) in the global system and groundwater depth under the ground surface G_w . If the nonlinear analysis is required, the ultimate bearing capacity of the soil quit must be defined (Figure C-77).

| So | il prope | rties | | | | | × |
|----|--------------------|--------------------|----------------------------------|----------------------------------|-----------------------------------------------|--------------------------------------------------------|-----------------|
| | Boring No. I | Label of Boring | x-coordinate of boring [m] | y-coordinate of boring [m] | Moduli of subgrade reactions ks [kN/m3] | Ultimate bearing capacity of the soil qu [kN/m2] | <u>Save</u> |
| F | 1 2 | BPN1 BPN2 | 4,00 1,00 | 3,00 9,00 | 5254 2989 | | Insert |
| F | 3 | BPN3 | 10,00 | 11,00 | 2315 | 2 | <u>С</u> ору |
| | | | | | | | <u>D</u> elete |
| | | | | | | | Load |
| | | | | | | | New |
| Γ | Groundw | ater: | | | | | Save <u>A</u> s |
| | Groundw | ater depth und | ler the ground | surface | Gw (| m] 1,00 🔹 | Help |

Figure C-77 "Soil properties" Dialog box (methods 2 and 3)

Soil properties for Isotropic Elastic Half-Space Model

When soil properties are required to define for the calculation method 2 (Modulus of subgrade reaction is determined from Half-Space) and calculation method 5 (Isotropic Elastic Half-Space), the following Dialog box of Figure C-78 appears.

| Soil properties Calculation parameters of flexibility coefficients Bea | aring capacity fact | ors] | × |
|------------------------------------------------------------------------|---------------------|---------|-----------------|
| Geotechnical data of the soil | | | |
| Soil properties are defined by Modulus of Elasticity E | | | <u> </u> |
| Modulus of Elasticity of the soil | E | [kN/m2] | 9500 |
| Unit weight of the soil | Gam | [kN/m3] | 18 |
| Angle of internal friction | Fhi | [*] | 0 |
| Cohesion of the soil | с | [kN/m2] | 0 |
| Poisson's ratio of the soil Nue <= .5, 0 <= Nue | Nue | [·] | 0 |
| Main soil data: | | | |
| Settlement reduction factor Alfa <= 1 | Alfa | [·] | 1 |
| Groundwater depth under the ground surface | Gw | [m] | 1,50 |
| L | | | |
| <u>Save</u> <u>Cancel</u> <u>H</u> elp | | Load | Save <u>A</u> s |

Figure C-78 "Soil properties" Dialog box (methods 2 and 5)

In the Dialog box of Figure C-78 define the settlement reduction factor α , *Poisson*'s ratio of the soil v_s, groundwater depth under the ground surface G_w and the modulus of compressibility of the soil E_s. If the nonlinear analysis is required, the angle of internal friction φ and the cohesion c of the soil must be defined.

Soil properties for Layered soil Model

Layered soil model is used in the analysis of the calculation methods shown in Table C-4. When soil properties are required to define for one of the calculation methods shown in this Table, the following embedded program (Figure C-79) appears with default-boring logs.

| Method | Method |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No. | |
| 2 | Constant modulus of subgrade reaction |
| | Winkler's model, Modulus of subgrade reaction is determined from soil layers |
| 3 | Variable modulus of subgrade reaction |
| | Winkler's model, Modulus of subgrade reaction is determined from soil layers |
| 4 | Modification of modulus of subgrade reaction by iteration <i>Winkler</i> 's model/ Continuum model |
| 6 | Modulus of compressibility method for elastic raft on layered soil medium Solving system of linear equations by iteration, Layered soil medium - Continuum model |
| 7 | Modulus of compressibility method for elastic raft on layered soil medium Solving system of linear equations by elimination, Layered soil medium - Continuum model |
| 8 | Modulus of compressibility method for rigid raft on layered soil medium, Layered soil medium - Continuum model |
| 9 | Modulus of compressibility method for flexible foundation on layered soil medium, Layered soil medium - Continuum model |

Table C-4Numerical calculation methods (Layered soil model)



Figure C-79 "Soil properties" embedded program

The menu head of Figure C-79 contains the following nine commands:

- File
- View
- Data
- Graphically
- Options
- Formats
- Main data
- Window
- Help

After clicking one of the nine menus other sub-menus or commands become available. The following paragraph presents and describes the nine menu commands and their sub-commands.

5.8.1 File Menu

This menu contains five commands:

- New boring logs
- Open boring logs
- Save boring logs
- Save boring logs as
- Close boring logs

File-"New boring logs" command

Defines new boring logs

File-"Open boring logs" command

Opens existing boring log-files again on the screen. Then they, if desired, can be redefined.

File-"Save boring logs" command

Saves the active boring logs under the available name

File-"Save boring logs as" command

Saves the active boring logs under a new name

File-"Close boring logs" command

Closes the Boring-embedded program and returns to ELPLA-Data.

5.8.2 View Menu (See paragraph 5.3.2)

5.8.3 Data Menu

The menu "Data" contains the following commands:

- Soil data
- Main soil data

Data Menu-"Soil data" command

When "Soil data" command is chosen, the following Dialog box in Figure C-80 appears.

| Soil data | | × |
|--------------------------------------|-------------------------------------------------------------|---|
| Boring log No. 1 from 3 boring logs: | - Contraducing Jata of the Jaway | |
| Main soil type 1 U, Silt | Soil properties are defined by Modulus of Elasticity E | |
| Submain soil 2 | E [kN/m2] 9500 Fhi [*] 20 | |
| Color -, No color | Gam [kN/m3] [19 Nue [-] [0 | |
| Layer <u>c</u> opy Layer insert Lay | Layer depth under the ground surface $[m]$ 1,50 ayer delete | |
| Boring log copy Boring log insert: | x-coordinate of boring log [m] 4,00 | |
| Boring delete | Label of boring log BPN1 | |
| | New | |

Figure C-80 "Soil data" Dialog box

Elastic settlement and consolidation settlement can be determined using their actual properties, where the soil properties of the individual layers are defined by:

- Modulus of Compressibility Es (1/mv)
- Modulus of Elasticity E
- Compression Index Cc

This option enables ELPLA to analyze rafts on consolidated clay deposits by the different calculation methods that are available in ELPLA. Also the user doesn't need to convert a soil parameter to other. When defining soil properties by the Modulus of Elasticity E, the *Poisson*'s ratio v_s can be different for every layer.

In the Dialog box of Figure C-80 the soil under the foundation may be defined by a number of boring logs. Each boring log has multi-layers with different soil materials. The geotechnical data for each layer are unit weight of the soil γ_s , modulus of compressibility for loading Es (or Modulus of Elasticity E or Compression Index Cc) and for reloading Ws and *Poisson*'s ratio of the soil v_s . If the nonlinear analysis is required, the angle of internal friction φ and the cohesion c of the soil must be defined; besides the boring coordinates x, y in the global system and its label are required to define. In order to draw the soil layers by different symbols according to the German specification code DIN 4023, define soil art and color in the Dialog box of Figure C-80.

Copy, Insert and Delete commands for both soil layer and boring log are available in the Dialog box of Figure C-80. Further more, boring logs can be inserted from a file by checking the option "From file" in the "Boring insert" Frame box (Figure C-81).

| Elle <u>V</u> iew <u>D</u> ata <u>G</u> raphically <u>O</u> ptions Format <u>Window M</u> ain data <u>H</u> elp ■ 😂 🔲 🔍 😤 🥙 🐼 🕼 👣 😭 |
|----------------------------------------------------------------------------------------------------------------------------------------|
| - 18 🗁 🖬 🔍 - 2 🖉 🖏 🚺 🛱 |
| |
| .≝ . = % ⇔ A |
| Soil data |
| Boring log No. 1 from 3 boring logs: Laver No. 1 from 4 lavers: |
| Soil and rock symbol Öffnen |
| Main soil type 1 🛛 Suchen in: 📻 Daten (H:) 🔽 🔃 💽 👘 📰 📰 |
| Main soil type 2 |
| Submain soil 1 |
| Submain soil 2 [.] gb5 [] [20000 |
| |
| Short text 🔲 🧱 gb8 |
| |
| Dateiname: |
| Abbrechen 00 |
| |
| Boring delete Label of boring log BPN1 |
| |
| |
| 20,00 / · · · · · · · · · · · · · · · · · · |
| |
| |
| |

Figure C-81 Boring log can be inserted from a file

Data Menu-"Main soil data" command

Main soil data is the general data for all soil layers and boring logs. When "Main soil data" command is chosen, the following Dialog box in Figure C-82 appears.

Settlement reduction factor

According to experience the real consolidation settlements are different from those calculated. Therefore the settlement s may be multiplied by a factor α according to the German standard DIN 4019. According to the German standard DIN 4019 the following reduction factors α can be applied:

| Sand and silt | $\alpha = 0.66$ |
|----------------------------------------------|----------------------|
| Normally and slightly over consolidated clay | $\alpha = 1.0$ |
| Heavily over consolidated clay | $\alpha = 0.5 - 1.0$ |

In the Dialog box of Figure C-82 define the settlement reduction factor α and the groundwater depth under the ground surface G_w.

| ■ ELPLA-Boring - [gb6] ◎ File View Data Graphically Options Format Window Main data | Help | | | _ # × |
|-------------------------------------------------------------------------------------|---------------------------------------------|-------------|------|-------|
| Ĩ D ☞ ■ \$, | Teb | | | |
| 📓 🔽 ָ ≡ 🦻 ↦ 🔺 ָ 🍳 ସ୍ 💷 💆 🔍 | 🖞 , 🛠 , | | | |
| Main soil data | | | | × |
| Soil properties Calculation parameters of flexibility coefficients | Bearing capacity factors | 1 | | |
| Main soil data: | | | | |
| Settlement reduction factor Alfa <= 1 | Alfa | [·] | 1 | |
| Groundwater depth under the ground surface | Gw | [m] | 1,50 | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| <u>Q</u> k <u>C</u> ancel | <u>H</u> elp | | | |
| 2 7 7 7 10 - 22 28,00 7 7 7 2 Gam - 11 | 0000 KX/m2 , C - 260 KX/m3 , Xue - 0 - | 10 KXF/m2 | | |
| | | | | |
| 4 | | | | |
| | 1 | | | |

Figure C-82 "Main soil data" dialog box

Bearing capacity factors

The bearing capacity factors used to determine the ultimate bearing capacity can optionally be defined according to different codes and authors. These factors are required to carry out the nonlinear analysis of the soil. The bearing capacity factors are defined according to Figure C-83:

- German Standard DIN 1054
- Euro Code EC 7
- Egyptian code ECP
- Terzaghi
- Meyerhof

| ELPLA-Boring - [Example] | _ 8 × |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| File View Data Graphically Options Format Window Main data Help | - |
| | |
| I I I I I I I I I I I I I I I I I I I | |
| Main soil data | |
| | |
| Soil properties Calculation parameters of flexibility coefficients Bearing capacity factors | |
| - Rearing capacity factors: | |
| Bearing capacity factors are determined according to: | |
| | |
| • DIN 1054 | |
| | |
| | |
| C Maueter | |
| | |
| | |
| | |
| | |
| | |
| <u>O</u> k <u>C</u> ancel <u>H</u> elp | |
| $\frac{S}{C_{2}m} = \frac{10000 [kM/m2]}{C_{2}m} = \frac{15 [kM/m2]}{C_{2}m} = 15 [kM/m$ | |
| | |
| | |
| | |
| | |

Figure C-83 Menu "Bearing capacity factors"

Flexibility coefficients for interior nodes

For rigid and elastic rafts it is convenient to determine the flexibility coefficient of interior node at the characteristic point of the loaded area on that node. For flexible foundation it is real to determine the flexibility coefficient of interior node at that node.

Now it is possible to determine the flexibility coefficient of the interior node due to a uniform load at that node (0):

- at the characteristic point of the loaded area, where rigid settlement is equal to flexible settlement
- at the midpoint of the loaded area, where maximum settlement occurs
- at the interior node on the loaded area

Flexibility coefficients for exterior nodes

Earlier versions of ELPLA determine flexibility coefficients for both interior and exterior nodes by assuming uniform loaded areas on these nodes. This assumption needs to use the principle of superposition for determining the flexibility coefficients. Now it is possible, optionally to convert the loaded areas on exterior nodes to point loads, Figure C-84. By this way the program doesn't need to use the principle of superposition in the analysis, making it much faster than the old analysis. The new way of analysis is consequently faster and more efficient for problems that contain a large finite element mesh.

Limit distance

If the distance between two nodes is too large, the settlement of a node due to a load on the other will be small enough to be neglected. To reduce the time required for determining the flexibility coefficients for great rafts, a limit distance between node i and j for determining the flexibility coefficient c(i, j) may be defined, Figure C-84.

| ELPLA-Boring - [Example] | |
|-------------------------------------------------------------------------------------------------------|----------|
| File View Data Graphically Options Format Window Main data Help | - |
| | |
| I I I I I I I I I I I I I I I I I I I | |
| Main soil data | <u>_</u> |
| | |
| Soil properties Calculation parameters of flexibility coefficients. Bearing capacity factors | |
| Flexibility coefficient c(i, i): | |
| The flexibility coefficient c(i, i) of the node i due to uniform load at that node is determined at: | |
| ☞ the characteristic point of the loaded area, where rigid settlement equal to flexible settlement | |
| C the midpoint of the loaded area, where maximum settlement occurs | |
| C the node i on the loaded area | |
| | |
| Flexibility coefficient clu, j: | |
| The flexibility coefficient c(i, i) of the node i is determined from: | |
| • point load at node j | |
| s unirom load at node (| |
| Limit distance between node i and j for determining the flexibility coefficient c(i, j) Zr [m] 100,00 | |
| | |
| <u>D</u> k <u>Cancel Help</u> | |
| \$ 0000[k3/m2], C - 5[k3/m2] | |
| 10,00 Gam - 13 KG/(m3 , Xwe - 0,3 - | |
| | |
| | |
| | |

Figure C-84 Menu "Flexibility coefficients"

5.8.4 Graphically Menu

In the program ELPLA it is also possible to define the boring logs graphically. This makes the definition of the boring logs very easy. This option is used also for drawing the defined boring logs to make a control on the input soil data and parameters.

The menu "Graphically" contains one command:

- Drawing boring logs

Graphically Menu-"Drawing boring logs" command

When "Drawing boring logs" command is chosen, the following Dialog box in Figure C-85 appears. In this Dialog box chose the boring logs you want to draw, then click on Button "OK". Then the menu of Figure C-86 appears to control input soil data and parameters or to redefine the boring data.

| Lis | t of b | oring log | \$ | | × |
|-----|---------|-------------|---------|---------------------|-----------------------|
| Г | List of | selected b | oring l | ogs to draw: | |
| | No. | Boring log | j No. | Label of boring log | |
| | 1 | | 1 | BPN1 | Cancel |
| | | | | | <u>H</u> elp |
| Γ | List of | the availat | ole bor | ing logs: | New |
| | Borir | ng log No. | | Label of boring log | |
| | | 1 | BPN: | | |
| | | 2 | BPN: | 2 | Boging insert |
| | | 3 | BPN: | 3 | |
| | | | | | Bori <u>ng</u> delete |

Figure C-85 "List of boring logs" Dialog box



Figure C-86 Boring logs on the screen

Definition of boring logs graphically

By double-clicking the left mouse Button on a specified screen position, the user can also define soil data and input parameters.

- By double-clicking on the geotechnical data of a soil layer the corresponding Dialog box to define the geotechnical data of that layer appears, Figure C-87

| data | | | | |
|--------------------------|-----------------------------------------------|--------------------|-----------|---|
| loring log 1 Laver No | No. 1 from 3 boring logs: 1 from 4 layers: | | | |
| Geotecl | nnical data of the layer: | | | |
| Soil pro | perties are defined by Modul | us of Elasticity I | E | • |
| E | [kN/m2] 9500 | Fhi | [*] 30 | _ |
| W | [kN/m2] 26000 | с | [kN/m2] 5 | |
| Gam | [kN/m3] 19 | Nue | [·] [0,3 | |
| | | | | |
| | | | | |
| Πk | Cancel | | | |
| <u>_</u> | | | | |

Figure C-87 "Geotechnical data of the layer" Dialog box

- By double-clicking on the layer level the corresponding Dialog box to define the layer depth under the ground surface appears, Figure C-88

| Soil data 🗙 |
|--------------------------------------------------------------------------------------------------------|
| Boring No. 1 from 3 borings: Layer No. 1 from 4 layers: Layer depth under ground surface [m] 1,5 |
| kCancel |

Figure C-88 "Layer depth under the ground surface" Dialog box

- By double-clicking on the soil symbol of a soil layer the corresponding Dialog box to define the soil symbols of that layer appears, Figure C-89

| Soil data Boring No. 1 from 3 b Layer No. 2 from 4 Soil and rock sym | oorings: layers: bols: | × |
|-------------------------------------------------------------------------------|------------------------------|----------|
| Main soil type 1 | U, Silt | - |
| Main soil type 2 | -, No symbole | - |
| Submain soil 1 | -, No symbole | - |
| Submain soil 2 | -, No symbole | - |
| Color | -, No color | - |
| Short text | U | |
| | | |
| <u> </u> | <u>C</u> ancel | |

Figure C-89 "Sand and rock symbols" Dialog box

- By double-clicking on the groundwater level the corresponding Dialog box to define the groundwater depth under the ground surface appears, Figure C-90

| Groundwater | × |
|--------------------------------------------|------|
| Groundwater: | |
| Groundwater depth under ground surface [m] | - 11 |
| | |
| | |
| <u> </u> | |

Figure C-90 "Groundwater" Dialog box

- By double-clicking on the label of a boring log the corresponding Text box to define the label of that boring log appears, Figure C-91

BPN1Figure C-91"Label of the boring log" Text box

5.8.5 Options Menu

The Options Menu has the following commands:

- Plot parameters
- Display values

Options Menu-"Plot parameters" command

Plot parameters may be set as default values by the program, or may be fully specified by the user.

By the "Plot parameters" command the following plot parameters can be specified, Figure C-92:

- Color soil layers
- Draw water table
- Simple drawing of boring logs
- Setting soil colors according to DIN 4023
- Display soil properties c, Phi and Nue

| Plot parameters | | |
|-------------------------------------------|--|--|
| Boring logs | | |
| Color soil layers | | |
| 🔽 Draw water table | | |
| Simple drawing of boring logs | | |
| Setting soil colors according to DIN 4023 | | |
| Display soil properties C, Fhi and Nue | | |
| <u>k</u> | | |
| <u>C</u> ancel <u>H</u> elp | | |

Figure C-92 "Plot parameters" Dialog box

Options Menu-''Display values'' command

By this command the values of the following items can be displayed on the drawing, Figure C-93:

- Label of boring
- Layer description
- Layer depth
- Display text of soil symbols
- Measurement bar (available in ELPLA-Boring)
- Foundation (available in ELPLA-Boring)
- Water level
- Limit depth (available in ELPLA-Boring)
- Stress value (available in ELPLA-Boring)

| Display values | × |
|----------------------------------------------------------------------------------------|--------------------------------|
| Label of boring Layer description Layer depth Display text of soil symbols | <u>O</u> k <u>S</u> ave |
| Measurement bar Foundation Water level Limit depth | <u>C</u> ancel <u>H</u> elp |
| ✓ Stress value | Select <u>A</u> ll |

Figure C-93 "Display values" Dialog box

5.8.6 Format Menu

The Format Menu has the following commands:

- Line formats
- Fill color
- Max. width
- Font

Format Menu-"Line formats" command

By the "Line formats" command the color, style and thickness of drawing lines can be defined, Figure C-94. The way a line is drawn depends on the setting of the color and style properties. There are available 15 different colors and 5 styles for line formats.

The following list shows the available lines, which can be formatted:

- Identification box (available in ELPLA-Boring)
- Page Boundary (available in ELPLA-Boring)
- Boring boundary
- Soil layer levels
- Soil symbols
- Groundwater
- Foundation (available in ELPLA-Boring)
- Measurement bar (available in ELPLA-Boring)
- Limit depth (available in ELPLA-Boring)

| Line formats | | | × |
|--------------------|--------------|----------------|-------|
| Lines | | Color | Style |
| Identification box | • | | |
| | | | [] |
| | | | |
| | | | |
| | | | |
| <u>O</u> k | <u>S</u> ave | | |
| <u>C</u> ancel | <u>H</u> elp | Thickness [mm] | 0,3 |

Figure C-94 "Line formats" Dialog box

Format Menu-"Fill color" command

By the "Fill color" command the fill color of drawing can be defined, Figure C-95. The following list shows the available items, which can be filled with a specified color:

- Groundwater
- Foundation (available in ELPLA-Boring)
- Measurement bar (available in ELPLA-Boring)
- Stress due to foundation (available in ELPLA-Boring)
- Stress from neighboring foundations (available in ELPLA-Boring)
- Stress from soil weight (available in ELPLA-Boring)

| Fill color | | × |
|------------|-------------|-----------------------------|
| Fill color | | |
| Color | | Se <u>t</u> color |
| Item | Groundwater | |
| | Save | <u>C</u> ancel <u>H</u> elp |

Figure C-95 "Fill color" Dialog box

Format Menu-"Max. width" command

Here the maximum width for the drawing can be defined, Figure C-96.

| Max. ordinate | × |
|----------------|----------------|
| Max. ordinate: | ∩k 1 |
| Boring logs | <u></u> |
| | <u>S</u> ave |
| [mm] 10 💼 | <u>C</u> ancel |
| | Help |

Figure C-96 "Max. width" Dialog box

Format Menu-"Font" command

By this command Font size (Figure C-97) and Font type (Figure C-98) can be defined.

| Font | | | | | × |
|-----------|--------------|-------------------|----------------|------|--------------|
| │ Size fa | ctor of font | | | | |
| Item | Geotechr | nical data of the | alayer 💌 | Size | 2,5 |
| Samp | le | | | | Eont type |
| A | .aBbYyZz | | | | Courier New |
| | k | <u>S</u> ave | <u>C</u> ancel | | <u>H</u> elp |

Figure C-97 "Font size" Dialog box

| Font | | ? × |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------|
| Eont: Arial [| Font style: Regular | ОК |
| T Arabic Transparent T Arial T Arial Black T Arial Narrow T Bold Italic Art T Book Antiqua T Bookman Old Style | Regular Italic Bold Bold Italic | Cancel |
| Effects Stri <u>k</u> eout Luderline Color: Black | Sample AaBbYyZz Script: | |
| This is a TrueType font. This sa your printer and your screen. | me font will be used on both | |

Figure C-98 "Font type" Dialog box

5.8.7 Main data Menu

The Main data Menu has the following command:

- Preferences

Main data Menu-"Preferences" command

When "Preferences" command is chosen, the following Dialog box in Figure C-99 appears.

| Preferences | | × |
|---------------------------|-------------------|--------------------|
| Number formats: | | |
| Number formats: | | 0.00 |
| | | |
| Default soil data: | | |
| File of default soil data | C:\Programme\ELPL | A PE 8.0\Default 📴 |
| | | |
| Save | <u>C</u> ancel | <u>H</u> elp |

Figure C-99 "Preferences" Dialog box
In the Dialog box of Figure C-99 the user can specify the following items:

- In the Dialog box "Default soil data" the user can specify the file of default soil data. Default soil data are considered when creating new boring logs
- In the Dialog box "Number formats" the user can specify how the numbers of soil parameter values (levels, depths, dimensions, etc.) are displayed or printed

The following examples describe the number formats:

 Number = 5459.3472

 Format "0.000"
 gives 5459.347

 Format "0.00"
 gives 5459.35

 Format "0.0"
 gives 5459.4

 Format "0"
 gives 5459

 Format "00E+00"
 gives 55E+02

 (Exponential format)

5.8.8 Window Menu (See paragraph 5.3.8)

5.8.9 Help Menu (See paragraph 5.3.9)

5.9 Data Menu–"Net of soil elements in z-direction" command

The number of elements and element sizes of the net of soil elements in z-direction are defined. This net is required for determining displacements, stresses and strains in soil. When the command is chosen, the following Dialog box of Figure C-100 appears. In order to activate the option of variable element sizes in z-direction, the corresponding item must be unchecked.

| × |
|----------------|
| Cause 1 |
| <u>5</u> ave |
| <u>C</u> ancel |
| |
| <u>L</u> oad |
| Sava An |
| <u>Jave As</u> |
| <u>H</u> elp |
| |

Figure C-100 "Net of soil elements in z-direction" Dialog box

5.10 Data Menu-"Limit depth" command

It is found from experience that the number of layers under foundation depends on the limit depth Zg, where no settlement occurs. The limit depth Zg is defined as the level of which the stress due to the foundation loads reaches a standard ratio Cs of the initial vertical stress due to the self-weight of the soil layers. According to the German Standard DIN 4019 part 1 the recommended standard value of Cs is 0.2.

By the "Limit depth" command limit depth of the soil layers in a boring is defined. When the "Limit depth" command is chosen, the following Dialog box of Figure C-101 appears.

| Limit depth | | × |
|--------------------------------------------------|--------------------|-----------------|
| For which boring logs (No.) shall the limit de | pth be determined? | |
| Boring No. Label of boring | | <u>S</u> ave |
| ✓ 1 BPN1 ✓ 2 BPN2 | | <u>C</u> ancel |
| BPN3 | | <u>L</u> oad |
| Factors: | | Save <u>A</u> s |
| Standard ratio of limit depth (0<=Cs<=1) | Cs [1] 0,2 | Help |
| Stress calculation based on: | | |
| C Stress under the characteristic point | | |
| Stress under the slab center | | |
| C Stress under the point: | × [m] 9,57 | y [m] 1,3 |
| | | |

Figure C-101 "Limit depth" Dialog box

The Dialog box of Figure C-101 shows the available boring logs in the project. To determine the limit depth of a boring log, check the box of that boring log.

5.11 Data Menu–"Foundation (Slab) properties" command

When the "Foundation properties" command is chosen, the following embedded program appears, Figure C-102.

| ELPLA-D a File View | ata - [Te Graph | est] - [Fo ically Ir | undatio h table | n prope i Foundati | r ties] on proper | ties Op | otions I | Format | Window | Help | | | | _ 8 |
|-------------------------------|--------------------|-------------------------|---------------------------|------------------------------|-----------------------------|------------|------------|--------|--------|------|---------|-------|--------------------|-----|
|) 🖻 🖡 | 3 🛋 | . 1 | ∜ | s į | ≡ ? | y ⊮× | A , | Θ | • • | 100 | • Q 🔉 🤞 | > 😡 🐿 | <mark>6</mark> 8 🖕 | • |
| | / 🖆 | # | ՝ Դ՝ ո | - 🔯 | - [| 9 F | • | | | | | | | |
| 4 | 4 | a | 4 | 4 | 4 | 4 | a | a | 4 | 4 | | | | |
| | | | | | | | | | | | | | | |
| 4 | 3 | 3 | 3 | 3 | э | 3 | 3 | 3 | 3 | 4 | | | | |
| 4 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | | | | |
| 4 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 4 | | | | |
| | | | | | | + | + | | | | | | | |
| 4 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 4 | | | | |
| 4 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 3 | 4 | | | | |
| 4 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 4 | | | | |
| | 2 | | ø | 2 | 2 | 2 | 2 | 2 | 5 | | | | | |
| | 3 | | 2 | 2 | 2 | 2 | | 2 | 3 | | | | | |
| 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | з | 4 | | | | |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | Þ |

Figure C-102 "Foundation properties" embedded program

The menu head of Figure C-102 contains the following nine commands:

- File
- View
- Graphically
- In table
- Foundation (Slab) properties
- Options
- Format
- Window
- Help

After clicking one of the nine menus other sub-menus or commands become available. The following paragraph presents and describes the nine menu commands and their sub-commands.

5.11.1 File Menu

This menu contains five commands:

- New foundation properties
- Open foundation properties
- Save foundation properties
- Save foundation properties as
- Close foundation properties

File Menu-"New foundation properties" command

Defines new foundation properties

File Menu-"Open foundation properties" command

Opens existing foundation properties-files again on the screen. Then the foundation properties, if desired, can be redefined.

File Menu-"Save foundation properties" command

Saves the active foundation properties under the available name

File Menu-"Save foundation properties as" command

Saves the active foundation properties under a new name

File Menu-"Close foundation properties" command

Closes the Foundation properties-embedded program and returns to ELPLA-Data

5.11.2 View Menu (See paragraph 5.3.2)

5.11.3 Graphically Menu

The menu "Graphically" contains the following commands:

- Undo
- Redo
- Select elements
- Element groups
- Cartesian grid

Graphically Menu-"Undo" command

This command is used to undo the effects of a selected command and return to a previous state.

Graphically Menu-"Redo" command

This command is used to redo the last action of "Undo" command.

Graphically Menu-"Select elements" command

The main function of the command is to provide a method to define the element properties. When the command is chosen, the cursor is changed from an arrow to a cross hair. The desired elements are selected by selecting a group of elements or click by Mouse on each element individually. A group of elements can be selected by holding the left mouse button down at the corner of the region and dragging the mouse until a rectangle encompasses the desired group of elements. When the left mouse button is released, all elements in the rectangle are selected.

Graphically Menu-"Element groups" command

When "Element groups" command is chosen, the following Dialog box in Figure C-103 appears. In this Dialog box define the group No..

| Group regions | × |
|----------------|--------------|
| Group regions: | |
| Group No. | · 1 🔽 |
| <u>k</u> ancel | <u>H</u> elp |

Figure C-103 Defining group No.

Graphically Menu–''Cartesian grid'' command See paragraph 5.3.3

5.11.4 In table Menu

The menu "In table" contains the following commands:

- Element groups
- Group regions

In table Menu-"Element groups" command

When "Element groups" command is chosen, the following Dialog box in Figure C-104 appears. In this Dialog box E-Modulus of the slab, *Poisson*'s ratio of the slab and slab thickness are defined. Element group is a group that has the same thickness and material.

| D | efining ele | ment groups (with | the same thickne | ss and slab material) | × |
|---|--------------|---------------------------------|-----------------------------------|----------------------------|--------------|
| | Group No. | E-Modulus of slab [kN/m2] | Poisson's ratio of slab [-] | Slab thickness d [m] | <u>Ok</u> |
| | 1 | 2E+07 | 0,25 | 0,5 | |
| | 2 | 2E+07 | 0,25 | 0,7 | Insert |
| | 3 | 2E+07 | 0,25 | 0,9 | |
| | 4 | 2E+07 | 0,25 | 1 | Сору |
| | | | | | Delete |
| | | | | | New |
| | | | | | <u>H</u> elp |
| | | | | | Excel |

Figure C-104 "Defining element groups" Dialog box

In table Menu-"Group regions" command

By the program ELPLA there are two alternative possibilities to define group regions graphically or numerically (in a table). If it is required to define the group regions in a table, the user must choose "Group regions" command from In table Menu. When "Group regions" command is chosen, the following Dialog box in Figure C-105 appears. Here the element groups of the elements are defined.

| Group reg | jions | | × |
|----------------|--------------|---|----------------|
| Element No. | Group No. | | <u>k</u> |
| | | | <u>C</u> ancel |
| | - | | <u>I</u> nsert |
| 1 | 4 | | Carry |
| 2 | 4 | | |
| 4 | 4 | | Delete |
| 5 | 4 | | |
| 6 | 4 | | New |
| 7 | 4 | | |
| 8 | 4 | | <u>H</u> elp |
| 9 | 4 | | |
| 10 | 4 | • | Excel |

Figure C-105 "Group regions" Dialog box

5.11.5 Foundation (Slab) properties Menu

The menu "Foundation properties" contains the following commands:

- Unit weight of the foundation
- Foundation depth
- Origin coordinates
- Foundation level from a fixed datum

Foundation properties Menu-"Unit weight of the foundation" command

When the command is chosen, the following Dialog box in Figure C-106 appears. To consider the self-weight of the slab in the analysis, define the unit weight of the slab material.

| Unit weight of t | ne foundation | | × |
|-------------------|---------------------------------|------------|--------------|
| Unit weight of th | ne foundation: ne foundation | Gb [kN/m3] | 25 |
| <u>0</u> k | <u>N</u> ew | Cancel | <u>H</u> elp |

Figure C-106 "Unit weight of the foundation" Dialog box

Foundation properties Menu-"Foundation depth" command

When "Foundation depth" command is chosen, the following Dialog box in Figure C-107 appears.



Figure C-107 "Foundation depth" Dialog box

In ELPLA, there are three different possibilities to define the slab thickness:

- Slab thickness is constant for the entire slab. In this case there is only one group, Figure C-108
- Variable slab thickness with constant foundation level, Figure C-109
- Variable slab thickness with variable foundation level, Figure C-110



Figure C-108 The slab thickness d is constant for the entire slab



Figure C-109 Variable slab thickness with constant foundation level



Figure C-110 Variable slab thickness with variable foundation level

In the Dialog box of Figure C-107 define the foundation depth under the ground surface Tf, if the foundation level is constant or define the depth of the slab surface under the ground surface Tk, if the foundation level is variable.

Foundation properties Menu-"Origin coordinates" command

By analysis of a system of slab foundations or study the effect of neighboring foundations, every slab is defined in a global system through the origin coordinates x_0 , y_0 and angle \exists_0 between the x-axes of global and local systems.

When "Origin coordinates" command is chosen, the following Dialog box in Figure C-112 appears. In this Dialog box define the origin coordinates x_0 , y_0 and angle β_0 between the x-axes of global and local systems.

Note

In the analysis of an isolated slab without consideration of neighboring foundations, the origin coordinates play no roles in the analysis.



Figure C-111 Geometrical plan by studding the influence of slab k on the slab i



Figure C-112 "Origin coordinates" Dialog box

Foundation properties Menu-"Foundation level from a fixed datum" command

Sometimes, when determining the influence of the neighboring slabs or the interaction of a system of slabs, the slabs are constructed with variable foundation levels, Figure C-113. This can be considered through the command "Foundation level from a fixed datum" as shown in Figure C-114. In this case, the foundation levels of the slabs must be related to a specified datum H_m .

Note

In the analysis of an isolated slab without consideration of neighboring foundations, the levels H_m play no roles in the analysis.



Figure C-113 Influence of slab k on the slab i



Figure C-114 "Foundation level from a fixed datum" Dialog box

- 5.11.6 Options Menu (See paragraph 5.3.6)
- **5.11.7 Format Menu** (See paragraph 5.3.7)
- 5.11.8 Window Menu (See paragraph 5.3.8)
- 5.11.9 Help Menu (See paragraph 5.3.9)

5.12 Data Menu-"Reinforcement data" command

The design of the slab for flexure moment and punching shear can be carried out according to the design codes EC 2, DIN 1045, ACI and ECP (working stress and limit state design methods). When "Reinforcement data" command is chosen, the following Dialog box in Figure C-115 appears. In this Dialog box define design code, concrete grade, steel grade and concrete covers.

| Reinforcement (Design | for flexural moment) |
|------------------------------|---------------------------------------------------------------|
| Design code: | Concrete grade: |
| EC 2 | Characteristic compressive cylinder strength fck [MN/m2] 40,0 |
| | ○ Another ○ C 12/15 ○ C 16/20 ○ C 20/25 ○ C 25/30 |
| | C C 30/37 C C 35/45 C C 40/50 C C 45/55 C C 50/60 |
| Steel grade: | |
| Characteristic tensile yield | d strength fyk [MN/m2] 500 |
| C Another C BSt | 220 C BSt 420 C BSt 500 C BSt 550 C BSt 600 |
| Concrete cover + 1/2 ba | ar diameter: |
| X-direction top | d1x[cm] 5,0 |
| X-direction bottom | d2x [cm] 5,0 |
| Y-direction top | d1y [cm] 6,0 |
| Y-direction bottom | |
| Save | Cancel Help Load Save As |

Figure C-115 "Reinforcement" dialog box

5.13 Data Menu–"Boring fields" command

If the subsoil under the slab foundation is characterized by more than one boring, the variation in the subsoil in the three directions must be taken into consideration according to ELPLA-Theory. By the "Boring fields" command the boring fields can be defined. It is also possible to define the boring fields graphically, which makes the definition of the boring fields very easy, or numerically (in a table). When the "Boring fields" command is chosen, the following embedded program appears, Figure C-116.

ELPLA-Data



Figure C-116 "Boring fields" embedded program

The menu head of Figure C-116 contains the following nine commands:

- File
- View
- Graphically
- In table
- Boring fields
- Options
- Format
- Window
- Help

After clicking one of the nine commands (options) other sub-commands or options become available. The following paragraph presents and describes the nine menu commands and their sub-commands.

5.13.1 File Menu

This menu contains five commands:

- New boring fields
- Open boring fields
- Save boring fields
- Save boring fields as
- Close boring fields

File Menu-"New boring fields" command

Defines new boring fields

File Menu-"Open boring fields" command

Opens existing boring fields-file again. Then the boring fields, if desired, can be redefined.

File Menu-"Save boring fields" command

Saves the active boring fields under the available name

File Menu-"Save boring fields as" command

Saves the active boring fields under a new name

File Menu-"Close boring fields" command

Closes the boring fields-embedded program and returns to ELPLA-Data

5.13.2 View Menu (See paragraph 5.3.2)

5.13.3 Graphically Menu

This menu contains the following commands:

- Undo
- Redo
- Select nodes
- Zone type I
- Zone type II
- Zone type III
- Cartesian grid

Graphically Menu-"Undo" command

This command is used to undo the effects of a selected command and return to a previous state.

Graphically Menu-"Redo" command

This command is used to redo the last action of "Undo" command.

Graphically Menu-"Select nodes" command

The main function of "Select nodes" command is to provide a method for defining the nodes of Zone type III. Soil properties for nodes lying in this zone are defined according to a specified boring by the user. Zone type III contains also the nodes that are outside the zones I and II.

When "Select nodes" command is chosen, the cursor is changed from an arrow to a cross hair. In this case, "Zone type I" and also "Zone type II" will be disabled. The desired 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 and 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.

Graphically Menu–"Zone type I" command

Zone type I is defined as a triangular region; such a region is confined by three boring logs. The flexibility coefficient or the modulus of subgrade reaction for a node that lies at a triangular region, can be obtained through interpolation among the three values of the parameters of these three boring logs.

When "Zone type I" command is chosen, the cursor is changed from an arrow to a cross hair. The desired triangular region of Zone type I is selected by clicking on the three borings that confine it, Figure C-117.



Figure C-117 Zone type I

Graphically Menu-"Zone type II" command

Zone type II is a region that is confined by one or more sides of the foundation and two borings. The flexibility coefficient or the modulus of subgrade reaction for a node in this region may be obtained by assuming a linear interpolation between the values of the parameters of these two boring logs.

When "Zone type II" command is chosen, the cursor is changed from an arrow to a cross hair. The desired region of Zone type II is selected by clicking on the two borings that confine it, then clicking on any point inside that region, Figure C-118.

ELPLA-Data



Figure C-118 Zone type II

Graphically Menu-"Zone type III" command

When "Zone type III" command is chosen, the following Dialog box of Figure C-119 appears to define the boring of the selected nodes.

| Boring fields | × |
|---------------------|--------------|
| Boring fields: | |
| Field of boring No. | [•] 1 |
| <u>k</u> ancel | <u>H</u> elp |

Figure C-119 "Definition of boring fields" Dialog box

Graphically Menu–''Cartesian grid'' command See paragraph 5.3.3

5.13.4 In table Menu

This menu contains the following commands:

- Zone type I
- Zone type II
- Zone type III

In table Menu-"Zone type I" command

When the "Zone type I" command is chosen, the following Dialog box appears. In the Dialog box of Figure C-120 each region of Zone type I is defined by the three borings that confine it.

| Zone type | e I | | | × |
|-------------|-------------|--------------|---------------|----------------|
| Zone No. | Boring I | Boring II | Boring III | <u>0</u> k |
| 1 | 3 | 1 | 2 | <u>C</u> ancel |
| | | | | <u>I</u> nsert |
| | | | | <u>С</u> ору |
| | | | | <u>D</u> elete |
| | | | | <u>N</u> ew |
| | | | | <u>H</u> elp |
| | | | | Excel |

Figure C-120 "Zone type I" Dialog box

In table Menu-"Zone type II" command

When the "Zone type II" command is chosen, the following Dialog box appears, Figure C-121. In this Dialog box each region of Zone type II is defined by the two borings that confine it as well as a corner of the foundation lies inside it. The corner of the foundation can be described as follows:

- Corner No. 1: bottom left corner of the foundation
- Corner No. 2: bottom right corner of the foundation
- Corner No. 3: top left corner of the foundation
- Corner No. 4: top right corner of the foundation

| Z | one type | e II | | | | × |
|---|-------------|-------------|--------------|---------------|-----|----------------|
| | Zone No. | Boring I | Boring II | Corner No. | | [<u></u> k] |
| | 1 | 2 | 3 | 3 | | <u>C</u> ancel |
| | 3 | 2 | 1 | 2 | | Insort |
| | | | | | , I | Inseit |
| | | | | | | <u>С</u> ору |
| | | | | | | <u>D</u> elete |
| | | | | | | New |
| | | | | | | Help |
| | | | | | | Excel |

Figure C-121 "Zone type II" Dialog box

In table Menu-"Zone type III" command

When the "Zone type III" command is chosen, the following Dialog box appears. In the Dialog box of Figure C-122 define the borings of nodes that are not considered in Zone type I or II.

| Z | one type | e III | | | × |
|---|----------|-------------|---------------|---|----------|
| | No. I | Node No. | Boring No. | - | |
| | 1 | 1 | 1 | | Cancel |
| L | 2 | 2 | 1 | | |
| | 3 | 3 | 1 | | Insert |
| | 4 | 4 | 1 | | |
| | 5 | 5 | 1 | | Conv |
| Γ | 6 | 6 | 1 | | |
| | 7 | 7 | 1 | | Delete |
| | 8 | 8 | 1 | | |
| Γ | 9 | 9 | 1 | | New |
| | 10 | 13 | 1 | | <u></u> |
| | 11 | 14 | 1 | | Help |
| | 12 | 15 | 1 | | <u> </u> |
| | 13 | 16 | 1 | F | Excel |
| | | | | | |

Figure C-122 "Zone type III" Dialog box

5.13.5 Boring fields Menu

Using the Boring fields Menu allows the user to choose one of the three different possibilities to determine the boring fields. This menu contains the following command:

- Interpolation method
- Subarea method
- Hand-Division of boring logs to nodes

Boring fields Menu-"Interpolation method" command

Interpolation method is an accurate one to determine the three-dimensional flexibility coefficient or variable modulus of subgrade reaction for arbitrary foundation on irregular subsoil. The "Interpolation method" command allows the user to define the interpolation zones I and II, and also Zone type III automatically. When the "Interpolation method" command is chosen, the following Figure C-123 appears.

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Figure C-123 Boring locations and region types by Interpolation method

Boring fields Menu-"Subarea method" command

In the Subarea method the entire foundation area is divided into subareas. Each subarea is corresponding to one of the boring logs. This method may be used if there is a little difference in soil properties of boring logs. The "Subarea method" command allows the user to define the subareas automatically. When the command is chosen, the following Figure C-124 appears.



Figure C-124 Boring locations and subareas by Subarea method

Boring fields Menu-"Hand-Division of boring logs to nodes" command

This command allows the user to define the zone types I, II, III graphically by using the commands of Graphically Menu or manually through In table Menu.

5.13.6 Options Menu (See paragraph 5.3.6)

5.13.7 Format Menu (See paragraph 5.3.7)

5.13.8 Window Menu (See paragraph 5.3.8)

5.13.9 Help Menu (See paragraph 5.3.9)

Numbering of borings

To determine the subareas or the interpolation zones automatically by ELPLA, the boring No. 1 must be always a central position for the other borings, if the subsoil is characterized through more than three borings. Figure C-125 to C-129 show five borings defining the subsoil under a raft. It can be carried out different arrangements of interpolation zones using the above role. Another arrangement for the boring numbering may cause some errors. In this case, the Hand-Division of the boring logs to the nodes by the user must be used.



Figure C-125 Division of interpolation zones (numbering of boring a)



Figure C-126 Division of interpolation zones (numbering of boring b)



Figure C-127 Division of interpolation zones (numbering of boring c)



Figure C-128 Division of interpolation zones (numbering of boring d)





5.14 Data Menu–"Loads" command

By the "Loads" command the loads on the slab such as point loads, line loads, distributed loads or moments at any position independently on the FE-Net are defined. When this command is chosen, the following embedded program appears, Figure C-130.



Figure C-130 "Loads" embedded program

The menu head of Figure C-130 contains the following nine commands:

- File
- View
- Graphically
- In table
- Using formula
- Options
- Format
- Window
- Help

After clicking one of the nine commands (options) other sub-commands or options become available. The nine menu commands and their sub-commands are presented and described in the following paragraphs.

5.14.1 File Menu

This menu contains five commands:

- New loads
- Open loads
- Save loads
- Save loads as
- Close loads

File Menu-"New loads" command

Defines new loads

File Menu-"Open loads" command

Opens existing load file again on the screen. Then the loads, if desired, can be redefined.

File Menu-"Save loads" command

Saves the active loads under the available name

File Menu-"Save loads as" command

Saves the active loads under a new name

File Menu-"Close loads" command

Closes the loads-embedded program and returns to ELPLA-Data

5.14.2 View Menu (See paragraph 5.3.2)

5.14.3 Graphically Menu

This menu contains the following commands:

- Undo
- Redo
- Point loads
- Moments M_x
- Moments M_y
- Line loads
- Line moments
- Distributed loads (Polygon)
- Distributed loads (Rectangle)
- Remove loads
- Edit loads
- Cartesian grid

Graphically Menu-"Undo" command

This command is used to undo the effects of a selected command and return to a previous state.

Graphically Menu-"Redo" command

This command is used to redo the last action of "Undo" command.

Graphically Menu-"Point loads" command

By the "Point loads" command the vertical concentrated loads can be defined at any position (x, y). The position of the load is independent on the FE-Net. When "Point loads" command is chosen, the cursor is changed from an arrow to a cross hair. Then, the load can be defined by clicking on the screen (slab). When the screen is clicked, the following Dialog box of Figure C-131 appears and the following data is required to define:

- Column type
- Load value
- Position of the load (x, y) in the local coordinates



Figure C-131 "Point loads P" Dialog box

Graphically Menu-"Moments Mx" command

By this command the applied moment about x-axis can be defined at any position (x, y). The position of applied moment is independent on the FE-Net. When the command is chosen, the cursor is changed from an arrow to a cross hair. Then, the moment can be defined by clicking on the screen. When the screen is clicked, the following Dialog box of Figure C-132 appears and the following data is required to define:

- Moment value
- Position of the moment (x, y) in the local coordinates



Figure C-132 "Moments M_x" Dialog box

Graphically Menu–"Moments My" command

By the "Moments M_y " command the applied moment about y-axis can be defined at any position (x, y). The position of applied moment is independent on the FE-Net. When "Moments M_y " command is chosen, the cursor is changed from an arrow to a cross hair. Then, the moment can be defined by clicking on the screen. When the screen is clicked, the following Dialog box of Figure C-133 appears and the following data is required to define:

- Moment value
- Position of the moment (x, y) in the local coordinates

| Loading | × |
|-------------|-----------------|
| Moments My: | |
| Moments My | [kN.m] 500,0 |
| X-position | [m] 9,20 |
| Y-position | [m] 5,50 |
| | |
| <u> </u> | << <u>L</u> ess |
| | - |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

Figure C-133 "Moments M_y" Dialog box

Graphically Menu-"Line loads" command

By the "Line loads" command the applied load per Meter can be defined at any position from point (x_1, y_1) to point (x_2, y_2) . The position of the applied load is independent on the FE-Net. When "Line loads" command is chosen, the cursor is changed from an arrow to a cross hair. Then, the line load can be defined by clicking on the starting point of the line load. As the cursor is moved, a black line appears; indicating a line load is being defined. When the ending point is clicked, the following Dialog box of Figure C-134 appears and the following data is required to define:

- Values of start and end points of the load
- Position of starting the line load (x_1, y_1) in the local coordinates
- Position of ending the line load (x_2, y_2) in the local coordinates



Figure C-134 "Line loads pl" Dialog box

Graphically Menu-"Line moments" command

By the "Line moments" command the applied moment can be defined at any position from point (x_1, y_1) to point (x_2, y_2) . The position of the applied moment is independent on the FE-Net. When "Line moments" command is chosen, the cursor is changed from an arrow to a cross hair. Then, the line moment can be defined by clicking on the starting point of the line moment. As the cursor is moved, a black line appears; indicating a line moment is being defined. When the ending point is clicked, the following Dialog box of Figure C-135 appears and the following data is required to define:

- Values of start and end points of the moment
- Position of starting the line moment (x_1, y_1) in the local coordinates
- Position of ending the line moment (x_2, y_2) in the local coordinates



Figure C-135 "Line moments Ml" Dialog box

Graphically Menu-"Distributed loads (Polygon)" command

By this command the applied load per Meter square can be defined for a polygon load. The position of the applied load is independent on the FE-Net. When this command is chosen, the cursor is changed from an arrow to a cross hair. To define a polygon load, click the polygon corners by Mouse to define the polygon. When double-click by Mouse on the last corner of the polygon, the following Dialog box of Figure C-136 appears and the following data is required to define:

- Load intensity at corners
- Corners position of the polygon



Figure C-136 "Distributed loads p" Dialog box

Graphically Menu-"Distributed loads (Rectangle)" command

By this command the applied load per Meter square can be defined at any diagonal position (x_1, y_1) to (x_2, y_2) . The position of the applied load is independent on the FE-Net. When "Distributed loads (Rectangle)" command is chosen, the cursor is changed from an arrow to a cross hair. Then, the load can be defined by holding the left mouse button down at the starting point of the distributed load. As the mouse is dragged, a box appears, indicating a distributed load is being defined. When the left mouse button is released, the following Dialog box of Figure C-137 appears and the following data is required to define:

- Distributed load value
- Position of the starting point (x_1, y_1) in the local coordinates
- Position of the ending point (x_2, y_2) in the local coordinates

| Loading | × |
|-----------------------------------------|-----------------------|
| Distributed loads: | |
| Load value | p [kN/m2] 120,0 |
| Load start x1 | [m] 0,00 |
| Load start y1 | [m] 0,00 |
| Load end x2 | [m] 0,50 |
| Load end y2 | [m] 14,00 |
| Dk Cancel (x, yp) (x, yp) | <u>H</u> elp <<< Less |

Figure C-137 "Distributed loads (Rectangle)" Dialog box

Graphically Menu-"Remove loads" command

The main function of "Remove loads" command is to provide a method for deleting loads. When the command is chosen, the cursor changes from an arrow to a cross hair. Then, the desired loads can be removed by double clicking on each load individually.

Graphically Menu-"Edit Loads" command

The main function of this command is to provide a method for redefine or editing loads. When "Edit loads" command is chosen, the cursor changes from an arrow to a cross hair. Then, the desired loads can be selected by double clicking on each load individually.

Note

If the snap to grid option in "Grid" Dialog box is checked, the cursor will snap to a grid point each time the screen is clicked at a point.

Graphically Menu-"Cartesian grid" command

(See paragraph 5.3.3)

5.14.4 In table Menu

This menu contains the following commands:

- Distributing the point load
- Column type
- Point loads
- Moments M_x
- Moments M_y
- Line loads
- Line moments
- Distributed loads (Polygon)
- Distributed loads (Rectangular)

In table Menu –"Distributing the point load" command

Point load never applied in realty. If a point load represents a column load on a mesh of refine finite elements, the moment under the column will be higher than the real moment. To take the effect of the load distribution through the slab thickness, the column load must be distributed outward at 45 [°] from the column face until reaching the center line of the slab. To convert the point load to an equivalent uniform load over an appropriate area, check the "Distribute column load" check box in the Dialog box of Figure C-138.



Figure C-138 Distributing the column point load over an appropriate area

In table Menu-"Column types" command

When the command is chosen, the following Table in Figure C-139 appears to define the column dimensions. Column dimensions are required for design of the slab for punching shear.



Figure C-139 Defining column dimensions

In table Menu -"Point loads" command

In the Dialog box of Figure C-140 the external point load P at the position (x, y) is defined. The coordinates for the input load are related to the left bottom corner of the corresponding slab (local coordinates).

| nt loa | ds | | | | |
|-----------------|--------------------------|-------------------|------------------------|------------------------|--------|
| No. [•] | Column types I [·] | Load P [kN] | x-position x [m] | y-position y [m] | |
| 1 | 1 | 1265,0 | 1,50 | 1,40 | |
| 2 | 1 | 1600,0 | 1,50 | 5,50 | Insert |
| 3 | 1 | 1350,0 | 1,50 | 9,90 | |
| 4 | 1 | 1368,0 | 1,50 | 12,60 | Сору |
| 5 | 1 | 1560,0 | 5,00 | 1,40 | |
| 6 | 1 | 1538,0 | 5,00 | 12,60 | Delete |
| 7 | 1 | 800,0 | 9,20 | 1,40 | |
| 8 | 1 | 750,0 | 9,20 | 5,50 | New |
| 9 | 1 | 1565,0 | 9,20 | 12,60 | |
| 10 | 1 | 2150,0 | 13,40 | 5,50 | Help |
| 11 | 1 | 1450,0 | 13,40 | 9,90 | |
| 12 | 1 | 1254,0 | 13,40 | 12,60 | Excel |

Figure C-140 "Point loads P" Dialog box

In table Menu-"Moments M_x" command

In the Dialog box of Figure C-141 the external moment M_x at the position (x, y) is defined. The coordinates for the input moment M_x are related to the left bottom corner of the corresponding slab (local coordinates).

| N | loments | Mx | | | × |
|---|-----------------|------------------------|------------------------|------------------------|----------------|
| | No. [•] | Moment Mx [kN.m] | x-position x [m] | y-position y [m] | |
| | 1 | 350,0 | 5,00 | 1,40 | |
| | | | | | Insert |
| | | | | | <u>C</u> opy |
| | | | | | <u>D</u> elete |
| | | | | | New |
| | | | | | <u>H</u> elp |
| | | | | | Excel |

Figure C-141 "Moments M_x" Dialog box

In table Menu–"Moments My" command

In the Dialog box of Figure C-142 the external moment M_y at the position (x, y) is defined. The coordinates for the input moment M_y are related to the left bottom corner of the corresponding slab (local coordinates).

| Þ | loments | My | | | × |
|---|-----------------|------------------------|------------------------|------------------------|--------------|
| | No. [•] | Moment My [kN.m] | x-position x [m] | y-position y [m] | |
| | 1 | 500,0 | 9,20 | 5,50 | |
| | | | | | Insert |
| | | | | | Сору |
| | | | | | Delete |
| | | | | | New |
| | | | | | <u>H</u> elp |
| | | | | | Excel |

Figure C-142 "Moments M_y" Dialog box

In table Menu-"Line loads" command

In the Dialog box of Figure C-143 the external line load pl from the position (x_1, y_1) to (x_2, y_2) is defined. The coordinates for the input line load pl are related to the left bottom corner of the corresponding slab (local coordinates).

| L | ine load | \$ | | | | | × |
|---|-----------------|-------------------------------------|-----------------------------------|-------------------------|-------------------------|-----------------------|------------------------------|
| | No. [-] | Load start value pl [kN/m] | Load end value pl [kN/m] | Load start x1 [m] | Load start y1 [m] | Load end x2 [m] | <u>O</u> k <u>C</u> ancel |
| | 1 | 89,0 | 89,0 | 10,50 | 4,80 | 15,00 | <u>I</u> nsert |
| | | | | | | | <u>С</u> ору |
| | | | | | | | <u>D</u> elete |
| | | | | | | | <u>N</u> ew |
| | | | | | | | <u>H</u> elp |
| | • | | | | | Þ | Excel |

Figure C-143 "Line loads pl" Dialog box

In table Menu–"Line moments" command

In the Dialog box of Figure C-144 the external line moment MI from the position (x_1, y_1) to (x_2, y_2) is defined. The coordinates for the input line moment MI are related to the left bottom corner of the corresponding slab (local coordinates).

| L | ine mom | ents | | | | | | × |
|---|----------|---------------------|-------------------|------------------|------------------|----------------|-----|----------------|
| | No. I | Load start value | Load end value | Load start x1 | Load start y1 | Load end x2 | Loa | <u>0</u> k |
| | [-] | MI [kN.m/m] | MI [kN.m/m] | [m] | [m] | [m] | 0 | <u>C</u> ancel |
| | 1 | 200,0 | 300,0 | 2,00 | 7,00 | 10,00 | | <u>I</u> nsert |
| | | | | | | | | <u>С</u> ору |
| | | | | | | | | <u>D</u> elete |
| | | | | | | | | <u>N</u> ew |
| | | | | | | | | (<u>H</u> elp |
| | • | | | | | | ▶ | Excel |

Figure C-144 "Line moments Ml" Dialog box

In table Menu-"Distributed loads (Polygon)" command

When "Distributed loads (Polygon)" command is chosen, the Dialog box of Figure C-136 appears to define load intensity at corners and corners position of the polygon.

In table Menu-"Distributed loads (Rectangle)" command

In the Dialog box of Figure C-145 the external distributed load p from the diagonal position (x_1, y_1) to (x_2, y_2) is defined. The coordinates for the input distributed load p are related to the left bottom corner of the corresponding slab (local coordinates).

| D | istribute | d loads | | | | | × |
|---|-----------------|----------------------------|-------------------------|-------------------------|-----------------------|-----------------------|----------------|
| | No. [•] | Load value p [kN/m2] | Load start x1 [m] | Load start y1 [m] | Load end x2 [m] | Load end y2 [m] | k Cancel |
| | 1 | 120,0 | 0,00 | 0,00 | 0,50 | 14,00 | <u>I</u> nsert |
| | | | | | | | <u>С</u> ору |
| | | | | | | | <u>D</u> elete |
| | | | | | | | New |
| | | | | | | | <u>H</u> elp |
| | • | | | | | F | Excel |

Figure C-145 "Distributed loads p" Dialog box

Note

If an element loaded area is overlap over another, the last input loaded area will be the valid one.

5.14.5 Using formula Menu

This menu contains the following commands:

- Point loads
- Moments M_x
- Moments M_y
- Line loads
- Line moments
- Distributed loads (Polygon)
- Distributed loads (Rectangle)

Using formula-"Point loads" command

This option is used to modify the load values through formula for existing load data. The option also may use to modify the load positions through formula in order to control the eccentricities e_x and e_y , Figure C-146.

| Load values using formula | | | | | | | |
|---------------------------|-----------------------|-----------------|--|--|--|--|--|
| Change Point loads: | | | | | | | |
| P (new) = factor * P (ol | d) + Delta P | <u><u> </u></u> | | | | | |
| Factor | [·] 1 | Cancel | | | | | |
| Delta P | [kN] 0 | | | | | | |
| Change load coordina | tes: | 7 | | | | | |
| x (new) = factor * x (old | d) + displacement (x) | | | | | | |
| y (new) = factor * y (old | d) + displacement (y) | | | | | | |
| Factor | [·] 1 | | | | | | |
| Displacement x | [m] 0 | | | | | | |
| Displacement y | [m] 0 | <u>H</u> elp | | | | | |

Figure C-146 "Load values using formula" Dialog box

Line loads, moments and distributed loads may be also modified independently using formula in the dialog box of Figure C-146.

5.14.6 Options Menu (See paragraph 5.3.6)

5.14.7 Format Menu (See paragraph 5.3.7)

5.14.8 Window Menu (See paragraph 5.3.8)

5.14.9 Help Menu (See paragraph 5.3.9)

5.15 Data Menu–"Neighboring foundations" command

To take the effect of neighboring foundations on the slab, the filenames for projects of neighboring foundations are required. In the Dialog box of Figure C-147 the filenames for projects of neighboring foundations can be defined.

| Neighboring fo | undations | × |
|---------------------------|----------------------------------------|-------------------------------|
| Neighboring foundation | File name of neighboring foundation | Save |
| No. | | <u>C</u> ancel |
| 1 | sf1 | Add neighboring foundation |
| 2 | 812 | |
| | | Remove neighboring foundation |
| | | Load |
| | | Save <u>A</u> s |
| | | New |
| | | <u>H</u> elp |

Figure C-147 "Neighboring foundations" Dialog box

5.16 Data Menu–"Temperature change" command

To take the effect of temperature change on the slab, the temperature difference Td and the coefficient of thermal expansion of the slab material are required in Figure C-148. Temperature difference Td occurs between the upper and lower surface of the slab foundation. If Td is 0 that means no temperature effect will occur. A positive Td means the temperature above the slab is greater than that under the slab. According to German Standard DIN 1045, the coefficient of thermal expansion of the concrete slab $\alpha = 0.00001$ [1/°C].

| C | Data of temperature change | | | | | | |
|---|---------------------------------------------------|----------------|--------------|------|--------------|-----------------|--|
| | Defining temperature difference | | | | | | |
| | Temperature dif | ference | | Td | [°C] 20 | | |
| | Coefficient of thermal expansion of slab material | | | Alfa | [1/°C] 0,0 | 0001 | |
| | <u>S</u> ave | <u>C</u> ancel | <u>H</u> elp | | <u>L</u> oad | Save <u>A</u> s | |

Figure C-148 "Data of temperature change" Dialog box

5.17 Data Menu-"Additional settlements" command

By this command additional settlements on the slab can be defined. It is also possible to define the additional settlements graphically, which makes the definition of the additional settlements very easy, or numerically (in a table). When the "Additional settlements" command is chosen, the following embedded program appears (Figure C-149).



Figure C-149 "Additional settlements" embedded program

The menu head of Figure C-149 contains the following eight commands:

- File
- View
- Graphically
- In table
- Options
- Format
- Window
- Help

After clicking one of the eight commands (options) other sub-commands or options become available. The following paragraph presents and describes the eight menu commands and their sub-commands.

5.17.1 File Menu

This menu contains five commands:

- New additional settlements
- Open additional settlements
- Save additional settlements
- Save additional settlements as
- Close additional settlements

File Menu-"New additional settlements" command

Defines new additional settlements

File Menu-"Open additional settlements" command

Opens existing additional settlements-file again on the screen. Then the additional settlements, if desired, can be redefined.

File Menu-"Save additional settlements" command

Saves the active additional settlements under the available name

File Menu-"Save additional settlements as" command

Saves the active additional settlements under a new name

File Menu-"Close additional settlements" command

Closes the additional settlements-embedded program and returns to ELPLA-Data

5.17.2 View Menu (See paragraph 5.3.2)

5.17.3 Graphically Menu

This menu contains the following commands:

- Undo
- Redo
- Select nodes
- Remove additional settlements
- Add additional settlements
- Cartesian grid

Graphically Menu-"Undo" command

This command is used to undo the effects of a selected command and return to a previous state.

Graphically Menu-"Redo" command

This command is used to redo the last action of "Undo" command.

Graphically Menu-"Select nodes" command

The main function of "Select nodes" command is to provide a method for removing or adding additional settlement on nodes. When "Select nodes" command is chosen, the cursor is changed from an arrow to a cross hair. In this case, "Add additional settlements" and also "Remove additional settlements" will be enabled, indicating the modes in which are being operated. The
desired 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 and 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.

Graphically Menu-"Remove additional settlements" command

The command is used to make the selected nodes free from additional settlements.

Graphically Menu-"Add additional settlements" command

This command is used to define the settlement value for the selected nodes. Any old additional settlements of the selected nodes will be replaced by the new editing. When this command is chosen, the following Dialog box of Figure C-150 appears to define the additional settlement.

| Additional settlements | | × |
|---------------------------|--------|----------------|
| Additional settlements | | |
| Additional settlements Ss | [cm] 2 | <u>U</u> K |
| | | <u>C</u> ancel |
| | | <u>H</u> elp |

Figure C-150 "Add additional settlements" Dialog box

Graphically Menu-"Cartesian grid" command

See paragraph 5.3.3

5.17.4 In table Menu

This menu contains the following command:

- Additional settlements

In table Menu-"Additional settlements" command

When the "Additional settlements" command is chosen, the following Dialog box appears. In this Dialog box (Figure C-151) define the additional settlement s_i at node i.

| A | dditiona | l settlements | | | × |
|---|----------|---------------|---------------------------------|---|---------------|
| | No. I | Node No. | Additional settlements Ss | • | <u>O</u> k |
| | | | [cm] | | Lancel |
| | 1 | 1 | 1,00 | | Insert |
| | 2 | 2 | 1,00 | | Insert |
| | 3 | 3 | 1,00 | | Copy |
| | 4 | 13 | 1,00 | | |
| | 5 | 14 | 2,00 | | Delete |
| | 6 | 15 | 2,00 | | <u></u> 0.000 |
| | 7 | 16 | 2,00 | | New |
| | 8 | 17 | 2,00 | | <u> </u> |
| | 9 | 25 | 2,00 | | Help |
| | 10 | 26 | 2,00 | | <u> </u> |
| | 11 | 27 | 2,00 | F | Excel |
| | 10 | | 2.00 | | Endor |

Figure C-151 Defining additional settlements in a table

- **5.17.5 Options Menu** (See paragraph 5.3.6)
- 5.17.6 Format Menu (See paragraph 5.3.7
- 5.17.7 Window Menu (See paragraph 5.3.8)
- 5.17.8 Help Menu (See paragraph 5.3.9)
- **6** View Menu (See paragraph 5.3.2)

7 Main Data Menu

The Main Data Menu has the following commands:

- Firm header
- Directory of data
- Preferences
- Help language setting
- System of units
- Number formats
- Design code parameters

7.1 Main Data–''Firm header'' command

The "Firm header" is two lines text to give information about your firm, company, institute or office, Figure C-152. The information is printed as headers at the top of the pages, which contain the tables of data and results that created by ELPLA-List. The information is also printed at the identification box for graphical drawings of data and results created by ELPLA-Graphic, ELPLA-Sections and ELPLA-Boring.

| Firm header | × |
|-----------------------------------------------------------------|--------------|
| Firm header: | |
| 1. Header Geotec Office | |
| 2. Header PO Box 14001 Richmond Road PO - Calgary AB, Canada T3 | 3E 7Y7 |
| | |
| <u>Save</u> <u>C</u> ancel | <u>H</u> elp |

Figure C-152 "Firm header" Dialog box

7.2 Main Data–"Directory of data" command

Instead of storing hundreds of project files, the files of input data, intermediate results or final results for a project can optionally be stored automatically in one compressed file. This makes it easier to send projects to other persons or to simply manage your own files. It also reduces the amount of disk space required to store all of your data files. The compressed file is ZIP-compatible, allowing you to manually extract the data files using WinZip or other data compression tools if you wish.

In the Dialog box of Figure C-153 specify which directory is used as default directory for files that are saved or opened by ELPLA. Also, check the files to be compressed.

| Directory of | data | × |
|--------------|-------------------------------|---|
| Directory of | data | |
| C:\PROGR | RAMME\ELPLA PE 9.0\ | |
| | s project files: | |
| | 🔽 Compress input data | |
| | Compress intermediate results | |
| | Compress final results | |
| | | |
| <u>S</u> ave | <u>Cancel</u> <u>H</u> elp | |

Figure C-153 "Directory of data" Dialog box

7.3 Main Data–"Preferences" command

In the Dialog box of Figure C-154 define the FE-Net and calculation of internal force preferences. To improve the distribution of the internal forces on the FE-Net, two possibilities for determining internal forces are available:

1. The internal forces are determined firstly at the element centers, and then distributed to the element nodes (recommended for triangular elements)

2. The internal forces are determined directly at the element nodes (recommended for rectangular elements)

| Preferences | | × |
|-------------------------------------------------------------------------------------------------------------------------------------|------------|--------------|
| FE-Net Preferences: | | |
| Check element overlaps | | |
| Check element size | | |
| Minimum distance between nodes | [m] | 0,05 |
| Calculation preferences: The Internal forces are determined at: the element centers and then distributed to the element nodes | element no | des |
| <u>Save</u> | | <u>H</u> elp |

Figure C-154 "Preferences" Dialog box

7.4 Main Data–"Help language setting" command

It can define the language of the help system used in ELPLA applications (Figure C-155). The three languages are English, German and Arabic.

| Help language settings | × |
|------------------------------------------|------------------|
| Help language settings: | |
| You can change the language of the help | |
| system used in the program applications. | |
| | Display help in: |
| | English |
| | German |
| | English |
| <u>Save</u> <u>C</u> ancel | |

Figure C-155 "Help language setting" Dialog box

7.5 Main Data–"System of unit" command

It is possible to set different unit systems such as SI-system or English-system without changing the real value of any previously defined data, Figure C-156.

| 9 | ystem of units | × |
|---|--------------------------------------------------------------------------------------|-----------------------------|
| | - System of units: | |
| | Lengths (1): Depths, coordinates, dimensions, thickness | meter, [m] |
| | Lengths (2): Reinforcement, concrete cover, settlements, eccentricity | centimeter, [cm] |
| | Forces (1): Loads, contact pressures, stresses | kilonewton, [kN] |
| | Forces (2): Punching shear stress, modulus of Compressibility, modulus of Elasticity | kilonewton, [kN] |
| | Temperature | Celsius (centigrade), [°C 💌 |
| | <u>Save</u> | <u>H</u> elp |

Figure C-156 "System of units" Dialog box

7.6 Main Data-"Number formats" command

By the "Number formats" command the user can choose, how the numbers of results and data are listed or printed, Figure C-157.

The following examples describe the number formats:

| Number = 5459.3472 | | |
|--------------------|----------------|----------------------|
| Format "0.000" | gives 5459.347 | |
| Format "0.00" | gives 5459.35 | |
| Format "0.0" | gives 5459.4 | |
| Format "0" | gives 5459 | |
| Format "00E+00" | gives 55E+02 | (Exponential format) |

| Number formats | × |
|---------------------------------------------|--------------|
| - Number formats: | |
| Loads, [kN], [kN/m], [kN/m2], [kN.m] | ▼ 0.0 |
| Format of Number = 5459.3472, gives: 5459,3 | |
| Save Cancel | <u>H</u> elp |

Figure C-157 "Number formats" Dialog box

7.7 Main data–"Design code parameters" command

The design of the slab for flexure moment and punching shear can be carried out according to the following design codes:

- EC 2

European Committee for Standardization, Design of Concrete Structures - Eurocode 2

- DIN 1045 German Institute for Standardization, Design and Construction of Reinforced Concrete
- ACI

American Concrete Institute Building Code Requirements for Structural Concrete

- ECP

Egyptian Code of Practice for Design and Construction of Reinforced Concrete Structures

In the menu of Figure C-158 the design code parameters may be redefined if desired. Also, the minimum reinforcements of tension and compression steel are defined.

| Design code parameters | | × |
|--------------------------------------------------------------------------|------------------|--------------|
| EC 2 DIN 1045 ACI ECP Minimum steel | | |
| Partial safety factors: | | |
| Partial safety factor for internal forces | γ | 1,4 |
| Partial safety factor for steel strength | γs | 1,15 |
| Partial safety factor for concrete strength | $\gamma_{\rm c}$ | 1,5 |
| Factors: | | |
| Reduction factor for sustained loading | α | 0,85 |
| Factor for obtaining depth of compression block | $\alpha_{\rm R}$ | 0,8 |
| Limitation of compression zone depth: | | |
| According to EC 2 (xi_lim=0,35 for <=C 40/50, xi_lim=0.45 for >=C 35/45) | | |
| C Ratio of the neutral axis depth is defined by the user | ξ _{lim} | 0,35 |
| Save Cancel Default parameters | | <u>H</u> elp |

Figure C-158 "Design code parameters" Dialog box

8 Help Menu (See paragraph 5.3.9)

9 Tips and Tricks

9.1 Keyboard

The user can obtain all menu titles and commands also through Shortcut keys. The action of the Shortcut keys is listed in Table C-5 to Table C-19:

| Shortcut keys | Action | |
|---------------|-------------------|-------------------------|
| [Alt+f] | Calling menu head | "File" |
| [Alt+v] | | "View" |
| [Alt+f] | | "FE-Net Generation" |
| [Alt+i] | | "In Table" |
| [Alt+g] | | "Graphically" |
| [Alt+d] | | "Data" |
| [Alt+m] | | "Main data" |
| [Alt+a] | | "Foundation properties" |
| [Alt+b] | | "Boring fields" |
| [Alt+u] | | "Using formula" |
| [Alt+o] | | "Option" |
| [Alt+f] | | "Format" |
| [Alt+w] | | "Window" |
| [Alt+h] | | "Help" |

Table C-5Shortcut keys of menu head

| Shortcut keys | Action |
|------------------------------|----------------------------------------------------------------|
| [Ctrl+n] or [Alt+f] then [n] | Calling command "New ***" |
| [Ctrl+o] or [Alt+f] then [o] | "Open ***" |
| [Alt+f] then [s] | "Save ***" |
| [Alt+f] then [a] | "Save *** as" |
| [Ctrl+q] or [Alt+f] then [c] | "Close ***" |
| [Alt+f] then [l] | "File list" |
| [Alt+f] then [1] | Calling the first project from the last four defined projects |
| [Alt+f] then [2] | Calling the second project from the last four defined projects |
| [Alt+f] then [3] | Calling the third project from the last four defined projects |
| [Alt+f] then [4] | Calling the fourth project from the last four defined projects |
| [Ctrl+q] or [Alt+f] then [x] | Calling command "Exit" |

Table C-6Shortcut keys of File-Command for embedded programs

The asterisks (***) matches any of the embedded program name or the word "project".

| Shortcut keys | Action | |
|----------------------------|-----------------|-----------------------------------------------------|
| [Alt+v] then [b] | Calling command | "Status bar" |
| [Alt+v] then [t] | | "Tool bars" |
| [Alt+v] then [t], then [f] | | "Tool bars-File" |
| [Alt+v] then [t], then [f] | | "Tool bars-FE-Net" |
| [Alt+v] then [t], then [e] | | "Tool bars-Edit" |
| [Alt+v] then [t], then [g] | | "Tool bars-Graphically" |
| [Alt+v] then [t], then [d] | | "Tool bars-Data" |
| [Alt+v] then [t], then [m] | | "Tool bars-Main data" |
| [Alt+v] then [t], then [g] | | "Tool bars-Girders" |
| [Alt+v] then [t], then [s] | | "Tool bars-Spring supports" |
| [Alt+v] then [t], then [s] | | "Tool bars-Supports/ Boundary conditions" |
| [Alt+v] then [t], then [p] | | "Tool bars-Piles" |
| [Alt+v] then [t], then [z] | | "Tool bars-Net of soil elements in z- direction" |
| [Alt+v] then [t], then [a] | | "Tool bars-Foundation properties" |
| [Alt+v] then [t], then [b] | | "Tool bars-Boring fields" |
| [Alt+v] then [t], then [l] | | "Tool bars-Loads" |
| [Alt+v] then [t], then [a] | | "Tool bars-Additional settlements" |
| [Alt+v] then [t], then [o] | | "Tool bars-Option" |
| [Alt+v] then [t], then [t] | | "Tool bars-Format" |
| [Alt+v] then [t], then [w] | | "Tool bars-Window" |
| [Alt+v] then [t], then [h] | | "Tool bars-Help" |
| [Alt+v] then [t], then [r] | | "Tool bars-Reset Toolbar" |

 Table C-7
 Shortcut keys of View-Command

 Table C-8
 Shortcut keys of FE-Net Generation-Command

| Shortcut keys | Action |
|------------------|-----------------------------------|
| [Alt+n] then [g] | Calling command "Generation type" |
| [Alt+n] then [n] | "New generation" |
| [Alt+n] then [f] | "Generating FE-Net" |
| [Alt+n] then [s] | "Smoothing mesh" |
| [Alt+n] then [b] | "Directing border elements" |
| [Alt+n] then [r] | "Refining mesh" |

 Table C-9
 Shortcut keys of Graphically-Command for embedded programs

| Shortcut keys | Action | |
|------------------|-----------------|------------------------------------------------------------------|
| [Alt+g] then [r] | Calling command | "Undo" |
| [Alt+g] then [r] | | "Redo" |
| [Alt+g] then [r] | | "Remove girders, spring supports, boundaries, piles or loads" |
| [Alt+g] then [a] | | "Add nodes, girders, spring supports, boundaries or piles" |
| [Alt+g] then [e] | | "Edit node, girders or loads" |
| [Alt+g] then [s] | | "Select nodes, elements" |
| [Alt+g] then [m] | | "Slab corner by Mouse" |
| [Alt+g] then [a] | | "Add opening" |
| [Alt+g] then [p] | | "Add reference points" |
| [Alt+g] then [l] | | "Add reference lines" |
| [Alt+g] then [0] | | "Boring logs" |
| [Alt+g] then [z] | | "Zone type I" |
| [Alt+g] then [0] | | "Zone type II" |
| [Alt+g] then [n] | | "Zone type III" |
| [Alt+g] then [p] | | "Point loads" |
| [Alt+g] then [x] | | "Moments Mx" |
| [Alt+g] then [y] | | "Moments My" |
| [Alt+g] then [l] | | "Line loads" |
| [Alt+g] then [m] | | "Line moments" |
| [Alt+g] then [d] | | "Distributed loads (Polygon)" |
| [Alt+g] then [t] | | "Distributed loads (Rectangle)" |
| [Alt+g] then [c] | | "Cartesian grid" |

| Shortcut keys | Action | |
|------------------|-----------------|---------------------------------|
| [Alt+i] then [c] | Calling command | "Column types" |
| [Alt+i] then [1] | | "Distributing the point load" |
| [Alt+i] then [n] | | "Net of finite elements" |
| [Alt+i] then [g] | | "Girder groups" |
| [Alt+i] then [d] | | "Girders" |
| [Alt+i] then [t] | | "Spring supports" |
| [Alt+i] then [n] | | "Node restraints" |
| [Alt+i] then [e] | | "Element groups" |
| [Alt+i] then [r] | | "Pile groups" |
| [Alt+i] then [p] | | "Pile locations and groups" |
| [Alt+i] then [m] | | "Pile material" |
| [Alt+i] then [g] | | "Group regions" |
| [Alt+i] then [z] | | "Zone type I" |
| [Alt+i] then [0] | | "Zone type II" |
| [Alt+i] then [n] | | "Zone type III" |
| [Alt+i] then [p] | | "Point loads" |
| [Alt+i] then [x] | | "Moments Mx" |
| [Alt+i] then [y] | | "Moments My" |
| [Alt+i] then [1] | | "Line loads" |
| [Alt+i] then [m] | | "Line moments" |
| [Alt+i] then [d] | | "Distributed loads (Polygon)" |
| [Alt+i] then [t] | | "Distributed loads (Rectangle)" |
| [Alt+i] then [s] | | "Additional settlements" |

Table C-10Shortcut keys of In table-Command for embedded programs

| Shortcut keys | Action | |
|------------------|-----------------|---------------------------------------|
| [Alt+d] then [s] | Calling command | "Soil data" |
| [Alt+d] then [o] | | "Main soil data" |
| [Alt+d] then [c] | | "Calculation methods" |
| [Alt+d] then [p] | | "Project identification" |
| [Alt+d] then [f] | | "FE-Net data" |
| [Alt+d] then [g] | | "Girders" |
| [Alt+d] then [t] | | "Spring supports" |
| [Alt+d] then [u] | | "Supports/ Boundary conditions" |
| [Alt+d] then [p] | | "Piles" |
| [Alt+d] then [i] | | "Soil properties" |
| [Alt+d] then [z] | | "Net of soil elements in z-direction" |
| [Alt+d] then [h] | | "Limit depth" |
| [Alt+d] then [a] | | "Foundation (or slab) properties" |
| [Alt+d] then [r] | | "Reinforcement data" |
| [Alt+d] then [b] | | "Boring fields" |
| [Alt+d] then [l] | | "Loads" |
| [Alt+d] then [n] | | "Neighboring foundations" |
| [Alt+d] then [t] | | "Temperature change" |
| [Alt+d] then [s] | | "Additional settlements" |
| [Alt+d] then [f] | | "Filenames of slab foundations" |

Table C-11Shortcut keys of Data-Command

 Table C-12
 Shortcut keys of Main data-Command for ELPLA-Data und the embedded program Soil properties

| Shortcut keys | Action | |
|------------------|-------------------|--------------------------|
| [Alt+m] then [f] | Calling command " | 'Firm header" |
| [Alt+m] then [d] | " | 'Directory of data" |
| [Alt+m] then [n] | " | 'Number formats" |
| [Alt+m] then [p] | " | 'Preferences" |
| [Alt+m] then [h] | " | 'Help language setting" |
| [Alt+m] then [s] | " | 'System of units" |
| [Alt+m] then [r] | " | 'Design code parameters" |

| Table C-13 | Shortcut keys of Foundation properties-Command for the embedded program |
|------------|-------------------------------------------------------------------------|
| | Foundation properties |

| Shortcut keys | Action |
|------------------|-------------------------------------------------|
| [Alt+a] then [u] | Calling command "Unit weight of the foundation" |
| [Alt+a] then [f] | "Foundation depth" |
| [Alt+a] then [0] | "Origin coordinates" |
| [Alt+a] then [f] | "Foundation level from fixed datum" |

 Table C-14
 Shortcut keys of Boring fields-Command for the embedded program Boring fields

| Shortcut keys | Action |
|-------------------|----------------------------------------|
| [Alt+ b] then [i] | Calling command "Interpolation method" |
| [Alt+ b] then [s] | "Subarea method" |
| [Alt+ b] then [h] | "Hand-Division of borings to nodes" |

| Table C-15 | Shortcut keys of | Using formula- | Command for the | e embedded | program loads |
|------------|------------------|----------------|-----------------|------------|---------------|
| | 2 | 0 | | | |

| Shortcut keys | Action | |
|------------------|-----------------|---------------------------------|
| [Alt+u] then [p] | Calling command | "Point loads" |
| [Alt+u] then [x] | | "Moments Mx" |
| [Alt+u] then [y] | | "Moments My" |
| [Alt+u] then [1] | | "Line loads" |
| [Alt+i] then [m] | | "Line moments" |
| [Alt+u] then [d] | | "Distributed loads (Polygon)" |
| [Alt+u] then [t] | | "Distributed loads (Rectangle)" |

| Table C-16 | Shortcut keys of Options-Command |
|------------|----------------------------------|
|------------|----------------------------------|

| Shortcut keys | Action |
|------------------|-----------------------------------|
| [Alt+o] then [1] | Calling command "Plot parameters" |
| [Alt+o] then [d] | "Display values" |
| [Alt+o] then [v] | "View grouping" |

| Shortcut keys | Action |
|------------------|--------------------------------|
| [Alt+t] then [l] | Calling command "Line formats" |
| [Alt+t] then [i] | "Fill color" |
| [Alt+t] then [x] | "Max. ordinate" |
| [Alt+t] then [f] | "Font" |
| [Alt+t] then [g] | "Grid" |

Table C-17Shortcut keys of Format-Command

| Table C-18 | Shortcut keys | of Window_ | Command |
|-------------|---------------|---------------|---------|
| 1 able C-10 | Shoricul Keys | s of willdow- | Commanu |

| Shortcut keys | Action |
|------------------|---------------------------|
| [Alt+w] then [i] | Calling command "Zoom in" |
| [Alt+w] then [0] | "Zoom out" |
| [Alt+w] then [w] | "Zoom window" |
| [Alt+w] then [z] | "Zoom %" |
| [Alt+w] then [r] | "Original size" |

Table C-19Shortcut keys of Help-Command

| Shortcut keys | Action | |
|------------------|-----------------|------------------------------|
| [Alt+h] then [c] | Calling command | "Contents" |
| [Alt+h] then [s] | | "New in ELPLA" |
| [Alt+h] then [n] | | "Short description of ELPLA" |
| [Alt+h] then [a] | | "About ELPLA-Data" |

9.2 Mouse

By clicking the right mouse Button on the screen, the user can also obtain the Popup-Main data-Menu, Figure C-159.



Figure C-159 Menu "Popup-Main data"

By clicking the right mouse Button on the screen for one of the embedded programs, the user can also obtain the Popup-Options-Menu, Figure C-160.



Figure C-160 Menu "Popup-Options"

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Part D

User's Guide for the program ELPLA-Solver



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

Version 9.2

Program authors: M. El Gendy A. El Gendy

GEOTEC: GEOTEC Software Inc. PO Box 14001 Richmond Road PO Calgary AB, Canada T3E 7Y7

> http://www.elpla.com geotec@elpla.com

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1 An Overview of ELPLA-Solver

When project data were defined and stored, ELPLA-Solver can carry out many calculations and finally solve the system of linear equations. The calculation steps, which are carried out by ELPLA-Solver, can be listed as follows:

- 1 Assembling the load vector
- 2 Preparing the calculation
- 3 Determining the ultimate bearing capacity
- 4 Determining the limit depth
- 5 Determining the modulus of subgrade reaction
- 6 Determining flexibility coefficients of piles
- 7 Determining flexibility coefficients of the soil
- 8 Determining flexibility coefficients for system of rafts
- 9 Assembling the soil stiffness matrix
- 10 Influence of neighboring foundations on settlements
- 11 Influence of the temperature change on raft
- 12 Influence of additional settlements on raft
- 13 Assembling the girder stiffness matrix
- 14 Assembling the slab stiffness matrix
- 15 Solving the system of linear equations
- 16 Iteration process
- 17 Analysis of the rigid raft
- 18 Analysis of the flexible foundation
- 19 Performing the nonlinear analysis
- 20 Performing the nonlinear analysis of piled raft foundation
- 21 Determining deformation, internal forces, contact pressures
- 22 Design of the slab
- 23 Determining displacements, stresses and strains in soil
- 24 Analysis of the plane frame
- 25 Analysis of the plane stress
- 26 Computation of all

All results are saved as ASCII-format in separate files and can therefore be read with any text editor. The file format is straightforward so that an interface for any self-developed or commercial package can be easily used.

2 Description of ELPLA-Solver

ELPLA-Solver is a 32-bit, analysis and design software product that operates under Microsoft Windows 9x/NT/ME/XP. The common "what you see is what you get" of Windows applications makes it easy to learn how to use ELPLA-Solver, especially if you are already familiar with the Windows environment.

ELPLA package consists of 7 separate programs. The programs can run independently. The name and short description of the seven separate programs are given in Table D-1.

The usage of ELPLA is typically such that first data files are created describing a certain problem by ELPLA-Data, then the project problem is analyzed by using ELPLA-Solver. Finally, the results can be presented as graphical drawing, graphs and tables using 5 separate programs ELPLA-Graphic, ELPLA-Section, ELPLA-List, ELPLA-Boring and GEOTEC-Editor.

Table D-1Names and descriptions of the 7 separate 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-Editor | Simple word processing program |

In order to use ELPLA-Solver, first the user must define the project data by ELPLA-Data. Table D-2 gives a list of files, which are read or created by ELPLA-Solver. The files can be classified in four groups.

Table D-2Names of file groups

| Gr | oup | Saved from the program |
|----|---------------------------|------------------------|
| Α | Main data files | ELPLA-Data |
| В | Project data files | ELPLA-Data |
| C | Intermediate result files | ELPLA-Solver |
| D | Final result files | ELPLA-Solver |

Further more, Table D-3 shows filenames, contents and groups of all files that may be read or created by ELPLA-Solver.

| Tuble D 5 Tubles and contents of thes | Table D-3 | Names and con | ntents of files |
|---------------------------------------|-----------|---------------|-----------------|
|---------------------------------------|-----------|---------------|-----------------|

| A | Main | data | files |
|---|------|------|-------|
| | | | |

| Filename | Contents |
|--------------|-----------------------------------------------------|
| FIRMA | Firm header |
| STEU | Default directory for files that are saved by ELPLA |
| NOFORMAT | Number formats |
| RFT | Design code parameters |
| UNITS | System of units |
| PREFEREN.DAT | FE-Net and calculation preferences |

| B Project data fil | les |
|--------------------|---------------------------------------------------------|
| Filename | Contents |
| * .PO1 | System data (Analysis of isolated raft) |
| * .PO2 | System data (Analysis of system of rafts) |
| *. BAU | Soil properties |
| *. LDH | Data of the limit depth |
| *. PC1 | Load data for slab and grid |
| *. PCF | Load data for plane frame |
| *. PCW | Load data for plane stress |
| *. PL6 | Node coordinates and element connectivity |
| *. PL8 | Slab boundary |
| *. GL1 | Girder data (Part 1) |
| *. GL2 | Girder data (Part 2) |
| *. P21 | Data of slab properties/ levels/ coordinates |
| *. P23 | Reinforcement data |
| *. P31 | Data of supports/ boundary conditions for slab and grid |
| *. P61 | Data of supports/ boundary conditions for plane frame |
| *. P71 | Data of supports/ boundary conditions for plane stress |
| *. P35 | Data of spring supports for slab and grid |
| *. P81 | Data of spring supports for plane frame |
| *. P91 | Data of spring supports for plane stress |
| *. P41 | File of boring fields |
| *. PT1 | Data of temperature change |
| *. PP1 | File of neighboring foundations |
| *. PV1 | Data of additional soil settlements |
| *. DSS | Net of soil elements in z-direction |
| *. PIL | Data of piles |

| C Intermediate r | esult files |
|------------------|------------------------------------------------------------------------------------------|
| Filename | Contents |
| *. PL3 | Indicators for old/ new nodes |
| *. PL4 | Area around nodes |
| *. PL5 | Node type and node art |
| *. PL7 | Element areas |
| *. PL9 | Node coordinates, element types and element groups |
| *. PC3 | Groundwater pressure on the raft |
| *. PC4 | Overburden pressure |
| *. PC5 | Load vector (Part 1) |
| *. PC6 | Load vector (Part 2) |
| *. PC7 | Foundation properties |
| *. PC8 | Average contact pressure, eccentricity and area of slab |
| *. PC9 | Coordinates of element centers |
| *. P33 | Vector of supports/ boundary conditions |
| *. PI1 | Vector of contact pressures (Iteration method) |
| *. PI2 | Flexibility band matrix (Iteration method) |
| *. PT2 | Load vector due to temperature change |
| *. PP2 | Load vector due to neighboring foundations |
| *. QUB | Main ultimate bearing capacity (q_b) |
| *. PW2 | Main moduli of subgrade reactions (k _b) |
| *. GF1 | Girder stiffness matrix |
| *. PE1 | Soil stiffness matrix |
| *. PE2 | Load vector due to reloading |
| *. PD1 | Flexibility soil matrix for loading for raft |
| *. PD2 | Flexibility soil matrix for reloading for raft |
| *ji. PD3 | Flexibility coefficients of raft j due to contact pressures of raft i |
| *. FP1 | Flexibility soil matrix due to end bearing of piles for loading |
| *. FP2 | Flexibility soil matrix due to end bearing of piles for reloading |
| *. FP3 | Flexibility soil matrix due to skin friction of piles for loading |
| *. FP4 | Flexibility soil matrix due to skin friction of piles for reloading |
| *. FP5 | Stiffness vector of piles |
| *. PF1 | Slab stiffness matrix |
| *. PF2 | Load vector from special cases |
| *. PG1 | Deformation vector (w, θ_x, θ_y) |
| *. PS1 | Deformations of the rigid raft (w _o , tan θ_{xo} , tan θ_{xo}) |

| D Final result file | es |
|---------------------|-------------------------------------------------|
| Filename | Contents |
| *. PT3 | Displacements due to temperature change (s_t) |
| *. PP3 | Settlements due to neighboring foundations (se) |
| *. PV2 | Load vector due to additional settlements |
| *. LD1 | Limit depth |
| *. GH1 | Internal forces of girders |
| *. QUN | Ultimate bearing capacities at nodes (qul) |
| *. PW1 | Modulus of subgrade reaction (k _s) |
| *. PH1 | Settlements (s) |
| *. PH2 | Contact pressures (q) |
| *. PH3 | Moments (m _x) |
| *. PH4 | Moments (m _y) |
| *. PH5 | Moments (m _{xy}) |
| *. PH6 | Shear forces (Q_x) |
| *. PH7 | Shear forces (Q_y) |
| *. PH8 | Settlements due to reloading (s _w) |
| *. PH9 | Overburden pressures (Q _u) |
| *. H10 | Support reactions (V) |
| *. H11 | Support reactions (M _y) |
| *. H12 | Support reactions (M_x) |
| *. H13 | Reinforcement of the slab (A_{sx1}) |
| *. H14 | Reinforcement of the slab (A _{sx2}) |
| *. H15 | Reinforcement of the slab (A _{sy1}) |
| *. H16 | Reinforcement of the slab (A_{sy2}) |
| *. THX | Rotations about x-axis (θ_x) |
| *. THY | Rotations about y-axis (θ_y) |
| *. THZ | Rotations about z-axis (θ_z) |
| *.U_X | X-Displacements in soil (u) |
| *.V_Y | Y-Displacements in soil (v) |
| *.W_Z | Z-Displacements in soil (w=s) |
| *.S_X | X-Stresses in soil (σ_x) |
| *.S_Y | Y-Stresses in soil (σ_y) |
| *.S_Z | Z-Stresses in soil (σ_z) |
| *.TXY | XY-Shear stresses in soil (τ_{xy}) |
| *.TXZ | XZ-Shear stresses in soil (τ_{xz}) |
| *.TYZ | YZ-Shear stresses in soil (τ_{yz}) |
| *.VAX | X-Strains in soil (ε_x) |
| *.VAY | Y-Strains in soil (ε_y) |
| *.VAZ | Z-Strains in soil (ε_z) |
| *.VXY | XY-Shear strains in soil (γ_{xy}) |
| *.VXZ | XZ-Shear strains in soil (γ_{xz}) |
| *.VYZ | YZ-Shear strains in soil (γ_{yz}) |
| *. PPU | Punching results |
| *. FP6 | Settlement vector of piles |
| *. PEI | Pile loads and displacements |

The asterisk (*) matches any filename with the specified extension.

Next paragraphs describe the purpose and function of each ELPLA-Solver command.

3 Starting ELPLA-Solver

Start ELPLA-Solver by clicking on the program icon in the Windows "Start"-Menu. The introduction screen (Figure D-1) appears.



Figure D-1 Introduction screen of the program ELPLA-Solver

The menu head of Figure D-1 contains the following four commands:

- File
- Calculation
- View
- Help

After clicking one of the four menu commands other sub-commands or options become available. The four menu commands and their sub-commands are presented and described in the following paragraphs 4 to 8.

4 File Menu

The File Menu commands are:

- Open
- Files 1, 2, 3, 4
- Exit

4.1 File Menu–"Open" command

By clicking "Open" command the current project is closed, if one is loaded, and an existing project is opened. Figure D-2 shows "Open" Dialog box used to open a specified project.

ELPLA is used to analyze not only an isolated raft but also a system of rafts. Therefore the program can read two types of file names. One has the extension PO1, which represents the isolated raft and the other has the extension PO2, which represents the system of rafts.

| Open | | | <u>?×</u> |
|------------------------|-------------------|-----------------------------|--------------|
| Look in: 🔂 | Example9 | 🗾 🖻 💆 | * = |
| Name | Size | Туре | Modif |
| 🐹 H12 | 1KB | ELPLA system of foundations | 01/01 |
| 🚛 ha1 | 1KB | ELPLA Project | 01/01 |
| Ha2 | 1KB | ELPLA Project | 01/01 |
| • | | | <u>•</u> |
| File <u>n</u> ame: | ha1 | | <u>O</u> pen |
| Files of <u>type</u> : | ELPLA-files (*.P0 | 01,*.P02) | Cancel |

Figure D-2 "Open project" Dialog box

4.2 File Menu–"Files 1, 2, 3, 4" command

By "Files 1, 2, 3, 4" command the user can open one of the last four loaded projects.

4.3 File Menu–"Exit" command

Here the current project is closed and ELPLA-Solver is quitted, Figure D-3.



Figure D-3 "Exit" Message box

5 Calculation Menu

The Calculation Menu is the main menu, which is used to carry out the problem analysis. The Calculation Menu commands are:

- Assembling the load vector
- Preparing the calculation
- Determining the ultimate bearing capacity
- Determining the limit depth
- Determining the modulus of subgrade reaction
- Determining flexibility coefficients of piles
- Determining flexibility coefficients of the soil

- Determining flexibility coefficients for system of rafts
- Assembling the soil stiffness matrix
- Influence of neighboring foundations on settlements
- Influence of the temperature change on raft
- Influence of additional settlements on raft
- Assembling the girder stiffness matrix
- Assembling the slab stiffness matrix
- Solving the system of linear equations
- Iteration process
- Analysis of the rigid raft
- Analysis of the flexible foundation
- Performing the nonlinear analysis
- Performing the nonlinear analysis of piled raft foundation
- Determining deformation, internal forces, contact pressures
- Design of the slab
- Determining displacements, stresses and strains in soil
- Analysis of the plane frame
- Analysis of the plane stress
- Computation of all

5.1 Calculation Menu–"Assembling the load vector" command

By "Assembling the load vector" command the load vector is assembled for all calculation methods. When this command is chosen, "Foundation properties" list box appears as shown in Figure D-4.

| ssembling the load vector | | | | |
|----------------------------------------|-----|---------|----------|-----|
| Summary of loading: | | | | |
| Summary of loading | | | | _ |
| Slab weight | Pe | [kN] | = 0.0 | |
| Force on slab | Pa | [kN] | = 17926. | 5 |
| Groundwater force | Pω | [kN] | = 2031,2 | |
| Total load ($P = Pe + Pa - Pw$) | Po | [kN] | = 15895, | 2 |
| Groundwater pressure on slab | Qw | [kN/m2] | = 12,000 | |
| Average contact pressure | Qo | [kN/m2] | = 93,905 | |
| Sum Mx from loads | Mx | [kN.m] | = 7035,0 | 30 |
| Sum My from loads | Му | [kN.m] | = -6679, | 037 |
| Foundation properties | | | | |
| Eccentricity of loading in x-direction | ex | [cm] | = -42,02 | |
| Eccentricity of loading in y-direction | еу | [cm] | = 44,26 | |
| Moment of inertia of slab about x-Axis | Ix | [m4] | = 2923,0 | 8 |
| Moment of inertia of slab about y-Axis | Iy | [m4] | = 3423,3 | 6 |
| Product of inertia | Ixy | [m4] | = 366,19 | |
| Area of slab | A | [m2] | = 169,27 | |
| Volume of slab | v | [m3] | = 84,63 | |
| Groundwater pressure | | Ok | Не | lp |

Figure D-4 "Foundation properties" list box

Overburden pressure and groundwater pressure can be also displayed and edited. Clicking "Overburden pressure" and "Groundwater pressure" Buttons can edit these pressures. Figure D-5 shows the Dialog box that appears when "Overburden pressure" Button is clicked. In this Dialog box the overburden pressure can be edited.

| Overburd | en pressures | × |
|---------------|------------------------------|----------------|
| Boring No. | Overburden Pressure Qv | <u>O</u> k |
| [·] | [kN/m2] | <u>C</u> ancel |
| 2 | 39,300 39,300 | Insert |
| 3 | 39,300 | <u>С</u> ору |
| | | <u>D</u> elete |
| | | New |
| | | <u>H</u> elp |
| | | Excel |

Figure D-5 "Overburden pressures" Dialog box

5.2 Calculation Menu–"Preparing the calculation" command

By "Preparing the calculation" command the optimization of band width is carried out and the load vector is assembled for plane frame and plane stress analyses.

5.3 Calculation Menu–"Determining the ultimate bearing capacity" command

By "Determining the ultimate bearing capacity" command determining the ultimate bearing capacity is carried out. When clicking this option, the program calculates the ultimate bearing capacity and the following menu in Figure D-6 appears. In this menu the main ultimate bearing capacity q_b of each boring is displayed. In the menu of Figure D-6 the ultimate bearing capacities of borings can be redefined, if desired. By clicking the Button "OK", the main ultimate bearing capacities q_{ul} at all nodes through interpolation or according to the subareas method whenever is applicable (Figure D-7). In the menu of Figure D-7 the ultimate bearing capacities q_{ul} at nodes are displayed and can be redefined, if desired.

| Main | ultir | nate bearing capacity ql |) | × |
|-----------------|-----------|--------------------------------------------|---|-----------------------------|
| Bori Ne I | ing o. | Ultimate bearing capacity qb [kN/m2] | | <u>Ok</u> <u>C</u> ancel |
| 1 | 2 | 150,1 150,1 | | <u>I</u> nsert |
| 3 | } | 150,1 150,1 | | <u>С</u> ору |
| 5 |) | 1752,8 | | <u>D</u> elete |
| | | | | New |
| | | | | <u>H</u> elp |
| | | | | Excel |

Figure D-6 Main ultimate bearing capacities of borings q_b

| Ultima | ate | bearing capacity at node | e qu | |
|--------|----------|--------------------------------------|------|----------------|
| No | de o. | Ultimate bearing capacity at node | - | <u>k</u> |
| [· |] | qul [kN/m2] | | <u>C</u> ancel |
| | 2 | 150,100 150,100 | | <u>I</u> nsert |
| | } | 150,100 | | Сору |
| | , j | 250,269 | | Delete |
| | ; , | 150,100 150,100 | | <u>Nava</u> |
| 8 | } | 250,269 350,437 | | <u></u> |
| 1 | 0 | 150,100 | | <u>H</u> elp |
| 1 | 2 | 150,100 | | Excel |

Figure D-7 Ultimate bearing capacities at nodes qui

5.4 Calculation Menu–"Determining the limit depth" command

By "Determining the limit depth" command the limit depth for the soil layers is determined for layered soil model.

5.5 Calculation Menu–"Determining the modulus of subgrade reaction" command

By "Determining the modulus of subgrade reaction" command determining the modulus of subgrade reaction is carried out for the following calculation methods:

- Constant modulus of subgrade reaction (method 2)
- Variable modulus of subgrade reaction (method 3)

The methods for determining the modulus of subgrade reaction are:

- Modulus is defined by the user
- Modulus is calculated from isotropic elastic half-space soil medium
- Modulus is calculated from layered soil medium

When clicking this option, the program calculates the modulus of subgrade reaction. Then the following menu (Figure D-8) appears. In this menu the average modulus of subgrade reaction k_{sm} of each borings is displayed. In the menu of Figure D-8 the average moduli of subgrade reactions for borings can be redefined, if desired. By clicking the Button "OK", the average moduli of subgrade reactions are considered. After that, the program calculates the moduli of subgrade reactions k_s at all nodes through interpolation or according to the subareas method, Figure D-9. In the menu of Figure D-9 the moduli of subgrade reactions k_s at nodes can be redefined, if desired.

| A | verage i | modulus of subgrade reaction | ksm | × |
|---|---------------|-----------------------------------------|-----|----------------|
| | Boring No. | Average modulus of subgrade reaction | | <u> </u> |
| | [-] | ksm [kN/m3] | | <u>C</u> ancel |
| | 1 | 5464,1 | | <u>I</u> nsert |
| | 2 | 3069,2 | | |
| | | 2300,3 | | |
| | | | | <u>D</u> elete |
| | | | | <u>N</u> ew |
| | | | | <u>H</u> elp |
| | | | | Excel |

Figure D-8 Average modulus of subgrade reactions of boring k_{sm}

| M | Hodulus of subgrade reaction at node ks | | | |
|---|-----------------------------------------|-----------------------------------------|--------------|----------------|
| | Node No. | Modulus of subgrade reaction at node | | <u>k</u> |
| | [-] | ks [kN/m3] | | <u>C</u> ancel |
| | 1 | 5464,1 | | Insert |
| | 2 | 5464,1 | | |
| | 3 | 5464,1 | | <u>C</u> opy |
| | 4 | 5464,1 | | |
| | 5 | 5464,1 | | <u>D</u> elete |
| | 6 | 5464,1 | | |
| | 7 | 5464,1 | | <u>N</u> ew |
| | 8 | 5464,1 | | |
| | 9 | 5464,1 | | <u>H</u> elp |
| | 10 | 5395,4 | | |
| | 11 | 5194,8 | \mathbf{T} | Excel |
| | | | | |

Figure D-9 Modulus of subgrade reactions at node k_s

5.6 Calculation Menu–"Determining flexibility coefficients of piles" command

By this command assembling the flexibility matrix of piles is carried out.

5.7 Calculation Menu–"Determining flexibility coefficients" command

By "Determining flexibility coefficients" command assembling the flexibility matrix is carried out for the following calculation methods:

- Modification of modulus of subgrade reaction by iteration (method 4)
- Modulus of compressibility (half-space, method 5)
- Modulus of compressibility (Iteration, method 6)
- Modulus of compressibility (Elimination, method 7)
- Rigid raft (method 8)
- Flexible foundation (method 9)

5.8 Calculation Menu–"Determining flexibility coefficients for system of rafts" command

By "Determining flexibility coefficients for system of rafts" command assembling the flexibility matrix for system of slab foundations is carried out.

5.9 Calculation Menu–"Assembling the soil stiffness matrix" command

By this command the soil stiffness matrix is carried out for the following calculation methods:

- Modulus of compressibility (half-space, method 5)
- Modulus of compressibility (Iteration, method 6)
- Modulus of compressibility (Elimination, method 7)
- Rigid raft (method 8)

5.10 Calculation Menu-"Influence of neighboring foundations on settlements" command

By "Influence of neighboring foundations on settlements" command determining the settlements due to influence of neighboring foundations is carried out for the following calculation methods:

- Modification of modulus of subgrade reaction by iteration (method 4)
- Modulus of compressibility (half-space, method 5)
- Modulus of compressibility (Iteration, method 6)
- Modulus of compressibility (Elimination, method 7)
- Rigid raft (method 8)
- Flexible foundation (method 9)

5.11 Calculation Menu–"Influence of the temperature change on raft" command

Determining displacements due to temperature change is carried out.

5.12 Calculation Menu-"Influence of additional settlements on raft" command

Determining the influence of additional settlements is carried out.

5.13 Calculation Menu–"Assembling the girder stiffness matrix" command

Assembling the girder stiffness matrix is carried out when girders are in the slab.

5.14 Calculation Menu–"Assembling the slab stiffness matrix" command

Assembling the slab stiffness matrix is carried out for the following calculation methods:

- Linear contact pressure (method 1)
- Constant modulus of subgrade reaction (method 2)
- Variable modulus of subgrade reaction (method 3)
- Modulus of compressibility (half-space, method 5)
- Modulus of compressibility (Elimination, method 7)

5.15 Calculation Menu – "Solving the system of linear equations" command

Solving the system of linear equations is carried out for the following methods:

- Linear contact pressure (method 1)
- Constant modulus of subgrade reaction (method 2)
- Variable modulus of subgrade reaction (method 3)
- Modulus of compressibility (half-space, method 5)
- Modulus of compressibility (Elimination, method 7)

5.16 Calculation Menu–"Iteration process" command

When choosing the command "Iteration process", the iteration process for analyzing the isolated raft (methods 4, 6) or system of rafts is carried out.

Iteration parameters

The iteration process continues until one of the following conditions is met (Figure D-10):

- The accuracy number reaches to the specified tolerance, which means that a sufficient compatibility between the raft deflection and the soil settlement is reached in the slab-soil interface
- The iteration process reaches the specified steps of iterations

An accuracy number controls the convergence progress of the solution. The solution is considered convergent if the accuracy number of the step I + 1 is less than that of the previous step i. The maximum difference between the soil settlement and the raft deflection in [m] is considered as an accuracy number.

In the menu of Figure D-10 select the option of the iteration condition. Then click "OK" Button.

| Iteration parameters | | |
|------------------------------------------|--------------|--|
| Which option is ending the iteration pro | cess? | |
| Accuracy [m] | 0,0001 | |
| C Iteration No. | 10 | |
| kCancel | <u>H</u> elp | |

Figure D-10 "Iteration parameters" selection box

Iteration Process

The menu of Figure D-11 displays information about the convergence progress of the solution during the iteration process.

- The iteration processing can be halted at any step by clicking "Stop" Button
- A pause is possible at any step by clicking "Pause" Button. Then "Pause" Button changes to "Continue" Button
- To continue the iteration processing, click "Continue" Button

| eration proc | ess | | |
|-----------------------------------------------------------------------------------|---------------|--|---------------|
| Iteration No. | Accuracy [m] | | <u>S</u> top |
| 1 | 0,03099103000 | | |
| 2 | 0,00383297800 | | <u>P</u> ause |
| 3 | 0,00132945100 | | |
| 4 | 0,00035650050 | | |
| | | | <u>H</u> elp |
| Iteration cycles is ended at accuracy [m]<= 0,0001 Computation time = 00:00:08 | | | |

Figure D-11 Menu "Iteration process"

5.17 Calculation Menu–"Analysis of the rigid raft" command

By this command performing the analysis of the rigid raft is carried out (method 8).

5.18 Calculation Menu–"Analysis of the flexible foundation" command

By "Analysis of the flexible foundation" command performing the analysis of the flexible foundation is carried out (method 9).

Negative contact pressures

If a negative value of contact pressure appears (Figure D-12), it indicates tension at the soil raft interface. Since the soil cannot resist tensile forces at the contact surface, a separation occurs between the raft and the soil. An iterative procedure is used to eliminate the negative contact pressures. To eliminate negative contact pressures, click "Yes" Button in the menu of Figure D-12.

| Negative contact pressures | | × | | |
|---------------------------------------------------------------------------------------------------------------------------------|---------------|--------------|--|--|
| Negative contact pressure appears. | | | | |
| Negative contact pressures: | | | | |
| Sum of positive contact pressures | Q+ve [kN] | 2279,8 | | |
| Sum of negative contact pressures | Q-ve [kN] | -279,8 | | |
| percent | Q-ve/Q+ve [%] | 12,27 | | |
| - Separation areas: | | | | |
| Sum of contact areas | A+ve [m2] | 59,88 | | |
| Sum of separation areas | A-ve [m2] | 18,88 | | |
| percent | A-ve/A+ve [%] | 31,52 | | |
| Elimination of the negative contact pressures may take several minutes. Do you want to eliminate negative contact pressures? | | | | |
| Yes <u>N</u> o | | <u>H</u> elp | | |

Figure D-12 Menu "Negative contact pressures"

5.19 Calculation Menu-"Performing the nonlinear analysis" command

The nonlinear analysis for methods 2 to 8 is carried out.

5.20 Calculation Menu-"Performing the nonlinear analysis of piled raft foundation" command

Here performing the nonlinear analysis of piled raft foundation is carried out.

5.21 Calculation Menu–"Determining deformation, internal forces, contact pressures" command

When clicking this command, the program calculates the settlements, contact pressures, deformation, rotations, moments and shear forces. By the rigid raft the program calculates only the settlements (= displacement), rotations and contact pressures, while by the flexible foundation, the program calculates only the settlements.

Check of the solution

After determining internal forces and deformation, a check of the solution by comparison between the values of actions and reactions is carried out for all calculation methods. Through this comparative examination, the calculation accuracy is determined, Figure D-13.

| Check of the solution | |
|-------------------------------|------------------|
| | |
| V - Load: | |
| Total load | [kN] = 15895,8 |
| Sum of contact pressures | [kN] = 15892,4 |
| X - Moment: | |
| Sum Mx from loads | [kN.m] = 7039,0 |
| Sum Mx from contact pressures | [kN.m] = 7040,2 |
| Y - Moment: | |
| Sum My from loads | [kN.m] = -6683,3 |
| Sum My from contact pressures | [kN.m] = -6688,6 |
| Ok <u>H</u> elp | |

Figure D-13 Menu "Check of the solution"

5.22 Calculation Menu–"Design of the slab" command

By "Design of the slab" command the reinforcement of the slab is determined and a check of punching stress due to column loads, pile reactions and support reactions are carried out for calculation methods 1 to 7.

5.23 Calculation Menu-"Determining displacements, stresses and strains in soil" command

By this command determining displacements, stresses and strains in soil is carried out.

5.24 Calculation Menu–"Analysis of the plane frame" command

By "Analysis of the plane frame" command analyzing plane frame is carried out.

5.25 Calculation Menu–"Analysis of the plane stress" command

By "Analysis of the plane stress" command analyzing plane stress is carried out.

5.26 Calculation Menu-"Computation of all" command

The progress of all computations according to the defined method is carried out.

Different computations are carried out for each method. At the start of the calculation and only by the iteration methods you are asked whether accuracy or iteration No. is to be used for ending the iteration cycles (Figure D-10). Table D-4 shows an overview of the individual calculations for different methods.

| Calculation | Numerical calculation method | | | | | | | | | |
|------------------------------------------------------------|------------------------------|---|---|---|---|---|---|---|---|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Assembling the load vector | Х | х | х | х | х | х | х | х | х | X |
| Determining the ultimate bearing capacity | - | х | х | х | х | х | х | х | - | X |
| Determining the limit depth | - | х | х | х | - | х | х | х | х | X |
| Determining the modulus of subgrade | - | х | х | - | - | - | - | - | - | - |
| Determining flexibility coefficients of piles | - | х | х | х | х | х | х | х | - | - |
| Determining flexibility coefficients | - | - | - | х | х | х | х | х | х | Х |
| Determining flexibility coefficients for system of rafts | - | - | - | - | - | - | - | - | - | Х |
| Assembling the soil stiffness matrix | - | - | - | * | х | х | х | х | х | X |
| Influence of neighboring foundations on settlements | - | - | - | х | х | х | х | х | х | X |
| Influence of the temperature change on raft | - | х | х | х | х | х | х | - | - | X |
| Influence of additional settlements on raft | - | х | х | х | х | х | х | х | х | Х |
| Assembling the girder stiffness matrix | х | х | х | - | х | - | х | - | - | - |
| Assembling the slab stiffness matrix | Х | х | х | - | х | - | х | - | - | - |
| Solving system equations (full matrix) | - | - | - | - | х | - | х | - | - | - |
| Solving system equations (banded matrix) | х | х | х | - | - | - | - | - | - | - |
| Analysis of the rigid raft | - | - | - | - | - | - | - | х | - | - |
| Analysis of the flexible foundation | - | - | - | - | - | - | - | - | х | - |
| Iteration process | - | - | - | х | - | х | - | - | - | Х |
| Performing the nonlinear analysis | - | х | х | х | х | х | х | х | - | Х |
| Performing the nonlinear analysis of piled raft foundation | | | | | | | | | | |
| Determining def., internal forces and contact pressures | Х | х | х | х | х | х | х | х | - | Х |
| Determining deformation and contact pressures | - | - | - | - | - | - | - | - | х | - |
| Design of the slab | х | х | х | х | х | х | х | - | - | Х |
| Determining displacements, stresses and strains in soil | - | - | - | х | х | х | х | х | х | Х |
| Computation of all | х | Х | X | Х | X | х | Х | X | X | X |

Table D-4Overview of the individual calculations for different methods

* Only by the two especial cases of influence of neighboring foundations on settlements and influence of the temperature change on the raft
The numerical calculation methods in the last 10 cells of Table D-4 are:

a) Analysis of isolated raft

- 1 Linear contact pressure
- 2 Constant modulus of subgrade reaction
- 3 Variable modulus of subgrade reaction
- 4 Modification of modulus of subgrade reaction by iteration
- 5 Modulus of compressibility (half-space)
- 6 Modulus of compressibility (Iteration)
- 7 Modulus of compressibility (Elimination)
- 8 Rigid raft
- 9 Flexible foundation

b) Analysis of system of rafts

10 Analysis of system of many flexible, rigid and elastic rafts

6 View Menu

The View Menu commands are:

- Status bar
- Tool bars

6.1 View Menu–"Status bar" command

"Status bar" command displays a status bar on the screen down. The status bar displays information about the progress of calculation.

6.2 View Menu–''Tool bars'' command

"Tool bars" command displays tool bars located just below the menu head. Tool bars contain icons of program menus.

7 Help Menu

The Help Menu commands are:

- Contents
- Short description of ELPLA
- New in ELPLA
- About ELPLA-Solver

7.1 Help Menu–"Contents" command

"Contents" command displays a help file in HTML-Format containing the complete ELPLA User's Guide, Figure D-14.



Figure D-14 Menu "Contents"

7.2 Help Menu-"Short description of ELPLA" command

"Short description of ELPLA" command gives a short description of ELPLA package.

7.3 Help Menu–"New in ELPLA" command

"New in ELPLA" command summarizes the new features and enhancements in ELPLA.

7.4 Help Menu–"About ELPLA-Solver" command

Clicking the command "About ELPLA-Solver" displays the information form of ELPLA-Solver as shown in Figure D-15, which gives information about ELPLA-Solver and the calculation method of the loaded project.



Figure D-15 Information form of ELPLA-Solver

8 Tips and Tricks

8.1 Keyboard

The user can obtain all menu titles and commands also through Shortcut keys. The action of the Shortcut keys is listed in Table D-5 to Table D-9:

| Shortcut keys | Action | |
|---------------|-------------------|---------------|
| [Alt+f] | Calling menu head | "File" |
| [Alt+v] | | "View" |
| [Alt+c] | | "Calculation" |
| [Alt+h] | | "Help" |

Table D-5Shortcut keys of menu head

| Table D-6 | Shortcut keys of File-Comma | nd |
|-----------|-----------------------------|----|
|-----------|-----------------------------|----|

| Shortcut keys | Action |
|-------------------------------|---------------------------------------------------------------|
| [Ctrl +o] or [Alt+f] then [o] | Calling command "Open" |
| [Alt+f] then [1] | Calling the first project from the last four loaded projects |
| [Alt+f] then [2] | Calling the second project from the last four loaded projects |
| [Alt+f] then [3] | Calling the third project from the last four loaded projects |
| [Alt+f] then [4] | Calling the fourth project from the last four loaded projects |
| [Ctrl+q] or [Alt+f] then [x] | Calling command "Exit" |

| Shortcut keys | Action | |
|------------------|-----------------|---------------------------------------------------------------|
| [Alt+c] then [t] | Calling command | "Assembling the load vector" |
| [Alt+c] then [p] | | "Preparing the calculation" |
| [Alt+c] then [m] | | "Determining the ultimate bearing capacity" |
| [Alt+c] then [z] | | "Determining the limit depth" |
| [Alt+c] then [m] | | "Determining the modulus of subgrade reaction" |
| [Alt+c] then [f] | | "Determining flexibility coefficients of piles" |
| [Alt+c] then [f] | | "Determining flexibility coefficients" |
| [Alt+c] then [x] | | "Determining flexibility coefficients for system of rafts" |
| [Alt+c] then [l] | | "Assembling the soil stiffness matrix" |
| [Alt+c] then [e] | | "Influence of neighboring foundations on settlements" |
| [Alt+c] then [i] | | "Influence of the temperature change on raft" |
| [Alt+c] then [u] | | "Influence of additional settlements on raft" |
| [Alt+c] then [g] | | "Assembling the girder stiffness matrix" |
| [Alt+c] then [b] | | "Assembling the slab stiffness matrix" |
| [Alt+c] then [s] | | "Solving the system of linear equations" |
| [Alt+c] then [s] | | "Solving the rigid raft" |
| [Alt+c] then [s] | | "Solving the flexible foundation" |
| [Alt+c] then [t] | | "Iteration process" |
| [Alt+c] then [n] | | "Performing the nonlinear analysis" |
| [Alt+c] then [n] | | "Performing the nonlinear analysis of piled raft foundation" |
| [Alt+c] then [d] | | "Determining deformation, internal forces, contact pressures" |
| [Alt+c] then [r] | | "Design of the slab" |
| [Alt+c] then [d] | | "Determining displacements, stresses and strains in soil" |
| [Alt+c] then [a] | | "Analysis of the plane frame" |
| [Alt+c] then [a] | | "Analysis of the plane stress" |
| [Alt+c] then [c] | | "Computation of all" |

 Table D-7
 Shortcut keys of Calculation-Command

| Shortcut keys | Action | |
|---------------------------|-----------------|---------------------------|
| [Alt+v] then [b] | Calling command | "Status bar" |
| [Alt+v] then [t] | | "Tool bars" |
| [Alt+v] then[t], then [f] | | "Tool bars-File" |
| [Alt+v] then[t], then [c] | | "Tool bars-Calculation" |
| [Alt+v] then[t], then [h] | | "Tool bars-Help" |
| [Alt+v] then[t], then [r] | | "Tool bars-Reset Toolbar" |

Table D-8Shortcut keys of View-Command

Table D-9Shortcut keys of Help-Command

| Shortcut keys | Action | |
|------------------|-----------------|------------------------------|
| [Alt+h] then [c] | Calling command | "Contents" |
| [Alt+h] then [s] | | "Short description of ELPLA" |
| [Alt+h] then [n] | | "New in ELPLA" |
| [Alt+h] then [a] | | "About ELPLA-Solver" |

8.2 Mouse

By clicking the right mouse Button on the screen, the user can also obtain the Popup-Calculation-Menu (Figure D-16).



Figure D-16 Menu "Popup-Calculation"

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|-----------------------|---|
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| Contact pressures | |
| | |

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|-------------|-----|-----|-----|----|

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|-----------|--|
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| - | |

0

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```

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|----------------------------|--------|
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|--------------------|--|
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U

| Ultimate bearing capacity | |
|---------------------------|--|
|---------------------------|--|

V

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|------|---|
|------|---|

Part E

User's Guide for the program ELPLA-Graphic



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

Version 9.2

Program authors: M. El Gendy A. El Gendy

GEOTEC: GEOTEC Software Inc. PO Box 14001 Richmond Road PO Calgary AB, Canada T3E 7Y7

> http://www.elpla.com geotec@elpla.com

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1 An overview of ELPLA-Graphic

ELPLA-Graphic is used to display graphically the calculated results and input project data. The drawing of the results and data can be displayed first on the screen, and then can be sent to the printer or plotter. The calculated results and input project data can be presented graphically as follows:

- Results in isometric view
- Results as contour lines
- Result values in the plan
- Distribution curves of results in the plan
- Results as circular diagrams
- Deformation
- Principal moments as streaks
- Support reactions as arrows
- Soil deformation as vectors
- Soil deformation as deformed mesh
- Principal soil stresses as streaks
- Principal soil strains as streaks
- Data in isometric view
- Data in the plan
- Boring locations
- Boring logs/ Limit depth
- Punching shear
- Beam results

The drawings, if desired, can be saved as WMF-format files, in which they can be exported to other Windows applications to prepare reports, slide presentations or add further information.

2 Description of ELPLA-Graphic

ELPLA-Graphic is a 32-bit, graphical software product that operates under Microsoft Windows 9x/NT/ME/XP. The common "what you see is what you get" of Windows applications makes it easy to learn how to use ELPLA-Graphic, especially if you are already familiar with the Windows environment. The program package ELPLA consists of 7 separate programs. These programs can run independently. The name and short description of the seven separate programs are given in Table E-1.

The usage of the program is typically such that first data files are created describing a certain problem by ELPLA-Data, then the project problem is analyzed by using ELPLA-Solver. Finally, the results can be presented as graphical drawing, graphs and tables using the five separate programs ELPLA-Graphic, ELPLA-Section, ELPLA-List, ELPLA-Boring and GEOTEC-Editor.

| 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-Editor | A simple text editor program | |

Table E-1Names and descriptions of the 7 separate programs

In order to use ELPLA-Graphic, first the user must define the project data by ELPLA-Data, and then must analyze the problem by ELPLA-Solver. Table E-2 gives a list of files, which are read or created by ELPLA-Graphic. The files can be classified in four groups.

Table E-2Names of file groups

| Gr | oup | Saved from the program |
|----|-----------------------|------------------------|
| Α | Main data files | ELPLA-Data |
| В | Graphic files (*.GRA) | ELPLA-Graphic |
| С | Project data files | ELPLA-Data |
| D | Final result files | ELPLA-Solver |

Further more, Table E-3 shows the filenames, contents and groups of all files that may be read or created by ELPLA-Graphic.

| Table E-5 Names and contents of me | Table E-3 | Names | and | contents | of | files |
|------------------------------------|-----------|-------|-----|----------|----|-------|
|------------------------------------|-----------|-------|-----|----------|----|-------|

| A Main data files | |
|-------------------|-----------------------------------------------------|
| Filename | Contents |
| FIRMA | Firm header |
| STEU | Default directory for files that are saved by ELPLA |
| NOFORMAT | Number formats |
| UNITS | System of units |

B Graphic files

| Filename | Contents |
|--------------|------------------------|
| LINEFORM.GRA | Line formats |
| FONT.GRA | Font data |
| LEGENDE.GRA | Legend data |
| PAINT.GRA | Fill color data |
| PLOTPAR.GRA | Plot parameters |
| NODISPLA.GRA | Data of display values |
| ORDINATE.GRA | Max. ordinate data |

| C Project data fil | les |
|--------------------|---------------------------------------------------------|
| Filename | Contents |
| *. AUF | 3 lines text to identify the project |
| * .PO1 | System data (calculation method-isolated slab) |
| * .PO2 | System data (calculation method-system of slabs) |
| *. P23 | Reinforcement data |
| *. P33 | Data of supports/ boundary conditions |
| *. P35 | Data of spring supports |
| *. P81 | Data of spring supports for plane frame |
| *. P91 | Data of spring supports for plane stress |
| *. P61 | Data of supports/ boundary conditions for plane frame |
| *. P71 | Data of supports/ boundary conditions for plane stress |
| *. P31 | Data of supports/ boundary conditions for slab and grid |
| * .BAU | Soil data |
| *. PC1 | Load data |
| *. PCF | Load data for plane frame |
| *. PCW | Load data for plane stress |
| *. PL6 | FE-Net data |
| *. PL4 | Area around nodes |
| *. GL1 | Girder data |
| *. P21 | Data of material/ slab thickness/ levels/ coordinates |
| *. P41 | File of boring fields |
| *. PP1 | File of external foundations |
| *. PV1 | Data of additional soil settlements |
| *. DSS | FE-Net in z-direction |
| *. PIL | Pile properties |

| D Final result files | | | | | |
|----------------------|-------------------------------------------------|--|--|--|--|
| Filename | Contents | | | | |
| *. GH1 | Internal forces of girders | | | | |
| *. PT3 | Displacements due to temperature change (s_t) | | | | |
| *. PP3 | Settlements due to neighboring foundations (se) | | | | |
| *. QUN | Ultimate bearing capacities at nodes (qul) | | | | |
| *. PW1 | Modulus of subgrade reaction (k _s) | | | | |
| *. PH1 | Settlements (s) | | | | |
| *. PH2 | Contact pressures (q) | | | | |
| *. PH3 | Moments (m _x) | | | | |
| *. PH4 | Moments (m _y) | | | | |
| *. PH5 | Moments (m _{xy}) | | | | |
| *. PH6 | Shear forces (Q_x) | | | | |
| *. PH7 | Shear forces (Q _y) | | | | |
| *. H10 | Support reactions (V) | | | | |
| *. H11 | Support reactions (M _y) | | | | |
| *. H12 | Support reactions (M _x) | | | | |
| *. H13 | Reinforcement of the slab (A_{sx1}) | | | | |
| *. H14 | Reinforcement of the slab (A _{sx2}) | | | | |
| *. H15 | Reinforcement of the slab (A _{sy1}) | | | | |
| *. H16 | Reinforcement of the slab (A _{sy2}) | | | | |
| *.U_X | X-Displacements in soil (u) | | | | |
| *.V_Y | Y-Displacements in soil (v) | | | | |
| *.W_Z | Z-Displacements in soil (w=s) | | | | |
| *.S_X | X-Stresses in soil (σ_x) | | | | |
| *.S_Y | Y-Stresses in soil (σ_y) | | | | |
| *.S_Z | Z-Stresses in soil (σ_z) | | | | |
| *.TXY | XY-Shear stresses in soil (τ_{xy}) | | | | |
| *.TXZ | XZ-Shear stresses in soil (τ_{xz}) | | | | |
| *.TYZ | YZ-Shear stresses in soil (τ_{yz}) | | | | |
| *.VAX | X-Strains in soil (ε_x) | | | | |
| *.VAY | Y-Strains in soil (ε _y) | | | | |
| *.VAZ | Z-Strains in soil (ε_z) | | | | |
| *.VXY | XY-Shear strains in soil (γ_{xy}) | | | | |
| *.VXZ | XZ-Shear strains in soil (γ_{xz}) | | | | |
| *.VYZ | YZ-Shear strains in soil (γ_{yz}) | | | | |
| *. PPU | Punching results | | | | |

The asterisk (*) matches any filename with the specified extension.

Next paragraphs describe the purpose and function of each ELPLA-Graphic command.

3 Starting ELPLA-Graphic

Start ELPLA-Graphic by clicking on the program icon in the Windows "Start"-Menu. The introduction screen (Figure E-1) appears.

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| | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 8.01.0 |)5 | | 19:4 | 16 | | |

Figure E-1 Introduction screen of ELPLA-Graphic

The menu head of Figure E-1 contains the following seven commands:

- File
- View
- Graphic
- Options
- Format
- Window
- Help

After clicking one of the seven menu commands, other sub-commands or options become available. The seven menu commands and their sub-commands are presented and described in the following paragraphs 4 to 11.

4 File Menu

The File Menu commands are:

- Open
- Make WMF-File
- Send to ELPLA-Section
- Print
- Page setup
- Files 1, 2, 3, 4
- Exit

4.1 File Menu–"Open" command

By "Open" command the current project is closed, if one is loaded, and an existing project is opened. Figure E-2 shows "Open" Dialog box used to open a specified project.

ELPLA is used to analyze not only isolated slab foundation but also system of rafts. Therefore the program can read two types of file names. One has the extension of PO1, which represents the isolated raft and the other has the extension of PO2, which represents the system of rafts.

| Open | | | ? × |
|------------------------|-------------------|-----------------------------|--------------|
| Look in: 🔂 | Example9 | 🗾 🖻 💆 | 📺 🔳 |
| Name | Size | Туре | Modif |
| 🔢 H12 | 1KB | ELPLA system of foundations | 01/01 |
| 👫 ha1 | 1KB | ELPLA Project | 01/01 |
| Ha2 | 1KB | ELPLA Project | 01/01 |
| | | | Þ |
| File <u>n</u> ame: | ha1 | | <u>O</u> pen |
| Files of <u>t</u> ype: | ELPLA-files (*.P0 | 01,×.P02) | Cancel |

Figure E-2 "Open project" Dialog box

4.2 File Menu–"Make WMF-File" command

The drawing can be saved in a format that can be read by other programs. This feature allows you to include your drawing in reports and presentations and to enhance the drawing using other drawing or CAD software packages. The drawing can be exported in the Windows Metafile format (WMF). Figure E-3 shows "Save as" Dialog box used to export the drawing with the filename you wish to give the exported file, including extension and the directory in which to save the file.

| Save As | | | | | ? | × |
|-----------------------|----------|----------|---------|----------|--------------|---|
| Save jn: 🔁 | Example7 | • | <u></u> | C | | |
| | | | | | | 1 |
| | | | | | | I |
| | | | | | | I |
| | | | | | | I |
| | | | | | | I |
| l File name: | ah7a | | _ | | Court | |
| rile <u>n</u> ame. | go/c | | | | <u>o</u> ave | |
| Save as <u>t</u> ype: | (*.WMF) | | • | (| Cancel | |

Figure E-3 "Save as" Dialog box

4.3 File Menu–"Send to ELPLA-Section" command

By "Send to ELPLA-Section" command it is possible, to define a diagram in ELPLA-Graphic by Mouse and end it to ELPLA-Section, Figure E-4.



Figure E-4 Defining a diagram in ELPLA-Graphic

4.4 File Menu–"Print" command

By "Print" command data and results can be graphically plotted or printed. Only the objects currently displayed on the drawing are printed. Figure E-5 shows "Print" Dialog box. The printer group box contains controls for selecting the printer and changing its properties. Use "Name" Combo box to select the printer and use "Properties" Button to set printer settings. The number of printing copies can be defined in "Copies" Input box, Figure E-5.



Figure E-5 "Print" Dialog box

4.5 File Menu–"Page setup" command

By "Page setup" command the standard "Page setup" Dialog box can be displayed with options to specify the printer, page orientation, paper size, and paper source, as well as other printing options. Figure E-6 shows "Page setup" Dialog box.

| Page Setup | ? × |
|---------------|--------------------------------|
| | |
| Paper | |
| Size: | 4 |
| Source: | uto Select |
| - Orientation | Margins (millimeters) |
| C Portrait | Left: 30mm <u>R</u> ight: 30mm |
| Landscape | Iop: 30mm Bottom: 30mm |
| | OK Cancel Printer |

Figure E-6 "Page setup" Dialog box

4.6 File Menu–''Files 1, 2, 3, 4'' command

By "Files 1, 2, 3, 4" command the user can open one of the last four loaded projects.

4.7 File Menu–''Exit'' command

By "Exit" command the current project is closed and ELPLA-Graphic is quitted, Figure E-7.

| Program end 🛛 🗙 | | | | | | | |
|-----------------|---------|--|--|--|--|--|--|
| ? Progra | m exit! | | | | | | |
| OK) | Cancel | | | | | | |

Figure E-7 "Exit" Message box

5 View Menu

The View Menu commands are:

- Status bar
- Tool bars

5.1 View Menu–"Status bar" command

The status bar displays information about the progress of the current operation.

5.2 View Menu–"Tool bars" command

Tool bars located just below the menu head are displayed with icons of program menus.

6 Graphic Menu

The graphic menu is the main menu, used to display the specified drawing with the setting given by options, format and window menus. The Graphic Menu commands are:

- Results in isometric view
- Results as contour lines
- Result values in the plan
- Distribution curves of results in the plan
- Results as circular diagrams
- Deformation
- Principal moments as streaks
- Support reactions as arrows
- Soil deformation as vectors
- Soil deformation as deformed mesh
- Principal soil stresses as streaks
- Principal soil strains as streaks
- Data in isometric view
- Data in the plan
- Boring locations
- Boring logs/ Limit depth
- Punching shear
- Beam results

6.1 Graphic Menu–"Results in isometric view" command

Calculated results can be displayed on the screen and plotted in isometric shape. In the Dialog box of Figure E-8 select an item to draw and click "OK". Figure E-9 shows the contact pressures in isometric view.



Figure E-8 "Results in isometric view" items



Figure E-9 Contact pressures in isometric view

6.2 Graphic Menu–"Results as contour lines"

By this command the calculated results can be contoured and shaded to reflect the variation of results. When "Results as contour lines" command is chosen, the selection Dialog box shown in Figure E-10 appears. In this dialog box select an item to draw and then click "OK" Button.



Figure E-10 "Results as contour lines" items

Contours with a constant interval

Contours can be displayed with a constant interval by checking "Contours with a constant interval" check box in "Plot parameters" form, Figure E-11. For drawing the contours, the minimum and maximum contour values, and also the contour interval are required. As an example, Figure E-12 shows the settlements as contours with a constant interval.



Figure E-11 "Contour lines parameters" Dialog box



Figure E-12 Settlements as contour lines with a constant interval

Contours with a variable interval

Contours can be displayed with a variable interval by making "Contours with a constant interval" check box unchecked in "plot parameters" form, Figure E-41. For drawing the contour lines with a variable interval, the contour values are required to define in the form "Contour lines", Figure E-13.

| С | ontour li | ines | | | × |
|---|---------------------|-----------------------------|--------------------------------------|---------------------------------------|----------------|
| | Contour No. I | Contour values s [cm] | - Result limits: Min. s = 1,09 [c | rm] | |
| Ī | 1 | 1,20 | Max. s = 4,26 [| cm] | |
| | 2 | 1,50 | Min is at node : | 9 | |
| | 3 | 1,80 | Mill. 0 demodo. | . • | |
| l | 4 | 2,10 | Max. s at node | : 211 | |
| | 5 | 2,40 | | | |
| L | 6 | 2,70 | | I | |
| | 7 | 3,00 | <u>С</u> ору | <u>N</u> ew | |
| | 8 | 3,30 | | | |
| | 9 | 3,60 | <u>D</u> elete | Insert | |
| | 10 | 3,90 | | · · · · · · · · · · · · · · · · · · · | I |
| | 11 | 4,20 | <u>0</u> k | <u>H</u> elp | <u>C</u> ancel |

Figure E-13 "Contours with a variable interval" Dialog box

Color contours

Contours can be colored and shaded by checking "Color contours" check box in "Plot parameters" form, Figure E-41. The number of shaded colors is 13, start at color blue, which represents the minimum value and end at color red, which represents the maximum value. The lines between shaded contours will be displayed, if "Display lines" check box in "Plot parameters" form is checked. As an example, Figure E-14 shows the settlements in color contours.



Figure E-14 Color contours for settlements

6.3 Graphic Menu–"Result values in the plan" command

The calculated results can be tabulated on the mesh. When this command is chosen, the selection Dialog box shown in Figure E-15 appears. Select an item to draw and then click "OK" Button. As an example, Figure E-16 shows the values of top reinforcement in x-direction on the mesh.

| Result values in plan | × |
|----------------------------------------|--------------------------------------|
| Select one item to draw: | |
| C Settlements s | Contact pressures q |
| C Moments mx | C Moments my |
| C Moments mxy | C Shear forces Qx |
| C Shear forces Qy | Top Rits in x-direction As,topx |
| C Top Rifts in y-direction As,topy | C Bottom Rfts in x-direction As,botx |
| C Bottom Rifts in y-direction As, boty | <u>D</u> k |
| C Moduli of subgrade reactions ks | Cancel |
| C Principal moments hm1 | |
| C Principal moments hm2 | <u>H</u> elp |

Figure E-15 "Result values in the plan" items



Figure E-16 Tabulation of the top reinforcement in x-direction on the mesh

6.4 Graphic Menu–"Distribution curves of results in the plan" command

By "Distribution curves of results in the plan" command the calculated results can be plotted as distribution curves on the mesh. When "Distribution curves of results in the plan" command is chosen, the selection Dialog box shown in Figure E-17 appears. In this Dialog box select an item to draw and then click "OK" Button. As an example, Figure E-18 shows the distribution curves of moment m_x on the slab.

| Distribution of results in plan | × |
|----------------------------------------|--------------------------------------|
| Select one item to draw: | |
| C Settlements s | C Contact pressures q |
| Moments mx | C Moments my |
| C Moments mxy | C Shear forces Qx |
| C Shear forces Qy | C Top Rfts in x-direction As,topx |
| C Top Rfts in y-direction As,topy | C Bottom Rits in x-direction As,botx |
| C Bottom Rifts in y-direction As, boty | <u>D</u> k |
| C Moduli of subgrade reactions ks | Cancel |
| C Principal moments hm1 | |
| C Principal moments hm2 | <u>H</u> elp |

Figure E-17 "Distribution curves of results in the plan" items



Figure E-18 Distribution curves of moment m_x on the slab

6.5 Graphic Menu-"Results as circular diagrams" command

By this command the calculated results can be plotted as circular diagrams on the mesh. When "Results as circular diagrams" command is chosen, the selection Dialog box shown in Figure E-19 appears. In this Dialog box select an item to draw, then click "OK" Button. As an example, Figure E-20 shows the circular diagrams for shear forces Q_x .

Color circles

Circular diagrams can be colored and shaded by checking "Color circles" check box in "Plot parameters" form, Figure E-41.

| Results as circular diagrams | × |
|--------------------------------------|------------------------------------|
| Select one item to draw: | |
| C Settlements s | C Contact pressures q |
| C Moments mx | Moments my |
| C Moments mxy | Shear forces Qx |
| 🔿 Shear forces Qy | C Top Rfts in x-direction As,topx |
| C Top Rifts in y-direction As,topy | Bottom Rfts in x-direction As,botx |
| C Bottom Rfts in y-direction As,boty | <u>D</u> k |
| C Moduli of subgrade reactions ks | Cancel |
| C Principal moments hm1 | |
| C Principal moments hm2 | <u>H</u> elp |

Figure E-19 "Results as circular diagrams" items



Figure E-20 Circular diagrams for shear forces Q_x

6.6 Graphic Menu–"Deformation" command

By "Deformation" command the slab deformation can be displayed as a deformed mesh plot as shown in Figure E-21.



Figure E-21 Slab deformation

6.7 Graphic Menu–"Principal moments as streaks" command

By "Principal moments as streaks" command the principal moments h_{m1} and h_{m2} can be displayed as streaks as shown in Figure E-22.



Figure E-22 Principal moments as streaks

6.8 Graphic Menu–"Support reactions as arrows" command

By "Support reactions as arrows" command the support reactions V, M_x and M_y can be displayed in isometric shape as arrows. When this command is chosen, the selection Dialog box shown in Figure E-23 appears. In this Dialog box select an item to draw, then click "OK" Button. As an example, Figure E-24 shows the support reactions V as arrows.

| Support reactions as arrow | vs 🔀 |
|----------------------------|----------|
| Select one item to draw: | <u> </u> |
| Support reactions V | Cancel |
| C Support reactions Mx | |
| C Support reactions My | Help |

Figure E-23 "Support reactions as arrows" items



Figure E-24 Support reactions V as arrows

6.9 Graphic Menu–"Soil deformation as vectors" command

By "Soil deformation as vectors" command the soil deformation can be displayed as vectors. When this command is chosen, the selection Dialog box shown in Figure E-25 appears. In this Dialog box select an item to draw, then click "OK" Button. As an example, Figure E-26 shows the soil deformation as vectors.



Figure E-25 "Soil deformation as vectors" items



Figure E-26 Soil deformation as vectors

6.10 Graphic Menu-"Soil deformation as deformed mesh" command

By this command the soil deformation can be displayed as deformed mesh. As an example, Figure E-27 shows the soil deformation as deformed mesh.



Figure E-27 Soil deformation as deformed mesh

6.11 Graphic Menu–"Principal soil stresses as streaks" command

Here the principal soil stresses can be displayed as streaks. As an example, Figure E-28 shows the principal soil stresses as streaks.



Figure E-28 Principal soil stresses as streaks

6.12 Graphic Menu-"Principal soil strains as streaks" command

By this command the Principal soil strains can be displayed as streaks. As an example, Figure E-29 shows the principal soil strains as streaks.



Figure E-29 Principal soil strains as streaks

6.13 Graphic Menu-"Data in isometric view" command

By "Data in isometric view" command the input data can be displayed on the screen and plotted in isometric shape. When "Data in isometric view" command is chosen, the selection Dialog box shown in Figure E-30 appears. In this Dialog box select an item to draw, then click "OK" Button. As an example, Figure E-31 shows the loading in isometric view.

| Data in isometric view | × |
|--------------------------|----------------|
| Select one item to draw: | <u>0</u> k |
| C Slab thickness | <u>C</u> ancel |
| | <u>H</u> elp |

Figure E-30 "Data in isometric view" items



Figure E-31 Loading in isometric view

6.14 Graphic Menu–"Data in the plan" command

By "Data in the plan" command the input data can be displayed in the plan view. When "Data in the plan" command is chosen, the selection Dialog box shown in Figure E-32 appears. In this Dialog box select an item to draw and click "OK" Button. As an example, Figure E-33 shows the loading in the plan.



Figure E-32 "Data in the plane" items

ELPLA-Graphic



Figure E-33 Loading in the plan

6.15 Graphic Menu-"Boring locations" command

By "Boring locations" command the boring locations in global coordinates can be displayed with the slab geometry as shown in Figure E-34.



Figure E-34 Location of boring with zone types

6.16 Graphic Menu–"Boring logs/ Limit depth" command

Here the boring logs (boring layers, soil material, water table and limit depth) can be displayed through ELPLA-Boring as shown in Figure E-35. The stress on soil under a specified point on the foundation with effective stress can be also displayed beside the corresponding boring log through ELPLA-Boring as shown in Figure E-36. The stress on soil is used to determine the limit depth of the soil layers. To get information about ELPLA-Boring, see the User's Guide of ELPLA-Boring.



Figure E-35 Boring logs with multi-layers with different soil material



Figure E-36 Limit depth of the soil layers

6.17 Graphic Menu–"Beam results" command

In ELPLA the finite element method was used to analyze both of the raft and girders, in which the raft was represented by plate bending elements while the girders were represented by grid elements. Furthermore, a combination between plate elements and grid elements may be used to represent ribbed rafts. If girders are considered in the project, "Beam results" command will appear in the graphic menu.

"Beam results" command has the following options (commands):

- Distribution of internal forces in the plan
- Internal forces in isometric view

"Distribution of internal forces in the plan"-Option

This option displays the beam internal forces (torsion moments, bending moments and shear forces) with the slab geometry in the plan. The selection Dialog box shown in Figure E-37 appears. In this Dialog box select an item to draw and click "OK" Button. As an example, Figure E-38 shows the distribution of bending moments in the plan.

| Distribution of internal forces in plan | | × |
|-----------------------------------------|----------------|---|
| Select one item to draw: | <u>0</u> k | 1 |
| C Beam-Torsion moments Mt | <u>C</u> ancel | |
| Beam-Shear forces Qs | <u>H</u> elp | |

Figure E-37 "Distribution of internal forces in the plan" items



Figure E-38 Distribution of bending moments in the plan

"Internal forces in isometric view"-Option

This option displays the beam internal forces (torsion moments, bending moments and shear forces) with the slab geometry in isometric view. When "Distribution of internal forces isometric view"-Option is chosen, the selection Dialog box shown in Figure E-39 appears. In this Dialog box select an item to draw, then click "OK" Button. As an example, Figure E-40 shows the distribution of shear forces in isometric view.



Figure E-39 "Distribution of internal forces in isometric view" items



Figure E-40 Distribution of shear forces in isometric view

7 Options Menu

The Options menu has the following commands:

- Plot parameters
- Display values
- Scale
- Set range
- Axes
- Title
- Page No.
- Copy
- View grouping

7.1 Options Menu–"Plot parameters" command

Plot parameters may be set as default values by the program or be fully specified by the user. By "Plot parameters" command the following plot parameters can be specified (Figure E-41):

- Display FE-Net, Axes, slab dimensions, FE-Net in separated elements, reference points and lines, axis arrows
- Pages with or without a frame
- Color element groups and slab thickness
- Color section of punching shear
- Color girders

- Draw girder thickness
- Color circles of circular diagrams. If "color circles" is checked, the positive circles are red and the negative circles are blue
- Color contours with or without display contour lines. If "color contours" is checked, the contours will have 13 constant intervals with 13 colors. Colors start at color blue, which represents the minimum value and end at color red representing the maximum value
- Writing factor. If "Writing factor" is checked, the intensity of numbers on the contour lines will be defined
- Display contours with a constant interval
- Display boring subareas boundary
- Color boring subareas
- Mark boring subareas
- Draw neighboring foundations
- Draw block element
- Draw element border
- Color solid element
- Display FE-Net in separated elements
- Display reference points/ lines

| Plot parameters | × |
|------------------------------------------------|----------------------------------------|
| General plot parameters: Soil plot parameters: | Block elements: Contour lines: FE-Net: |
| General plot parameters: | Girder system: |
| Page with frame | Color girders |
| 🗖 Display slab dimensions | ☑ Draw thickness |
| 🗖 Display Axes | |
| ☑ Draw neighboring foundation | Punching shear: |
| Display axis arrows | Color section of punching shear |
| Element groups: | Circular diagrams: |
| Color element groups and slab thickness | Color circles |
| <u>Dk</u> <u>S</u> ave | <u>C</u> ancel <u>H</u> elp |

Figure E-41 "Plot parameters" Dialog box

7.2 Options Menu–"Display values" command

By "Display values" command the values of the following items can be displayed, if desired, on the drawing (Figure E-42):

- Loads
- Boundary conditions
- Spring supports
- Element groups
- Girder system
- Piles
- Internal forces of girders
- Axes
- Support reactions as arrows
- Slab thickness
- Isometric views
- Contour lines
- Circular diagrams
- Distribution curves of results
- Soil deformation as vectors
- Soil deformation as deformed mesh
- Punching shear
- Column types

| Display values | X |
|------------------------------|---------------------------------------|
| ✓ Loads | |
| Boundary conditions | |
| Spring supports | Save |
| Element groups | |
| Girder system | Course 1 |
| ✓ Pile group | |
| ✓ Internal forces of girders | |
| Axes | Help |
| Support reactions as arrows | |
| ✓ Slab thickness | Select <u>All</u> |

Figure E-42 "Display values" Dialog box

7.3 Options Menu–"Scale" command

By "Scale" command the scale factor of the drawing can be defined as shown in Figure E-43. The defaulted value for the scale factor is chosen to pass the active printer-paper format. By graphical drawing in the plan the scale is changed to scale factor, "scale factor" = "scale 1: ".

| Scale | × |
|---------------------------|--------------|
| Drawing scale factor | |
| O 50 O 75 O 125 O 150 | C 175 |
| C Another 100 | |
| <u>O</u> k <u>C</u> ancel | <u>H</u> elp |

Figure E-43 "Scale" Dialog box

7.4 Options Menu–"Set range" command

By "Set range" command the area of the slab, that will be drawn, can be defined. In the Dialog box shown in Figure E-44 define ranges, which bound this slab area.

| et range in local coordinates | | |
|----------------------------------------|-------|----------------|
| Set range | | |
| Start range in x-direction at distance | | [m] 0,00 |
| End range in x-direction at distance | | [m] 10,00 |
| Start range in y-direction at distance | | [m] 0,00 |
| End range in y-direction at distance | | [m] 10,00 |
| | | |
| FE-Net limits | | Ωμ |
| Min. distance in x-direction: | 0,00 | <u></u> |
| Max. distance in x-direction: | 10,00 | <u>C</u> ancel |
| Min. distance in y-direction: | 0,00 | |
| Max. distance in y-direction: | 10,00 | <u>H</u> elp |

Figure E-44 "Set range" Dialog box

7.5 Options Menu–"Axes" command

By "Axes" command scaled axes can be defined on the drawing, Figure E-45.

| Axes | × | |
|----------------|----------------|--|
| Scaling x-Axis | Scaling y-Axis | |
| Minimum -2,00 | Minimum -2,00 | |
| Maximum 12,00 | Maximum 12,00 | |
| Interval 1,00 | Interval 1,00 | |
| <u>k</u> | | |

Figure E-45 "Axes" Dialog box

7.6 Options Menu–"Title" command

By "Title" command the text data (two lines text above the drawing and two lines text under the drawing) can be defined, Figure E-46.

Default texts are:

- A-Title1: Method No.
- A-Title2: Name of method
- U-Title1: Name of drawing
- U-Title2: No. of nod columns and nod rows that define the drawing

| Title | × |
|-------------------------------------------------------------|--------------|
| Title above drawing | |
| A-Title1 Method (6) | |
| A-Title2 Modulus of Compressibility (Iteration) | |
| | |
| Title under drawing | |
| U-Title1 Settlements s [cm] | |
| U-Title2 Max. s = 4,45 at node 211, Min. s = 1,14 at node 9 | |
| | |
| | <u>H</u> elp |

Figure E-46 "Title" Dialog box

7.7 Options Menu–"Page No." command

By "Page No." command the page No. can be defined, Figure E-47.

| Page No. | × |
|------------|----------------|
| Page No. 1 | <u>k</u> |
| | <u>C</u> ancel |
| | <u>H</u> elp |

Figure E-47 "Page No." Dialog box

7.8 Options Menu–"Copy" command

By "Copy" command the current drawing can be copied in Metafile-Format to Clipboard. Then it can be inserted directly to other Windows programs such as Word and AutoCAD, Figure E-48.



Figure E-48 Drawing can be copied to other Windows programs

7.9 Options Menu–"View grouping" command

Draw a group of data with results or a group of data together in one presentation (contour lines of settlements with loads and slab thickness, or loads with boring locations), Figure E-49.



Figure E-49 Presentation of a group of data with results

8 Format Menu

The Format menu has the following commands:

- Line formats
- Fill color
- Max. ordinate
- Font
- Legend

8.1 Format Menu–"Line formats" command

By "Line formats" command the color, style and thickness of drawing lines can be defined, Figure E-50. The way a line is drawn depends on the setting of the color and style properties. There are available 15 different colors and 5 styles for line formats. The following list shows the available lines, which can be formatted:

- Slab boundary
- Elements
- Isometric view
- Distribution curves of results
- Contour lines

- Legends
- Circular diagrams
- Arrows of support reactions
- Page boundary
- Identification box
- Streaks of principal moments (+ve)
- Streaks of principal moments (-ve)
- Slab dimensions
- Loads
- Boundary conditions
- Boring logs
- Slab thickness
- Axes of symmetry
- Beam elements
- Spring supports
- Axes of symmetry
- Symbol of symmetry
- Vectors of soil deformation
- Deformed mesh of soil deformation
- Axis arrows
- Girder axes
- Piles in plan
- Pile length
- Pile hatching
- Additional settlements
- Reference points and lines
- Columns
- Cartesian grid
- Punching shear
- Borders of block elements

| Line formats | | | × |
|----------------|--------------|----------------|-------|
| Lines | | Color | Style |
| Slab boundary | • | | |
| | | | [] |
| | | | |
| | | | |
| | | | |
| <u>0</u> k | <u>S</u> ave | | |
| <u>C</u> ancel | Help | Thickness [mm] | 0,6 |

Figure E-50 "Line formats" Dialog box

8.2 Format Menu–"Fill color" command

By "Fill color" command the fill color of drawing can be defined, Figure E-51. The following list shows the available items, which can be filled with a specified color:

- Loads
- Boundary conditions
- Springs
- Zone type I: Bilinear interpolation
- Zone type II: Linear interpolation
- Zone type III: Node corresponds to boring
- Circle of boring
- Additional settlements
- (+ve) Circular diagrams
- (-ve) Circular diagrams
- Punching shear
- Material No.
- Girder group No.
- Sub area of boring No.
- Pile group No.
- Column group No.

| Fill color | | | | | X |
|-------------|-------|-----|-------|----|--------------|
| Fill color— | | | | | |
| Color | | | | Se | t color |
| Item | Loads | | | | • |
| <u>k</u> | | ave | Cance | el | <u>H</u> elp |

Figure E-51 "Fill color" Dialog box

8.3 Format Menu–"Max. ordinate" command

By "Max. ordinate" the max. ordinate, max. diameter, max. side, max. width and max. length for the drawing can be defined, Figure E-52.

| Max. ordinate | | | × |
|---------------------------------------|------|------|----------------------------------------------|
| Max. ordinate: | | | |
| Max. length for rotational boundaries | | • | <u> <u>U</u>K </u> |
| | | | <u>S</u> ave |
| | [mm] | 10 ÷ | <u>C</u> ancel |
| | | | Help |

Figure E-52 "Max. ordinate" Dialog box

8.4 Format Menu–"Font" command

By "Font" command the font size (Figure E-53) and font type (Figure E-54) can be defined.

| Font | | × |
|---------------------|----------------|--------------------------|
| Size factor of font | | Size 2,5 |
| Sample AaBbYyZz | | Eont type Courier New |
| kSave | <u>C</u> ancel | <u>H</u> elp |

Figure E-53 "Font size" Dialog box

| Font | | ? × |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------|
| Eont: Arial [| Font style: Regular | ОК |
| T Arabic Transparent T Arial T Arial Black T Arial Narrow T Bold Italic Art T Book Antiqua T Bookman Old Style | Regular Italic Bold Bold Italic | Cancel |
| Effects Stri <u>k</u> eout Linderline Color: Black | Sample AaBbYyZz Script: | |
| This is a TrueType font. This sa your printer and your screen. | me font will be used on both | |

Figure E-54 "Font type" Dialog box

8.5 Format Menu–"Legend" command

By this command the height and width of legends can be specified as shown in Figure E-55. **Display legend**

In "Display legend" Group box check the legend that you wish to display.

Legend size

In "Legend size" Group box the height and width of the legend can be defined.

| Legend | | | × |
|-------------------|--------------|----------|--------------------|
| Legend | | | |
| Isometric drawing | | _ | Legend size : |
| Tromene arawing | | | Height [cm] 1,00 - |
| | | | Width [cm] 1,00 |
| <u> </u> | <u>S</u> ave | | |
| <u>C</u> ancel | <u>H</u> elp | | 🔽 Display Legend |

Figure E-55 "Legend" Dialog box

The Window menu has the following commands:

- Zoom in
- Zoom out
- Zoom window
- Zoom %
- Original size
- Viewing angle

9.1 Window Menu–"Zoom in" command

By "Zoom in" command the size of the drawing on the screen can be reduced.

9.2 Window Menu-"Zoom out" command

By "Zoom out" command the size of the drawing on the screen can be increased.

9.3 Window Menu-"Zoom window" command

By "Zoom window" command the size of the drawing on a specified area can be increased.

9.4 Window Menu–"Zoom %" command

When you choose "Zoom %" command, the following Dialog box in Figure E-56 appears.

| Zoom 🗙 | |
|----------------------------------------|--|
| Zoom % | |
| C 50% C 75% C 125% C 150% C 175% | |
| • Another 100 | |
| <u>O</u> k <u>C</u> ancel <u>H</u> elp | |

Figure E-56 "Zoom %" Dialog box

By "Zoom %" command the size of drawing on the screen can be specified. Choosing "Zoom %" allows you to increase or decrease the size at which the drawing is displayed. Choosing 100% displays the drawing at its original size. Clicking on the percentage, changes the drawing size to the specified percentage. The drawing can be displayed at any size by typing the desired percentage in the specified Edit box.

9.5 Window Menu–"Original size" command

The commands "Zoom in", "Zoom out" and "Zoom %" can change the size of drawing on the screen. The drawing can be displayed in its original size again using "Original size" command.

9.6 Window Menu–"Viewing angle" command

The perspective drawing in a three dimensional view can be defined, Figure E-57.

The default viewing angle for isometric drawing, Figure E-58:

Viewing angle about x-Axis = 295Viewing angle about y-Axis = 0Viewing angle about z-Axis = 20

The default viewing angle for drawing in the plans:

Viewing angle about x-Axis = 0 Viewing angle about y-Axis = 0 Viewing angle about z-Axis = 0

| Viewing angle | | × |
|----------------------------|-------|-----------------|
| Viewing angle | | <u>k</u> |
| Viewing angle about x-Axis | 295 - | <u>C</u> ancel |
| Viewing angle about y-Axis | 0 - | <u>H</u> elp |
| Viewing angle about z-Axis | 20 + | << <u>L</u> ess |
| | | |

Figure E-57 "Viewing angle" Dialog box

ELPLA-Graphic



Figure E-58 Contour lines of settlements with viewing angles 295, 0, and 20 about the x-, y-, and z-axes, respectively

10 Help Menu

The Help Menu commands are:

- Contents
- Short description of ELPLA
- New in ELPLA
- About ELPLA-Graphic

10.1 Help Menu–"Contents" command

"Contents" command displays a help file in HTML-Format containing the complete ELPLA User's Guide, Figure E-59.

ELPLA-Graphic



Figure E-59 Menu "Contents"

10.2 Help Menu-"Short description of ELPLA" command

"Short description of ELPLA" command gives a short description of ELPLA package.

10.3 Help Menu-"New in ELPLA" command

"New in ELPLA" command summarizes the new features and enhancements in ELPLA.

10.4 Help Menu–"About ELPLA-Graphic" command

Clicking the command "About ELPLA-Graphic" displays the information form of ELPLA-Graphic as shown in Figure E-60, which gives information about ELPLA-Graphic and the calculation method of the loaded project.

| Information | x |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| Analysis of slab foundation Professional, Version 9.3 | |
| Calculation method Method (6) (Layered soil model) Modulus of Compressibility (Iteration) | |
| Graphical drawing of results and data: | |
| By ELPLA-Graphic, the calculated results (settlements, contact pressures, deformation, ir modulus of subgrade reaction, Rfts) and Input data (loads, slab thickness, boundary con groups, coordinates x/y, slab numbering, boring locations, arrangement of neighboring for displayed | nternal forces, ditions, element oundations) can be |
| The drawing of the results and data can be displayed first on the screen, then can be ser plotter. | nt to the printer or |
| Program authors | <u>O</u> k |
| Prof. M. El Gendy Dr. A. El Gendy | <u>S</u> ystem-Info |
| GEOTEC Software | Online Support |

Figure E-60 Information form of program ELPLA-Graphic

11 Tips and Tricks

11.1 Keyboard

The user can obtain all menu titles and commands also through Shortcut keys. The action of the Shortcut keys is listed in Table E-4 to Table E-11:

| Tuble L + Diloiteut | . Keys of menu nead | |
|---------------------|---------------------|-----------|
| Shortcut keys | Action | |
| [Alt+f] | Calling menu head | "File" |
| [Alt+v] | | "View" |
| [Alt+g] | | "Graphic" |
| [Alt+o] | | "Options" |
| [Alt+t] | | "Format" |
| [Alt+w] | | "Window" |
| [Alt+h] | | "Help" |

Table E-4Shortcut keys of menu head

| Shortcut keys | Action |
|-------------------------------|---------------------------------------------------------------|
| [Ctrl +o] or [Alt+f] then [o] | Calling command "Open" |
| [Alt+f] then [w] | "Make WMF-File" |
| [Alt+f] then [s] | "Send to ELPLA-Section" |
| [Ctrl +p] or [Alt+f] then [p] | "Print" |
| [Alt+f] then [u] | "Page setup" |
| [Alt+f] then [1] | Calling the first project from the last four loaded projects |
| [Alt+f] then [2] | Calling the second project from the last four loaded projects |
| [Alt+f] then [3] | Calling the third project from the last four loaded projects |
| [Alt+f] then [4] | Calling the fourth project from the last four loaded projects |
| [Ctrl+q] or [Alt+f] then [x] | Calling command "Exit" |

 Table E-5
 Shortcut keys of File-Command

 Table E-6
 Shortcut keys of View-Command

| Shortcut keys | Action | |
|----------------------------|-----------------|---------------------|
| [Alt+v] then [b] | Calling command | "Status bar" |
| [Alt+v] then [t] | | "Tool bars" |
| [Alt+v] then [t], then [f] | | "Tool bars-File" |
| [Alt+v] then [t], then [g] | | "Tool bars-Graphic" |
| [Alt+v] then [t], then [o] | | "Tool bars-Options" |
| [Alt+v] then [t], then [t] | | "Tool bars-Format" |
| [Alt+v] then [t], then [w] | | "Tool bars-Window" |
| [Alt+v] then [t], then [h] | | "Tool bars-Help" |
| [Alt+v] then [t], then [r] | | "Reset Toolbar" |

| Shortcut keys | Action | |
|------------------|-----------------|----------------------------------------------|
| [Alt+g] then [r] | Calling command | "Results in isometric view" |
| [Alt+g] then [e] | | "Results as contour lines" |
| [Alt+g] then [v] | | "Result values in the plan" |
| [Alt+g] then [d] | | "Distribution curves of results in the plan" |
| [Alt+g] then [f] | | "Deformation" |
| [Alt+g] then [p] | | "Principal moments as streaks" |
| [Alt+g] then [s] | | "Support reactions as arrows" |
| [Alt+g] then [v] | | "Soil deformation as vectors" |
| [Alt+g] then [m] | | "Soil deformation as deformed mesh" |
| [Alt+g] then [s] | | "Principal soil stresses as streaks" |
| [Alt+g] then [p] | | "Principal soil strains as streaks" |
| [Alt+g] then [a] | | "Data in isometric view" |
| [Alt+g] then [n] | | "Data in the plan" |
| [Alt+g] then [b] | | "Boring locations" |
| [Alt+g] then [0] | | "Boring logs/ Limit depth" |
| [Alt+g] then [g] | | "Beam results" |

 Table E-7
 Shortcut keys of Graphic-Command

Table E-8Shortcut keys of Options-Command

| Shortcut keys | Action | |
|------------------|-----------------|-------------------|
| [Alt+o] then [l] | Calling command | "Plot parameters" |
| [Alt+o] then [d] | | "Display values" |
| [Alt+o] then [c] | | "Scale" |
| [Alt+o] then [s] | | "Set range" |
| [Alt+o] then [a] | | "Axes" |
| [Alt+o] then [t] | | "Title" |
| [Alt+o] then [p] | | "Page No." |
| [Alt+o] then [c] | | "Copy" |
| [Alt+o] then [v] | | "View grouping" |

| Shortcut keys | Action |
|------------------|--------------------------------|
| [Alt+t] then [1] | Calling command "Line formats" |
| [Alt+t] then [i] | "Fill color" |
| [Alt+t] then [x] | "Max. ordinate" |
| [Alt+t] then [f] | "Font" |
| [Alt+t] then [d] | "Legend" |

Table E-9Shortcut keys of Format-Command

Table E-10Shortcut keys of Window-Command

| Shortcut keys | Action | |
|------------------|-----------------|-----------------|
| [Alt+w] then [i] | Calling command | "Zoom in" |
| [Alt+w] then [o] | | "Zoom out" |
| [Alt+w] then [w] | | "Zoom window" |
| [Alt+w] then [z] | | "Zoom %" |
| [Alt+w] then [r] | | "Original size" |
| [Alt+w] then [v] | | "Viewing angle" |

Table E-11Shortcut keys of Help-Command

| Shortcut keys | Action | |
|------------------|-----------------|------------------------------|
| [Alt+h] then [c] | Calling command | "Contents" |
| [Alt+h] then [s] | | "New in ELPLA" |
| [Alt+h] then [n] | | "Short description of ELPLA" |
| [Alt+h] then [a] | | "About ELPLA-Graphic" |

11.2 Mouse

By double-clicking the left mouse Button on a specified screen position the user can obtain almost menus of the program.

- By double-clicking on *legend*, *firm header*, *title* or *project identification* the corresponding menu appears
- By double-clicking on *scale* in the identification box "Scale"-Menu appears
- By double-clicking on *file name* in the identification box "Open"-Menu appears
- By double-clicking on page No. in the identification box "Page No."-Menu appears
- By clicking the right mouse Button at any position on the screen the user can also obtain the Popup-Options-Menu, Figure E-61
- By double-clicking on a specified node on the FE-Net the corresponding node information appears, Figure E-62

ELPLA-Graphic







Figure E-62 Node information

12 Samples for graphical drawings using ELPLA-Graphic

ELPLA-Graphic gives the ability to present more than 100 different graphical drawings for data and results. In this paragraph some graphical drawings for data and results of example problems "gb7" (an irregular raft on irregular subsoil) and "rib" (a ribbed raft) are presented.

The pages P1 to P10 show some graphical presentations of data and results for example problem "gb7", while pages P11 and P12 show the graphical presentation of girders for example problem "rib".

12.1 Graphical drawings of data

| Data in isometric view | Loading | Page | P1 |
|--------------------------------------------|------------------------------------------------------|------|----------|
| Data in the plan | Geometry of slab with loading Location of borings | | P2 P3 |
| 12.2 Graphical drawings of results | | | |
| Results in isometric view | Contact pressures q | | P4 |
| Deformation | Deformation w | | P5 |
| Results as contour lines | Settlements s | | P6 |
| Result values in the plan | Bottom Rafts y-Direction A _{sy2} | | P7 |
| Distribution curves of results in the plan | Moments m _y | | P8 |
| Results as circular diagrams | Moments m _x | | P9 |
| Principal moments as streaks | Principal moments | | P10 |
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| | | Met. Modi | hod ulus | (7) 3 of | (La com | yere | ed s ssib | oil ilit | mode ty | 2) | | | | | | | | |
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| | | 0.00 | ,.41 | 6 14 | 34 | 1 1 | 1 | | 1 19 | | | 0.79 | | 0.33 | 14 72 | 17 65 | | |
| | | 0.00 | 4.28 | 8 4 . 8 | 0 0.47 | * | - | | 1.13 | | | | | 0.25 | 8.51 | 8.98 | 0.10 | |
| | | | 2.63 | 3 2.1 | 2 | | | | | | | | | 0.20 | 5.59 | 6.28 | 0.10 | |
| | | | 2.49 | 9 1.9 | 0 | | | | | | | | | | 3.70 | 5.06 | | |
| | | 0.01 | 4.33 | 3 7.1 | 3 | | 1.39 | 9 3.51 | 1 | | | 0.30 | 0.49 | | | | | |
| | | | 4.37 | 7 7.4 | 2 | | 2.09 | 9 4.09 | 9 | | | 1.59 | | | | | | |
| | | | 2.31 | 1 2.4 | 3 | | | | | | | | 0.41 | | | | | |
| | | Bot: Max | tom . As | rei 3 bc | nfor tx = | ceme 17 | ent .65 | in 1 at 1 | x-diı node | ectio 97, 1 | on As Min. | _bot As b | x [c otx | m2/m_ = 0.0 |] 00 at | nod | e 85 | |
| | | | | | | | | | | | | _ ` | | | | | | |
| | | Geot | tec | Off | ice | | | | | | | | | 7 | | | | |
| P(| Box 14001 Richmond | Road | PO | - c | Calga | ary | AB, | Can | ada ' | C3E 7 | ¥7 | | | - | | | | |
| caie 1:115 | Title: An irregular : | raft | on | irr | egul | ar s | ubs | 011 | | | | | | | | | | |
| ilo, ar ' | | | | | | | | | | | | | | | | | | |











Part F

User's Guide for the program ELPLA-Section



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

Version 9.2

Program authors: M. El Gendy A. El Gendy

GEOTEC: GEOTEC Software Inc. PO Box 14001 Richmond Road PO Calgary AB, Canada T3E 7Y7

> http://www.elpla.com geotec@elpla.com

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1 An overview of ELPLA-Section

ELPLA-Section is used to display graphically the calculated results (settlements, contact pressures, deformation, internal forces, modulus of subgrade reaction and reinforcement) and input project data (additional settlements) at specified sections. The drawing of the results and data can be displayed first on the screen, and then can be sent to the printer or plotter. Also, all drawing sections can be exported to MS Excel.

The calculated results and input project data can be presented graphically as follows:

- 1 Section in x-direction
- 2 Max./ Min. values in x-direction
- 3 Overlapping in x-direction
- 4 Section in y-direction
- 5 Max./ Min. values in y-direction
- 6 Overlapping in y-direction
- 7 Arbitrary section

The drawings, if desired, can be saved as WMF-Format files, in which they can be exported to other Windows applications such as Word and AutoCAD to prepare reports, slide presentations or add further information.

2 Description of ELPLA-Section

ELPLA-Section is a 32-bit analysis and design software product that operates under Microsoft Windows 9x/NT/ME/XP. The common "what you see is what you get" of Windows applications makes it easy to learn how to use ELPLA-Section, especially if you are already familiar with the Windows environment.

The program package ELPLA consists of 7 separate programs. The separate programs can be run independently. The name and short description of the programs are given in Table F-1.

The usage of the program is typically such that first data files are created describing a certain problem by ELPLA-Data, then the project problem is analyzed by using ELPLA-Solver. Finally, the results can be presented as graphical drawing, graphs and tables using the five separate programs ELPLA-Graphic, ELPLA-Section, ELPLA-List, ELPLA-Boring and GEOTEC-Editor.

In order to use ELPLA-Section, first the user must enter the project data by ELPLA-Data, and then must analyze the problem by ELPLA-Solver. Table F-2 gives a list of files, which are read or created by ELPLA-Section. The files can be classified in four groups.

| 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-Editor | A simple text editor program |

Table F-1Names and descriptions of the seven separate programs

Table F-2Names of file groups

| Gr | oup | Saved from the program |
|----|-----------------------|------------------------|
| Α | Main data files | ELPLA-Data |
| В | Section files (*.SEC) | ELPLA-Section |
| С | Project data files | ELPLA-Data |
| D | Final result files | ELPLA-Solver |

Further more, Table F-3 shows filenames, contents and groups of all files that may be read or created by ELPLA-Section.

Table F-3Names and contents of files

| А | Main | data | files |
|---|------|------|-------|
| | | | |

| Filename | Contents |
|----------|-----------------------------------------------------|
| FIRMA | Firm header |
| STEU | Default directory for files that are saved by ELPLA |
| NOFORMAT | Number formats |
| UNITS | System of units |

B Section files

| Filename | Contents |
|---------------|--------------------|
| PLOTPAR.SEC | Plot parameters |
| LEGENDE.SEC | Legend data |
| ORDINATE. SEC | Max. ordinate data |
| LINEFORM.SEC | Line formats |
| FONT.SEC | Font data |

C Project data files

| Filename | Contents |
|----------|---------------------------------------|
| *. AUF | 3 line texts to identify the project |
| *. BAU | Soil properties |
| * .PO1 | System data (calculation method) |
| *. PL6 | FE-Net data |
| *. P33 | Data of supports/ boundary conditions |
| *. PV1 | Data of additional soil settlements |
| D Final result | files |
|----------------|-------------------------------------------------|
| Filename | Contents |
| *. PT3 | Displacements due to temperature change (st) |
| *. PP3 | Settlements due to neighboring foundations (se) |
| *. QUN | Ultimate bearing capacities at nodes (qul) |
| *. PW1 | Modulus of subgrade reaction (k _s) |
| *. PH1 | Settlements (s) |
| *. PH2 | Contact pressures (q) |
| *. PH3 | Moments (m _x) |
| *. PH4 | Moments (m _y) |
| *. PH5 | Moments (m _{xy}) |
| *. PH6 | Shear forces (Q_x) |
| *. PH7 | Shear forces (Q_y) |
| *. PH8 | Settlements due to reloading (s _w) |
| *. PH9 | Overburden pressures (Q _u) |
| *. H10 | Support reactions (V) |
| *. H11 | Support reactions (M _y) |
| *. H12 | Support reactions (M _x) |
| *. H13 | Reinforcement of the slab (A _{sx1}) |
| *. H14 | Reinforcement of the slab (A _{sx2}) |
| *. H15 | Reinforcement of the slab (A _{sy1}) |
| *. H16 | Reinforcement of the slab (A _{sy2}) |

The asterisk (*) matches any filename with the specified extension.

Next paragraphs describe the purpose and function of each ELPLA-Section command.

3 Starting ELPLA-Section

Start ELPLA-Section by clicking on the program icon in the Windows "Start"-Menu. The introduction screen (Figure F-1) appears.



Figure F-1 Introduction screen of ELPLA-Section

The menu head of Figure F-1 contains the following seven commands:

- File
- View
- Sections
- Options
- Format
- Window
- Help

After clicking one of the seven menu commands, another sub-commands or options become available. The seven menu commands and their sub-commands are presented and described in the following paragraphs 4 to 11.

4 File Menu

The File Menu commands are:

- Open
- Combination of many projects
- Make WMF-File
- Print
- Page setup
- Send to Excel
- Files 1, 2, 3, 4
- Exit

4.1 File Menu–"Open" command

By "Open" command the current project is closed, if one is loaded, and an existing project is opened. Figure F-2 shows "Open" Dialog box used to open a specified project.

| Open | | | | | ? × |
|----------------------------------------|-----------------------------------|-------|---------|--------------|---------|
| Look in: 🖂 | Example7 | - 🗈 | <u></u> | * | |
| gb1 gb2 gb3 gb4 gb5 gb6 | ∰gb7 ∰gb8 | | | | |
| File <u>n</u> ame: | [| | | <u>0</u> per | 1 |
| Files of <u>type</u> : | Isolated slab foundation-files (* | .P01) | • | Cance | el |

Figure F-2 "Open project" Dialog box

4.2 File Menu–"Combination of many projects" command

The extreme values of calculated results (settlements, contact pressures, deformation, internal forces, modulus of subgrade reaction and reinforcement) of many projects can be drawn.

For determining results as extreme values or drawing results of many projects in a diagram, project names and their comments are required.

When the command is chosen, the input Dialog box shown in Figure F-3 appears. In this input Dialog box the project name and its identification can be defined.

4.3 File Menu–"Make WMF-File" command

By "Make WMF-File" command the drawing can be saved in a format that can be read by other programs. This feature allows you to include your drawing in reports and presentations and to enhance the drawing using other drawing or CAD software packages. The drawing can be exported in the Windows Metafile (WMF) format.

| No. | File name of the project | Project identification | |
|-----|--------------------------|------------------------|----------------|
| 1 | H:\gb1 | Method 1 | <u>C</u> ancel |
| 2 | H:\gb2 | Method 2 | |
| 3 | H:\gb3 | Method 3 | |
| 4 | H:\gb4 | Method 4 | Add project |
| 5 | H:\gb5 | Method 5 | |
| 6 | H:\gb6 | Method 6 | Bemove projec |
| 7 | H:\gb7 | Method 7 | |
| 8 | H:\gb8 | Method 8 | |
| | | | New |

Figure F-3 "Combination of many projects" input Dialog box

4.4 File Menu–"Print" command

By "Print" command data and results can be graphically plotted or printed. Only the objects currently displayed on the drawing are printed. Figure F-4 shows "Print" Dialog box. The printer group box contains controls for selecting the printer and changing its properties. Use "Name" Combo box to select the printer and use "Properties" Button to set printer settings. The number of printing copies can be defined in "Copies" Input box.

| Print | | ? | × |
|----------------------------------------------|------------------------------------------------------------------|----------------------------------------------------|---|
| Printer — | | | |
| <u>N</u> ame: | HP LaserJet 2100 Series PCL 6 | Properties | |
| Status: Type: Where: Comment: | Default printer; Ready HP LaserJet 2100 Series PCL 6 LPT1: | | |
| Print range <u>A</u> I Pages Select | from: to: | Copies Number of copies: 1 = 1 2 3 C Collate | |
| | | OK Cancel | |

Figure F-4 "Print" Input box

4.5 File Menu–"Page setup" command

By "Page setup" command the standard "Page setup" Dialog box can be displayed with options to specify the printer, page orientation, paper size and paper source, as well as other printing options. Figure F-5 shows "Page setup" Dialog box.

| Page Setup | ? × |
|---------------------|--------------------------------|
| | |
| Paper | |
| Size: | 4 |
| Source: | uto Select |
| Orientation | Margins (millimeters) |
| C P <u>o</u> rtrait | Left: 30mm <u>R</u> ight: 30mm |
| C Landscape | Iop: 30mm Bottom: 30mm |
| | OK Cancel Printer |

Figure F-5 "Page setup" Dialog box

4.6 File Menu–"Send to Excel" command

By this command, it is possible to export results as diagrams to MS Excel.

4.7 File Menu–"Files 1, 2, 3, 4" command

By "Files 1, 2, 3, 4" command the user can open one of the last four loaded projects.

4.8 File Menu–''Exit'' command

By "Exit" command the current project is closed and ELPLA-Section is quitted (Figure F-7).



Figure F-7 "Exit" Message box

5 View Menu

The View Menu commands are:

- Status bar
- Tool bars

5.1 View Menu–"Status bar" command

"Status bar" command displays a status bar on the screen down. The status bar displays information about the progress of the current operation.

5.2 View Menu–''Tool bars'' command

"Tool bars" command displays tool bars located just below the menu head. Tool bars contain icons of program menus.

6 Sections Menu

The Section menu is the main menu, which is used to display the specified drawing with the setting given by options, format and window menus.

The Sections Menu commands are:

- Section in x-direction
- Max./ Min. values in *x*-direction
- Overlapping in x-direction
- Section in y-direction
- Max./ Min. values in y-direction
- Overlapping in y-direction
- Arbitrary section

6.1 Sections Menu–"Section in x-direction" command

By "Section in x-direction" command the calculated results (settlements, contact pressures, deformation, internal forces, modulus of subgrade reaction and reinforcement) and input data (additional settlements) can be plotted at a specified section in x-direction.

When this command is chosen, the selection Dialog box shown in Figure F-8 appears. In this Dialog box select one item to draw, then click "OK" Button.

| Section in x-direction | × |
|------------------------------------|-----------------------------------|
| Select one item to draw: | |
| Settlements s | C Contact pressures q |
| O Moments mx | C Moments my |
| O Moments mxy | 🔿 Shear forces Qx |
| O Shear forces Qy | C Top Rfts x-direction As,topx |
| C Top Rfts y-direction As,topy | C Bottom Rfts x-direction As,botx |
| C Bottom Rifts y-direction As,boty | |
| C modulus of subgrade reaction ks | |
| C Ultimate bearing capacity qul | Cancel |
| C Principal moments hm1 | |
| O Principal moments hm2 | <u>H</u> elp |

Figure F-8 "Section in x-direction" items

For drawing results at a specified section in x-direction, ranges of the section are required as shown in Figure F-9.

| Section in x-direction | × |
|-------------------------------------------------------|-----------|
| Set range in y-direction: | |
| Section at y-coordinate | [m] 3,50 |
| Set range in x-direction: | |
| at x-coordinate X1 | [m] 0,00 |
| to x-coordinate X2 | [m] 15,01 |
| <u>Ok</u> <u>C</u> ancel <u>H</u> elp << <u>L</u> ess | |
| | |

Figure F-9 "Section in x-direction" Dialog box

As an example, Figure F-10 shows a specified section of settlement in x-direction.

ELPLA-Section



Figure F-10 Section of settlement in x-direction

6.2 Sections Menu-"Max./ Min. values in x-direction" command

By "Max./ Min. values in x-direction" command the extreme values of results (settlements, contact pressures, deformation, internal forces, modulus of subgrade reaction and reinforcement) and input data (additional settlements) can be plotted at a specified range in x-direction. When the command is chosen, the selection Dialog box shown in Figure F-11 appears. In this Dialog box select one item to draw and then click "OK" Button.



Figure F-11 "Max./ Min. values in x-direction" items

For drawing extreme values of results at a specified range in x-direction, ranges of the section are required as shown in Figure F-12.



Figure F-12 "Section in x-direction" Dialog box

As an example, Figure F-13 shows extreme values of moments m_x in x-direction for the whole raft.



Figure F-13 Extreme values of moments m_x in x-direction for the whole raft

6.3 Sections Menu–"Overlapping in x-direction" command

Values of calculated results (settlements, contact pressures, deformation, internal forces, modulus of subgrade reaction and reinforcement) and input data (additional settlements) can be plotted in many sections for a specified range in x-direction in one graph.

When "Overlapping in x-direction" command is chosen, the selection Dialog box shown in Figure F-14 appears. In this Dialog box select one item to draw, then click "OK" Button.



Figure F-14 "Overlapping in x-direction" items

For drawing values of calculated results at a specified range in x-direction in one graph, ranges of the section are required as shown in Figure F-15.



Figure F-15 "Overlapping in x-direction" Dialog box

As an example, Figure F-16 shows values of shear forces Q_y in x-direction in a specified zone of the raft.

ELPLA-Section



Figure F-16 Sections of shear forces Q_y in x-direction for a specified zone

6.4 Sections Menu–"Section in y-direction" command

By "Section in y-direction" command the calculated results (settlements, contact pressures, deformation, internal forces, modulus of subgrade reaction and reinforcement) and input data (additional settlements) can be plotted at a specified section in y-direction.

When this command is chosen, the selection Dialog box shown in Figure F-17 appears. In this Dialog box select one item to draw, then click "OK" Button.

| Section in y-direction | × |
|-----------------------------------|-----------------------------------|
| Select one item to draw: | |
| C Settlements s | Contact pressures q |
| C Moments mx | C Moments my |
| C Moments mxy | C Shear forces Qx |
| C Shear forces Qy | C Top Rfts x-direction As,topx |
| C Top Rfts y-direction As,topy | C Bottom Rfts x-direction As,botx |
| C Bottom Rfts y-direction As,boty | |
| C modulus of subgrade reaction ks | <u> </u> |
| O Ultimate bearing capacity qui | Cancel |
| O Principal moments hm1 | |
| O Principal moments hm2 | <u>H</u> elp |

Figure F-17 "Section in y-direction" items

For drawing results at a specified section in y-direction, ranges of the section are required as shown in Figure F-18.

| Section in y-direction | × |
|------------------------------------------------|-----------|
| Set range in x-direction: | |
| Section at x-coordinate | [m] (0,00 |
| Set range in y-direction: | |
| at y-coordinate Y1 | [m] 0,00 |
| to y-coordinate Y2 | [m] 13,98 |
| Dk Cancel Help << Less | |
| | |

Figure F-18 "Section in y-direction" Dialog box

As an example, Figure F-19 shows a specified section of contact pressures in y-direction.



Figure F-19 Section of contact pressures in y-direction

6.5 Sections Menu-"Max./ Min. values in y-direction" command

By "Max./ Min. values in y-direction" command the extreme values of results (settlements, contact pressures, deformation, internal forces, modulus of subgrade reaction and reinforcement) and input data (additional settlements) can be plotted at a specified range in y-direction.

When the command is chosen, the selection Dialog box shown in Figure F-20 appears. In this Dialog box select one item to draw, then click "OK" Button.



Figure F-20 "Max./ Min. values in y-direction" items

For drawing extreme values of results at a specified range in y-direction, ranges of the section are required as shown in Figure F-21.



Figure F-21 "Section in y-direction" Dialog box

As an example, Figure F-22 shows the extreme values of moments m_y in y-direction for the whole raft.

ELPLA-Section



Figure F-22 The extreme values of moments my in y-direction for the whole slab

6.6 Sections Menu–"Overlapping in y-direction" command

By "Overlapping in y-direction" command the values of calculated results (settlements, contact pressures, deformation, internal forces, modulus of subgrade reaction and reinforcement) and input data (additional settlements) can be plotted at a specified range in y-direction in one graph.

When this command is chosen, the selection Dialog box shown in Figure F-23 appears. In this Dialog box select one item to draw, then click "OK" Button.

| Overlapping in y-direction | × | |
|-----------------------------------|-----------------------------------|--|
| Select one item to draw: | | |
| O Settlements s | C Contact pressures q | |
| C Moments mx | C Moments my | |
| C Moments mxy | Shear forces Qx | |
| C Shear forces Qy | O Top Rits x-direction As,topx | |
| C Top Rfts y-direction As,topy | C Bottom Rfts x-direction As,botx | |
| C Bottom Rfts y-direction As,boty | | |
| C modulus of subgrade reaction ks | <u>k</u> | |
| O Ultimate bearing capacity qul | Cancel | |
| O Principal moments hm1 | | |
| C Principal moments hm2 | Help | |

Figure F-23 "Overlapping in y-direction" items

For drawing values of calculated results at a specified range in y-direction in one graph, the ranges of the section required as shown in Figure F-24.

| Overlapping in y-direction | × |
|----------------------------|-----------|
| Set range in x-direction: | |
| at x-coordinate X1 | [m] 0,00 |
| to x-coordinate X2 | [m] 3,00 |
| Set range in y-direction: | |
| at y-coordinate Y1 | [m] 0,00 |
| to y-coordinate Y2 | [m] 13,98 |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| 1 | |

Figure F-24 "Section in y-direction" Dialog box

As an example, Figure F-25 shows values of shear forces Q_x in y-direction in a specified zone of the raft.



Figure F-25 Sections of shear forces Q_x in y-direction

6.7 Sections Menu–"Arbitrary section" command

By "Arbitrary section in x-direction" command the calculated results (settlements, contact pressures, deformation, internal forces, modulus of subgrade reaction and reinforcement) and input data (additional settlements) can be plotted at any arbitrary section.

When "Arbitrary section" command is chosen, the selection Dialog box shown in Figure F-26 appears. In this Dialog box select one item to draw, then click "OK" Button.



Figure F-26 "Section in x-direction" items

For drawing results at any arbitrary section, ranges of the section are required as shown in Figure F-27.



Figure F-27 "Section in x-direction" Dialog box

As an example, Figure F-28 shows an arbitrary section of settlement.

ELPLA-Section



Figure F-28 Arbitrary section of settlement

7 Options Menu

The Options Menu has the following commands:

- Plot parameters
- Scale
- Axes
- Title
- Page No.
- Copy

7.1 Options Menu–"Plot parameters" command

Plot parameters may be set as default values by the program, or be fully specified by the user. The following plot parameters can be specified (Figure F-29):

- Display grid
- Page with or without frame
- Display values on lines
- Display marks on lines



Figure F-29 "Plot parameters" Dialog box

7.2 Options Menu–"Scale" command

By "Scale" command the scale factor of the drawing can be defined as shown in Figure F-30. The defaulted value for the scale factor is chosen to pass the active printer-paper format.

| Scale 2 |
|----------------------------------------|
| Scale of drawing: |
| ○ 1:50 ○ 1:75 ○ 1:125 ○ 1:150 ○ 1:175 |
| • Another 1: 100 |
| <u>O</u> k <u>C</u> ancel <u>H</u> elp |

Figure F-30 "Scale" Dialog box

7.3 Options Menu–"Axes" command

By "Axes" command scaled axes can be defined on the drawing, Figure F-31.

| Axes | | × |
|-----------------------|-------------------|----------------|
| Scaling vertical a | xis: | |
| Min. value | [kN/m] -200,0 | |
| Max. value | [kN/m] 200,0 | <u>C</u> ancel |
| Interval | [kN/m] 50,0 | <u>H</u> elp |
| - Interval of horizor | ntal axis: | |
| Interval in directio | on of slab length | [m] 2,00 |
| Interval in direction | on of slab width | [m] 2,00 |
| | | |

Figure F-31 "Axes" Dialog box

7.4 Options Menu–"Title" command

By "Title" command the text data (two line texts above the drawing and two line texts under the drawing) can be defined, Figure F-32. Default texts are:

- A-Title1: Method No.
- A-Title2: Name of method
- U-Title1: Name of drawing
- U-Title2: Ranges that define the section

| Title | × |
|-------------------------------------------------------|--------------|
| Title above drawing | |
| A-Title1 Method (7) (Layered soil model) | |
| A-Title2 Modulus of Compressibility (Elimination) | |
| | |
| Title under drawing | |
| U-Title1 Settlements s [cm] | |
| U-Title2 Horizontal section at y-coordinate=10,00 [m] | |
| | |
| | <u>H</u> elp |

Figure F-32 "Title" Dialog box

7.5 Options Menu–"Page No." command

By "Page No." command the page No. can be defined, Figure F-33.

| × |
|----------------|
| <u>k</u> |
| <u>C</u> ancel |
| Help |
| |

Figure F-33 "Page No." Dialog box

7.6 Options Menu–"Copy" command

By "Copy" command the current drawing can be copied in Metafile-Format to Clipboard. Then it can be inserted directly to another Windows programs such as Word, WordPerfect and AutoCAD.

8 Format Menu

The Format menu has the following commands:

- Line formats
- Max. ordinate
- Font
- Legend

8.1 Format Menu–"Line formats" command

Color, style and thickness of drawing lines can be defined, Figure F-34. The way a line is drawn depends on the setting of the color and style properties. There are available 15 different colors and 5 styles for line formats.

The following list shows the available lines, which can be formatted:

- Grid
- Page boundary
- Identification box
- Axes
- Location of the section
- Sections

Note: The asterisk (*) matches drawing section number.

| Line formats | | | × |
|----------------|--------------|----------------|-------|
| Lines | | Color | Style |
| Grid | • | | |
| | | | |
| | | | |
| | | | [] |
| | | | |
| | <u>S</u> ave | | |
| <u>C</u> ancel | Help | Thickness [mm] | 0,3 |

Figure F-34 "Line formats" Dialog box

8.2 Options Menu–"Max. ordinate" command

By "Max. ordinate" command the maximum ordinate of the vertical axis and the maximum size of markers can be defined in [mm], Figure F-35.

| Max. ordinate | × |
|---------------------------------------------|----------------|
| Max. ordinate: | |
| Size of marker | |
| Size of marker Ordinate of vertical axis | <u>S</u> ave |
| [mm] 2 | <u>C</u> ancel |
| | Help |

Figure F-35 "Max. ordinate" Dialog box

8.3 Format Menu–"Font" command

By "Font" command font size (Figure F-36) and font type (Figure F-37) for the drawing can be defined.

| Font | × |
|---------------------|--------------------------|
| Size factor of font | Size 3 + |
| Sample AaBbYyZz | Eont type Courier New |
| <u>Dk</u> ancel | Help |

Figure F-36 "Font size" Dialog box

| Font | | ? X |
|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------|
| Eont: Arial | Font style: Regular | ОК |
| Trabic Transparent Tr Arial Tr Arial Black Tr Arial Narrow Tr Bold Italic Art Tr Book Antiqua Tr Bookman Old Style | Regular Italic Bold Bold Italic | Cancel |
| Effects Strikeout Underline Color: Black | Sample AaBbYyZz Script: | |
| This is a TrueType font. This sa your printer and your screen. | me font will be used on both | |

Figure F-37 "Font" Dialog box

8.4 Format Menu–"Legend" command

By "Legend" command the height and width of legends (Identification box, symbol and location of the section) can be specified as shown in Figure F-38.

Display legend

In "Display legend" Group box check the legend that you wish to display.

Legend size

In "Legend size" Group box the height and width of the legend can be defined.

| L | egend | | | × |
|---|-------------------------|-------------------------|-------------|--------------|
| | Display Legend | Legend size | | |
| | Legend | Legend | Height [cm] | Width [cm] |
| | Identification box | Identification box | 3,00 | 12,00 |
| | 🔽 Symbol | Symbol | 0,50 | 2,00 |
| | Location of the section | Location of the section | 3,00 | 8,00 |
| | k | e <u>C</u> ance | <u>!</u> | <u>H</u> elp |

Figure F-38 "Legend" Dialog box

9 Window Menu

The Window menu has the following commands:

- Zoom in
- Zoom out
- Zoom window
- Zoom %
- Original size

9.1 Window Menu-"Zoom in" command

By "Zoom in" command the size of the drawing on the screen can be reduced.

9.2 Window Menu-"Zoom out" command

By "Zoom out" command the size of the drawing on the screen can be increased.

9.3 Window Menu-"Zoom window" command

By "Zoom window" command the size of the drawing on a specified area can be increased.

9.4 Window Menu–"Zoom %" command

When you choose "Zoom %" command, the following Dialog box appears, Figure F-39.

| Zoom 🗙 | 1 |
|----------------------------------------|---|
| Zoom % | |
| C 50% C 75% C 125% C 150% C 175% | |
| C Another 100 | |
| <u>O</u> k <u>C</u> ancel <u>H</u> elp | |

Figure F-39 "Zoom %" Dialog box

By "Zoom %" command the size of drawings on the screen can be specified. Choosing "Zoom %" allows you to increase or decrease the size at which the drawing is displayed. Choosing 100% displays the drawing at its original size. Clicking on the percentage, changes the drawing size to the specified percentage. The drawing can be displayed at any size by typing the desired percentage in the specified Edit box.

9.5 Window Menu–"Original size" command

The commands "Zoom in", "Zoom out" and "Zoom %" can change the size of drawing on the screen. The drawing can be displayed in its original size again using "Original size" command.

10 Help Menu

The Help Menu commands are:

- Contents
- Short description of ELPLA
- New in ELPLA
- About ELPLA-Section

10.1 Help Menu–"Contents" command

"Contents" command displays a help file in HTML-Format containing the complete ELPLA User's Guide, Figure F-40.



Figure F-40 Menu "Contents"

10.2 Help Menu-"Short description of ELPLA" command

"Short description of ELPLA" command gives a short description of ELPLA package.

10.3 Help Menu-"New in ELPLA" command

"New in ELPLA" command summarizes the new features and enhancements in ELPLA.

10.4 Help Menu–"About ELPLA-Section" command

Clicking the command "About ELPLA-Section" displays the information form of ELPLA-Section as shown in Figure F-41 This gives information about ELPLA-Section and the calculation method of the loaded project.



Figure F-41 Information form of ELPLA-Section

11 Tips and Tricks

11.1 Keyboard

The user can obtain all menu titles and commands also through Shortcut keys. The action of the Shortcut keys is listed in Table F-4 to Table F-11:

| Shortcut keys | Action | |
|---------------|-------------------|------------|
| [Alt+f] | Calling menu head | "File" |
| [Alt+v] | | "View" |
| [Alt+s] | | "Sections" |
| [Alt+o] | | "Options" |
| [Alt+t] | | "Format" |
| [Alt+w] | | "Window" |
| [Alt+h] | | "Help" |

Table F-4Shortcut keys of menu head

| Shortcut keys | Action | |
|-------------------------------|---------------------------------------------------------------|--|
| [Ctrl +o] or [Alt+f] then [o] | Calling command "Open" | |
| [Alt+f] then [c] | "Combination of many projects" | |
| [Alt+f] then [w] | "Make WMF-File" | |
| [Ctrl +p] or [Alt+f] then [p] | "Print" | |
| [Alt+f] then [u] | "Page setup" | |
| [Alt+f] then [s] | "Send to Excel" | |
| [Alt+f] then [1] | Calling the first project from the last four loaded projects | |
| [Alt+f] then [2] | Calling the second project from the last four loaded projects | |
| [Alt+f] then [3] | Calling the third project from the last four loaded projects | |
| [Alt+f] then [4] | Calling the fourth project from the last four loaded projects | |
| [Ctrl+q] or [Alt+f] then [x] | Calling command "Exit" | |

Table F-5Shortcut keys of File-Command

Table F-6Shortcut keys of View-Command

| Shortcut keys | Action | |
|----------------------------|-----------------|----------------------|
| [Alt+v] then [b] | Calling command | "Status bar" |
| [Alt+v] then [t] | | "Tool bars" |
| [Alt+v] then [t], then [f] | | "Tool bars-File" |
| [Alt+v] then [t], then [s] | | "Tool bars-Sections" |
| [Alt+v] then [t], then [o] | | "Tool bars-Options" |
| [Alt+v] then [t], then [t] | | "Tool bars-Format" |
| [Alt+v] then [t], then [w] | | "Tool bars-Window" |
| [Alt+v] then [t], then [h] | | "Tool bars-Help" |
| [Alt+v] then [t], then [r] | | "Reset Toolbar" |

| Shortcut keys | Action | |
|------------------|-----------------|------------------------------------|
| [Alt+s] then [x] | Calling command | "Section in x-direction" |
| [Alt+s] then [m] | | "Max./ Min. values in x-direction" |
| [Alt+s] then [0] | | "Overlapping in x-direction" |
| [Alt+s] then [y] | | "Section in y-direction" |
| [Alt+s] then [a] | | "Max./ Min. values in y-direction" |
| [Alt+s] then [r] | | "Overlapping in y-direction" |
| [Alt+s] then [a] | | "Arbitrary section" |

Table F-7Shortcut keys of Sections-Command

Table F-8Shortcut keys of Options-Command

| Shortcut keys | Action | |
|------------------|-----------------|-------------------|
| [Alt+o] then [l] | Calling command | "Plot parameters" |
| [Alt+o] then [s] | | "Scale" |
| [Alt+o] then [a] | | "Axes" |
| [Alt+o] then [t] | | "Title" |
| [Alt+o] then [p] | | "Page No." |
| [Alt+o] then [c] | | "Copy" |

Table F-9 Shortcut keys of Format-Command

| Shortcut keys | Action | |
|------------------|-----------------|-----------------|
| [Alt+t] then [1] | Calling command | "Line formats" |
| [Alt+o] then [x] | | "Max. ordinate" |
| [Alt+t] then [f] | | "Font" |
| [Alt+t] then [d] | | "Legend" |

Table F-10Shortcut keys of Window-Command

| Shortcut keys | Action | |
|------------------|-----------------|-----------------|
| [Alt+w] then [i] | Calling command | "Zoom in" |
| [Alt+w] then [0] | | "Zoom out" |
| [Alt+w] then [w] | | "Zoom window" |
| [Alt+w] then [z] | | "Zoom %" |
| [Alt+w] then [r] | | "Original size" |

| Shortcut keys | Action | |
|------------------|-----------------|------------------------------|
| [Alt+h] then [c] | Calling command | "Contents" |
| [Alt+h] then [s] | | "Short description of ELPLA" |
| [Alt+h] then [n] | | "New in ELPLA" |
| [Alt+h] then [a] | | "About ELPLA-Section" |

Table F-11Shortcut keys of Help-Command

11.2 Mouse

By double-clicking the left mouse Button on a specified screen position, the user can obtain almost menus of the program.

- By double-clicking on *Legend*, *Firm header*, *Title* or *Project identification*, the corresponding menu appears
- By double-clicking on Scale in the identification box, "Scale"-Menu appears
- By double-clicking on *File name* in the identification box, "Open"-Menu appears
- By double-clicking on *Page No*. in the identification box, "Page No."-Menu appears
- By clicking the right mouse Button at any position on the screen, the user can also obtain the Popup- Options-Menu, Figure F-42



Figure F-42 Menu "Popup- Options"

12 Samples for graphical drawings using ELPLA-Section

ELPLA-Section gives the ability to present many different graphical drawings for results. In this paragraph the graphical drawings for results of example problem gb7, an irregular raft on irregular subsoil, is presented.

The pages P1 to P3 show some graphical presentations of example gb7 in different possibilities according to Table F-12. There is also a great number of presentation possibilities that are not consider in this paragraph. Color presentation is also possible by ELPLA-Section.

Table F-12Graphical drawings for results

| Presentation | Page |
|----------------------------------------------------------|------|
| Contact pressure q | P1 |
| Max./ Min. values of moments m_x | P2 |
| Overlapping of 3 Sections of shear forces Q _y | P3 |

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| , | ٨ |
|---|----|
| | -1 |
| | |

| Axes | | | | 22, 24 |
|------|--------|------|--------|--------|
| inco | •••••• | | •••••• | 22, 24 |

С

| Combination of many projects | |
|------------------------------|------------|
| Copy | 22, 23, 31 |

D

| Display grid | |
|----------------|--|
| Display marks | |
| Display values | |
| | |

E

| Exit | Exit | 3, 1 | 1, 3 | 30 |
|------|------|------|------|----|
|------|------|------|------|----|

F

| File | |
|--------------------|---|
| File groups | |
| Final result files | 6 |
| Font | |
| Format | 7 |
| Format menu | |
| | |

G

H

| Help | 7 |
|-----------|---|
| Help Menu | |

Ι

| Identification | box | 25, | 32 |
|----------------|-----|-----|----|
| Identification | box | 25, | 32 |

L

| Legend | |
|--------------|--|
| Line formats | |
| | |

Μ

| Main data files | 5 |
|----------------------------------|---|
| Make WMF-File | |
| Max. ordinate | |
| Max./ Min. values in x-direction | |
| Max./ Min. values in y-direction | |
| Mouse | |

N

| 8 |
|---|
| í |

0

| Open | |
|----------------------------|--------|
| Options | 7, 22 |
| Original size | |
| Overlapping in x-direction | 11, 15 |
| Overlapping in y-direction | 11, 19 |

Р

| Page boundary | |
|--------------------|------|
| Page No. | |
| Page setup | |
| Plot parameters | |
| Print | 8, 9 |
| Project data files | |

S

| Scale | |
|------------------------|--|
| Section files | |
| Section in x-direction | |
| Section in y-direction | |
| Send to Excel | |
| Short description | |
| Shortcut keys | |
| Size of markers | |
| Status bar | |

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V

| View | · | | |
|------|---|------|------|
| W | | | |

| Window | 7.27 |
|--------|----------|

Z

| Zoom % | 27 |
|-------------|----|
| Zoom in | 27 |
| Zoom out | 27 |
| Zoom window | 27 |







Part G

User's Guide for the program ELPLA-List



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

Version 9.2

Program authors: M. El Gendy

A. El Gendy

GEOTEC: **GEOTEC** Software Inc. PO Box 14001 Richmond Road PO Calgary AB, Canada T3E 7Y7

> http://www.elpla.com geotec@elpla.com

ELPLA-List

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ELPLA-List

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1 An overview of ELPLA- List

ELPLA-List is used to display and print input data and calculated results. Listing data and results can be displayed first on the screen, and then can be sent to the printer or MS Word.

The data and results can be viewed as follows:

- Display tables of data
- Print tables of data
- List tables of data through Text-Editor
- Display tables of results
- Print tables of results
- List tables of results through Text-Editor

The data and results, if desired, can be saved as ASCII-format Files, in which they can be exported to other Windows applications to prepare reports or add further information.

2 Description of ELPLA-List

ELPLA-List is a 32-bit software product that operates under MS Windows 9x/NT/ME/XP. The common "what you see is what you get" of Windows applications makes it easy to learn how to use ELPLA-List, especially if you are already familiar with the Windows environment.

The program package ELPLA consists of 7 separate programs. They can be run independently. The name and short description of the seven separate programs are given in Table G-1. The usage of the program is typically such that first data files are created describing a certain problem by ELPLA-Data. Then the project problem is analyzed by ELPLA-Solver. Finally, the results can be presented as graphical drawing, graphs and tables using the five separate programs ELPLA-Graphic, ELPLA-Section, ELPLA-List, ELPLA-Boring and GEOTEC-Editor.

| 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-Editor | A simple text editor program |

 Table G-1
 Names and description of the seven separate programs

In order to use ELPLA-List, first the user must define the project data by ELPLA-Data, and then analyze the problem by ELPLA-Solver. Table G-2 gives a list of files, which are read or created by ELPLA-List. The files can be classified in four groups.
Table G-2Names of file groups

| Group | | Saved from the program | | |
|-------|--------------------|------------------------|--|--|
| А | Main data files | ELPLA-Data | | |
| В | List files (*.LST) | ELPLA-List | | |
| С | Project data files | ELPLA-Data | | |
| D | Result files | ELPLA-Solver | | |

Further more, Table G-3 shows filename, contents and groups of all files that may be read by ELPLA-List.

Table G-3Names and contents of files

A Main data files

| Filename | Contents |
|----------|-----------------------------------------------------|
| FIRMA | Firm header |
| STEU | Default directory for files that are saved by ELPLA |
| NOFORMAT | Number formats |
| RFT | Design code parameters |
| UNITS | System of units |

B List file

| Filename | Contents |
|--------------|-------------|
| PAGELAYO.LST | Page format |
| FONT.LST | Font format |

C Project data files

| Filename | Contents |
|----------|----------------------------------------------|
| *. AUF | 3 lines text to identify the project |
| *. BAU | Soil properties |
| *. LDH | Data of limit depth |
| * .PO1 | System data (Analysis of isolated raft) |
| *. PC1 | Load data |
| *. PL6 | FE-Net data |
| *. P21 | Data of slab properties/ levels/ coordinates |
| *. P23 | Reinforcement data |
| *. GL1 | Girder data |
| *. P31 | Data of supports/ boundary conditions |
| *. P35 | Data of spring supports |
| *. P41 | File of boring fields |
| *. PT1 | Data for temperature change |
| *. PP1 | File of neighboring foundations |
| *. PV1 | Data of additional soil settlements |

| D Result files | |
|----------------|----------------------------------------------------------------------------------|
| Filename | Contents |
| *. PL4 | Area around nodes |
| *. PC7 | Foundation properties |
| *. PC8 | Average contact pressure, eccentricity and area of slab |
| *. PS1 | Deformations of the rigid slab (w_0 , tan θ_{x0} , tan θ_{x0}) |
| *. PT2 | Load vector due to temperature change |
| *. PP2 | Load vector due to neighboring foundations |
| *. PW2 | Moduli of subgrade reactions of borings |
| *. QUB | Main ultimate bearing capacity (q_b) |
| *. PD1 | Flexibility matrix for loading |
| *. PD2 | Flexibility matrix for reloading |
| *. PE1 | Soil stiffness matrix |
| *. LD1 | Limit depth |
| *. GH1 | Internal forces of grid elements |
| *. PT3 | Displacements due to temperature change (s_t) |
| *. PP3 | Settlements due to neighboring foundations (se) |
| *. PV2 | Load vector due to additional settlements |
| *. QUN | Ultimate bearing capacities at nodes (qult) |
| *. PW1 | Modulus of subgrade reaction (k_s) |
| *. PH1 | Settlements (s) |
| *. PH2 | Contact pressures (q) |
| *. PH3 | Moments (m _x) |
| *. PH4 | Moments (m _y) |
| *. PH5 | Moments (m _{xy}) |
| *. PH6 | Shear forces (Q_x) |
| *. PH7 | Shear forces (Q_y) |
| *. PH8 | Settlements due to reloading (sw) |
| *. PH9 | Overburden pressures (Q _u) |
| *. H10 | Support reactions (V) |
| *. H11 | Support reactions (M _y) |
| *. H12 | Support reactions (M_x) |
| *. H13 | Reinforcement of the slab (A _{sx1}) |
| *. H14 | Reinforcement of the slab (A _{sx2}) |
| *. H15 | Reinforcement of the slab (A _{sy1}) |
| *. H16 | Reinforcement of the slab (A _{sy2}) |
| *. THY | Rotations about y-axis (θ_y) |
| *. THZ | Rotations about z-axis (θ_z) |
| *. PPU | Punching results |

The asterisk (*) matches any filename with the specified extension.

Next paragraphs describe the purpose and function of each ELPLA-List command.

3 Starting ELPLA-List

Start ELPLA-List by clicking on the program icon in the Windows "Start"-Menu. The introduction screen (Figure G-1) appears.

| ELPLA-List - [untitled] | | _ 8 × |
|--------------------------------------------------------------------------------------|----------|-------|
| 🖞 Eile View List Forma <u>t W</u> indow <u>H</u> elp 💶 Data Graphic Section Solver 🖕 | | |
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| | 28.01.05 | 19:50 |

Figure G-1 Introduction screen of ELPLA-List

The menu head of Figure G-1 contains the following 6 commands:

- File
- View
- List
- Format
- Window
- Help

After clicking one of the six menu commands other sub-commands become available. These are presented and described in the following paragraphs 4 to 10.

4 File Menu

The File Menu commands are:

- Open
- Close project
- Print setup
- Send to Word
- Send to Excel
- Files 1, 2, 3, 4
- Exit

4.1 File Menu –"Open" command

By "Open" command the current project is closed, if one is loaded, and an existing project is opened. Figure G-2 shows "Open" Dialog box used to open a specified project.

| Open | | | ? × |
|----------------------------------------|--------------------------------|-----------|--------------|
| Look jn: 🦳 | Example7 | - 🗈 🜌 | |
| gb1 gb2 gb3 gb4 gb5 gb6 | gb7 ∰gb8 | | |
| File <u>n</u> ame: | | | <u>O</u> pen |
| Files of type: | Isolated slab foundation-files | (*.P01) 💌 | Cancel |

Figure G-2 "Open project" Dialog box

4.2 File Menu –''Close project'' command

By "Close project" command the current project is closed.

4.3 File Menu –"Print setup" command

By this command the standard "Print setup" Dialog box can be displayed with options to specify printer, page orientation, paper size and paper source, as well as other printing options.

Table G-3 shows "Print setup" Dialog box. The printer group box contains controls for selecting the printer and changing its properties. Use "Name" combo box to select the printer and use "Properties" Button to set printer settings.



Figure G-3 "Print setup" Dialog box

4.4 File Menu –"Send to Word" command

By "Send to Word" command it is possible to export data to MS Word, Figure G-4.



Figure G-4 Export data to MS Word

4.5 File Menu –"Send to Excel" command

By "Send to Excel" command it is possible to export results to MS Excel, Figure G-5.

4.6 File Menu –''Files 1, 2, 3, 4'' command

By "Files 1, 2, 3, 4" command the user can open one of the last four loaded projects.

| ELPLA List - [gb7] - [Settlements s] | | | | | | | | Jwer R X | |
|--------------------------------------|------|---------------------------------------|--------------|----------------------------|------------------|------------------------|--------------------|---------------|----------|
| | | | . . E | | · 🗔 📼 | | | | |
| | | · · · · · · · · · · · · · · · · · · · | | 3 <u>)</u> 21 | | | Ø8 Ø2 | | |
| ⊡ <u>=</u> = <u></u> | Node | Total | Relo | ading | Loading | | | | |
| Node coordinates | | \$ [em] | r. | su | se | | | | |
| Settlements s | | [Cm] | Į | smj | [cm] | | | | |
| | 1 | 2.00 | | 0.01 | | 1 70 | | | 1 |
| | 2 | 1.89 | M 192 | icrosoft E | xcel - Book | 1 | | | |
| | 3 | 1.77 | | <u>File E</u> dit <u>y</u> | /iew Insert | Format <u>T</u> ools D | ata <u>Wi</u> ndow | Help | _ 8 × |
| | 4 | 1.63 | Aria | ıl | • 10 | - B A | » 🛋 🕯 | 0 100% | • 2 » |
| | 5 | 1.51 | | | | A | •]=• [| | |
| | 6 | 1.40 | | F5 | <u> </u> | - | _ | _ | |
| | | 1.30 | | A | B | C | D | E | ┶╼┺╼║ |
| | | 1.21 | - | Node | lotal | Reloading | Loading | | |
| | 10 | 1.14 | | 1 | s | su | se | | |
| | 11 | 1.13 | | 1-1 | [cm] | [cm] | [cm] | | |
| | 12 | 1.30 | - 4 | | 1 2 | 0.21 | 1.79 | | |
| | 13 | 2.18 | - 3 | | 2 1.89 | 0.28 | 1.61 | | |
| | 14 | 2.06 | 4 | | 1.77 | 0.31 | 1.40 | | I |
| | 15 | 1.93 | 3 | | I.03 | 0.33 | 1.31 | | <u> </u> |
| | 16 | 1.78 | | C | 0 I.0I 2 4 4 | 0.34 | 1.17 | | |
| | 17 | 1.65 | - 6 | | 7 1.4 | 0.34 | 0.0 | | |
| | 18 | 1.55 | - - | / | 1.3 | 0.35 | 0.96 | | |
| | 19 | 1.45 | - 10 | |) 1.21 A 1.14 | 0.33 | 0.00 | | |
| | 20 | 1.36 | | 10 | 1.14 | 0.34 | 0.0 | | |
| | 21 | 1.30 | - 12 | 11 | 1.13 | 0.34 | 0.01 | | |
| | 22 | 1.55 | 13 | 10 | 0 13 | 0.34 | 0.00 | | |
| | 24 | 1.51 | 14 | 12 | 2 18 | 0.23 | 19 | | |
| | 25 | 2.34 | 15 | 14 | , 2.10 1 2.06 | 0.20 | 1.69 | | |
| | 26 | 2.22 | 16 | 14 | 193 | 0.37 | 1.60 | | |
| | 27 | 2.07 | | | anti (shad | 0.41 | 1.02 | | |
| | 28 | 1 91 | | P P SN | eeu A snee | IZ A prieets / | | | |
| | | | – Kéa | ay | | | NUN | VI I | |

Figure G-5 Export results to MS Excel

4.7 File Menu –''Exit'' command

By "Exit" command the current project is closed and ELPLA-List is quitted, Figure G-6.



Figure G-6 "Exit" Message box

5 View Menu

The View Menu commands are:

- Project explorer
- Status bar
- Tool bars

5.1 View Menu–"Project explorer" command

"Project explorer" command displays an explorer window on the screen at the left. It is possible to swap between data and results easily, Figure G-7.

| 🗮 ELPLA-List - [gb7] - [Moments] | | | | | | _ 8 |
|--------------------------------------------|------------------|--------------------------|--------------------------|---------------------------|----------------------------------------|----------------------------------------|
| <u>File View List Format Window H</u> e | elp | | | | | * <u>- 18</u> |
| 🖻 🗋 🖷 🖹 🖡 🚚 🛍 A |) 🔁 🗉 | 🗖 🐛 🤗 | 🖗 🛍 🕼 | 、 🏛 · 🖻 | 72 7 7 7 | 2 |
| gb7 gb7 Soil properties Connectivity Nodes | Node I [·] | Moment mx [kN.m/m] | Moment my [kN.m/m] | Moment mxy [kN.m/m] | Principal moment mh1 [kN.m/m] | Principal moment mh2 [kN.m/m] |
| Moduli of subgrade reactions ks | 1 | -0,111 | 2,583 | -7,372 | 8,730 | -6,258 |
| Slab deformation | 2 | 30,221 | -1,484 | -9,451 | 32,825 | -4,088 |
| Data of boring fields | 3 | 32,160 | -1,966 | -25,147 | 45,487 | -15,293 |
| Limit depth za | 4 | -31,207 | 0,576 | -26,964 | 15,983 | -46,614 |
| Shear forces | 5 | -46,950 | -3,203 | -6,403 | -2,285 | -47,868 |
| | 6 | -6,403 | -0,911 | 3,524 | 0,811 | -8,124 |
| Moments | 7 | -15,478 | 4,022 | -3,891 | 4,770 | -16,226 |
| Contact pressures q | 8 | -84,957 | -5,410 | 0,912 | -5,399 | -84,968 |
| Settlements s | 9 | -150,571 | -0,326 | 21,483 | 2,686 | -153,583 |
| | 10 | -99,775 | -1,283 | 30,846 | 7,580 | -108,638 |
| | 11 | -23,870 | -3,969 | 23,344 | 11,457 | -39,296 |
| | 12 | 5,451 | 7,208 | 13,440 | 19,799 | -7,140 |
| | 13 | -0,727 | 31,281 | -15,400 | 37,487 | -6,933 |
| | 14 | 59,706 | 77,014 | -18,822 | 89,076 | 47,644 |
| | 15 | 101,429 | 106,254 | -29,444 | 133,384 | 74,299 |
| | 16 | -51,491 | 59,040 | -30,334 | 66,818 | -59,269 |
| | 17 | -67,777 | 63,847 | -8,830 | 64,437 | -68,367 |
| | 18 | 31,553 | 127,395 | 5,402 | 127,699 | 31,250 |
| | 19 | 60,122 | 153,001 | -11,121 | 154,314 | 58,809 |
| | 20 | -112,920 | 66,299 | -5,061 | 66,442 | -113,062 |
| | 21 | -164,084 | 33,913 | 26,851 | 37,490 | -167,661 |
| | 22 | -98,075 | 42,119 | 38,221 | 51,862 | -107,818 |
| | 23 | 22,933 | 61,797 | 37,866 | 84,926 | -0,196 |
| | 24 | -6,348 | 0,051 | 32,941 | 29,947 | -36,244 |
| | 25 | 0,113 | 13,868 | -34,440 | 42,110 | -28,130 |
| | 26 | 59,734 | 57,035 | -39,480 | 97,887 | 18,882 |
| | 27 | 98,415 | 88,878 | -34,064 | 128,042 | 59,250 |
| | 28 | -57,115 | 45.558 | -34,904 | 56,299 | -67.857 |
| | | | | | 23.01.05 | 21.57 |

Figure G-7 "Project explorer"-Window

5.2 View Menu–"Status bar" command

"Status bar" command displays a status bar on the screen down. The status bar displays information about the progress of the current operation.

5.3 View Menu–"Tool bars" command

"Tool bars" command displays tool bars located just below the menu head. Tool bars contain icons of program menus.

6 List Menu

The List menu is the main menu, which is used to view or print the calculated results and input project data with the setting given by option format menus.

The Menu List commands are:

- Display tables of data
- Print tables of data
- List tables of data through Text-Editor
- Display tables of results
- Print tables of results
- List tables of results through Text-Editor

6.1 List Menu –"Display tables of data" command

By "Display tables of data" command the input project data can be tabulated.

The input project data, which can be tabulated, are:

- Node coordinates
- Node boundaries
- Data of supports/ Boundary conditions
- Spring supports
- Girders
- Loading
- Slab properties/ Foundation level/ Global coordinates
- Data of reinforcement
- Data of temperature change
- Data of neighboring foundations
- Data of additional soil settlements
- Data of boring fields
- Soil properties

When the command is chosen, the selection Dialog box shown in Figure G-8 appears. In this Dialog box select one item to be tabulated and click "OK" Button. As an example, Figure G-9 shows a list of soil data.



Figure G-8 "Display tables of data" items

| 🗮 ELPLA-List - [gb7] - [Soil propertie | es] | | | | | | _ 8 × |
|----------------------------------------|--------------------------------------------------------------|----------------------------------------------------------|-------------------------------------------------------------------|------------------------------------|-----------------|-------------|----------|
| <u>File View List Format Window</u> | Help | ∃× | | | | | |
| | A 2 | — — 🖄 | 🔊 🕼 🌇 | l 😋 🐰 | | | |
| | ·· 🐺 🗖 | •••••••••••••••••••••••••••••••••••••• | | 1 2 2 | | | |
| 月・月 元 月・月 元 、 | • | | | | | | |
| ☐ gb7 Soil properties | S o i l Groundwats Poisson's Reduction B o r i n | main er depth ur ratio of s factor of g lays | data ader ground s soil Nue settlement <i>b</i> ers | urface CW -] = 0 lfa [-] = . | [m] = 1,5 1 | | <u> </u> |
| | Boring No. Name of bo Location of Lover | : 1 pring: BPNJ of boring i | n global coo | rdinates sys | tem [m]: Xb | = 4, Yb= 3 | |
| | No. | laver | compres- | compres- | weight | for | |
| | | under | sibilty for | sibilty for | of | soil type | |
| | | ground | loading | reloading | soil | and | |
| | I | z | Es | Ws | Gama | rocks after | |
| | [-] | [m] | [kN/m2] | [kN/m2] | [kN/m3] | DIN 4023 | |
| | 1 | 1,5 | 9500 | 26000 | 19 | υ | |
| | 2 | 3,8 | 9500 | 26000 | 11 | Ū | |
| | з | 10 | 22000 | 52000 | 11 | fS | |
| | 4 | 20 | 120000 | 220000 | 11 | Z | |
| | Boring No. Name of bo Location o | : 2 pring: BPN2 of boring i | : n global coo | rdinates sys | tem [m]: Xb | = 1, Yb= 9 | |
| | Laver | Level of | Modulus of | Modulus of | Unit | Symbole | • |
| | | | | | 23.0 | 1.05 2 | 2:38 |

Figure G-9 List of node coordinates

6.2 List Menu –"Print tables of data" command

By "Print tables of data" command the title page of ELPLA can be printed. The input project data that can be viewed can be also printed. When "Print tables of data" command is chosen, the selection Dialog box shown in Figure G-10 appears. In this Dialog box check the items that you want to print, then click "OK" Button.



Figure G-10 "Print tables of data" items

For printing tables of data, the header options, page numbering and also number of copies are required as shown in Figure G-11.

Header

- To print headers (Company), check the control box "Print header (Company)"
- To print an identification header, check the control box "Print identification header"

Page numbering

- By the option "Start at" renumbering pages can be defined. To change the page number, type the new number in "Start at" Text box
- If the option "No page numbering" is activated, the page numbers will not be included in the document

Copies

In Dialog box "No. of copies" the number of printing copies can be defined

| Print | x |
|-----------------------------|------------------|
| Header | Copies |
| Print header (Company) | No. of copies: 1 |
| Print identification header | |
| -Page numbering | 2 |
| r age numbering | <u> </u> |
| Start at: 1 | <u>C</u> ancel |
| O No page numbering | |
| | <u>H</u> elp |

Figure G-11 "Print" Dialog box

6.3 List Menu –''List tables of data through Text-Editor'' command

By this command the title page of ELPLA can be displayed through the ELPLA Text-Editor. The input project data that can be viewed can be also displayed. When the command is chosen, the selection Dialog box shown in Figure G-12 appears. In this Dialog box check the items that you want to list through Text-Editor, then click "OK" Button.



Figure G-12 "List tables of data through Text-Editor" items

For listing tables of data through Text-Editor, the header options and page numbering are required before loading Text-Editor. Figure G-13 shows Title page of ELPLA through the ELPLA Text-Editor (program GEOTEC-Editor). To get information about GEOTEC-Editor, see the User's Guide of GEOTEC-Editor.

| 🚆 ELPLA-Text - [untitled1 (Modified)] | _ 8 × |
|------------------------------------------------------------------------------------|-------|
| 🗋 <u>F</u> ile <u>E</u> dit <u>V</u> iew <u>Format</u> <u>W</u> indow <u>H</u> elp | |
| | |
| | |
| | |
| | |
| | |
| | |
| by the program package ELPLA | |
| Version 8.0 | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| Title . In irregular raft on irregular subsoil | |
| Date : 13.07.1998 | |
| Project : Method 7 Vile ch7 | |
| rite .gb/ | - |
| ji Li sa kata | |

Figure G-13 Title page of ELPLA through GEOTEC-Editor

6.4 List Menu –''Display tables of results'' command

By "Display tables of results" command the calculated results can be tabulated.

The calculated results, which can be tabulated, are:

- Settlements, contact pressures, deformation and internal forces
- Flexibility matrix [C_e]
- Flexibility matrix [Cw]
- Stiffness matrix [k_s]
- Modulus of subgrade reaction (k_s)
- Ultimate bearing capacity (q_{ult})
- Settlements due to temperature change (s_t)
- Settlements due to neighboring foundations (se)
- Additional soil settlements (s_s)
- Support reactions (V)
- Limit depth (zg)
- Reinforcement (A_s)
- Punching results

When "Display tables of results" command is chosen, the selection Dialog box shown in Figure G-14 appears. In this Dialog box select one item to be tabulated, then click "OK" Button. As an example, Figure G-15 shows a list of settlements.

| Display tables of results | × |
|----------------------------------------------|-------------------------------------------------|
| Select one item to list: | |
| C Moduli of subgrade reactions ks | C Settlements s |
| C Contact pressures q | C Deformation |
| C Moments | C Shear forces |
| C Beam-Torsion moments Mt | C Beam-Bending moments Mb |
| C Beam-Shear forces Qs | C Support reactions |
| C Reinforcement As | 🔿 Limit depth zg |
| C Displacements due to temperature change St | C Settlements due to neighboring foundations Se |
| C Additional soil settlements Ss | C Flexibility matrix of soil [Ce] |
| C Flexibility matrix of soil [Cw] | <u> </u> |
| C Stiffness matrix of soil [ks] | Cancel |
| C Main ultimate bearing capacity qb | |
| C Ultimate bearing capacity at nodes qui | <u>H</u> elp |

Figure G-14 "Display tables of results" items

| | ⊌ ** | | * • • • | · · | | |
|-----------------------------------------------------|------|--------------------|-------------------------|-----------------------|----------|--|
| b7 ¹ Soil properties Settlements s | | Total s [cm] | Reloading su [cm] | Loading se [cm] | <u> </u> | |
| | 1 | 1.9742 | 0.1880 | 1.7862 | | |
| | 2 | 1.8514 | 0.2522 | 1.5992 | | |
| | 3 | 1,7184 | 0,2809 | 1,4375 | | |
| | 4 | 1,5765 | 0,2971 | 1,2794 | | |
| | 5 | 1,4439 | 0,3067 | 1,1373 | | |
| | 6 | 1,3302 | 0,3120 | 1,0181 | | |
| | 7 | 1,2213 | 0,3147 | 0,9066 | | |
| | 8 | 1,1212 | 0,3157 | 0,8055 | | |
| | 9 | 1,0411 | 0,3127 | 0,7284 | | |
| | 10 | 1,0353 | 0,3089 | 0,7264 | | |
| | 11 | 1,0825 | 0,3015 | 0,7811 | | |
| | 12 | 1,1468 | 0,2468 | 0,9000 | | |
| | 13 | 2,1221 | 0,2533 | 1,8688 | | |
| | 14 | 1,9950 | 0,3442 | 1,6508 | | |
| | 15 | 1,8532 | 0,3839 | 1,4692 | | |
| | 16 | 1,6939 | 0,4045 | 1,2894 | | |
| | 17 | 1,5521 | 0,4162 | 1,1359 | | |
| | 18 | 1,4396 | 0,4227 | 1,0169 | | |
| | 19 | 1,3311 | 0,4261 | 0,9051 | | |
| | 20 | 1,2254 | 0,4257 | 0,7997 | | |
| | 21 | 1,1521 | 0,4327 | 0,7194 | | |
| | 22 | 1,1650 | 0,4442 | 0,7208 | | |
| | 23 | 1,2339 | 0,4331 | 0,8008 | | |
| | 24 | 1,3111 | 0,3548 | 0,9562 | | |
| | | | | | | |

Figure G-15 List of settlements

6.5 List Menu –"Print tables of results" command

The calculated results can be printed. When "Print tables of results" command is chosen, the selection Dialog box shown in Figure G-16 appears. In this Dialog box check the items that you want to print, then click "OK" Button.

For printing tables of results, the header options, page numbering and also number of copies are required as shown in Figure G-11.



Figure G-16 "Print tables of results" items

6.6 List Menu –''List tables of results through Text-Editor'' command

By "List tables of data through Text-Editor" command the calculated results can be displayed through ELPLA Text-Editor. When the command is chosen, the selection Dialog box shown in Figure G-17 appears. In this Dialog box check the items that you want to list through Text-Editor, then click "OK" Button.



Figure G-17 "List tables of results through Text-Editor" items

For listing tables of data through Text-Editor, the header options and page numbering are required before loading Text-Editor. Figure G-18 shows moments through ELPLA Text-Editor. To get information about GEOTEC-Editor, see the User's Guide of GEOTEC-Editor.

| E GEC | | | | | | | | |
|-------|--------------------------------------------------------|-------------------------------|-----------------------------|---------------------------------|-------------------|-----------------|------------|---------|
| 🗟 Ei | le <u>E</u> dit | <u>V</u> iew Forma <u>t M</u> | <u>/</u> indow <u>H</u> elp | | | | | _ 8 × |
| | i 🖉 🖉 | 1 / A D I I. | 8 8 M | 🧼 🙆 👘 | 😭 🙆 | | | |
| 10 | | | ABZ | и 80 = = ≡ | | = | | |
| | - 00 - | | | 2 2 1 =1 = | = = = 3- | - | | |
| 11 | | | | | | | | Â |
| | | | | Geotec Offi | ice | | | = |
| | | РО Вож | 14001 Richmon | d Road PO - Ca | algary AB, Canad | a T3E 7Y7 | | |
| | Moments | I. | | | | | Page 1 | |
| | Title: | An irregular r | aft on irregul | ar subsoil | | | | |
| | Date: 1 | 3.07.1998 | | | | | | |
| | Project | : Method 6 | | | | | | |
| | riie. g | 107 | | | | | | |
| | | | Analy | sis of slab fo | oundation | | | |
| | | | by th | e program pack Version 9-2-5 | tage ELPLA Sp1 | | | |
| | | | | | | | | |
| | Coloulo | tion method: | | | | | | |
| | Calculation method: Method (7) (Lavered soil model) | | | | | | | |
| | Modulus | of compressib | ility | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | Moments | | | | | | | |
| | Node | Moment | Moment | Moment | Principal | Principal | | |
| | No. | | | | moments | moments | | |
| | I [-] | mx [kN m/m] | my [kN m/m] | mxy [kN m/m] | mhl [kN m/m] | mh2 [kN m/m] | | |
| | | | | | [| | | |
| | 1 | -0.3 | 2.3 | -6.1 | 7.2 | -5.2 | | |
| | 2 | 32.1 33.8 | -1.3 | -7.7 | 33.8 | -3.0 | | |
| | 4 | -30.4 | 0.6 | -23.6 | 13.4 | -43.2 | | |
| | 5 | -47.4 | -3.2 | -2.6 | -3.0 | -47.6 | | - |
| • | ć | -0 7 | -0 9 | | 4 0 | _10 1 | | - F |
| | | | | | | | 21/11/2014 | م 05:34 |

Figure G-18 Moments through GEOTEC-Editor

7 Format Menu

The Format menu has the following commands:

- Page format
- Font

7.1 Format Menu –"Page format" command

By "Page format" command the page margins, number of lines per page and number of characters per line can be defined, Figure G-19. The user has the possibility at any time to specify one of the following left, top or bottom boundaries.

| F | age format | | | | × |
|---|-----------------------------------|--------------|---|---|----------------|
| | Page margins | | | | |
| | Left | [characters] | 5 | | <u>UK</u> |
| | Тор | [Lines] | 2 | ÷ | <u>S</u> ave |
| | Bottom | [Lines] | 2 | 3 | |
| | Page size | | | | <u>C</u> ancel |
| | Number of lines pe | | | | |
| | Number of characters per Line 127 | | | | <u>H</u> elp |

Figure G-19 "Page format" Dialog box

7.2 Format Menu –"Font" command

By this command font size (Figure G-20) and font type (Figure G-21) for the text can be defined.

| Font | | | | × |
|---------------|---------------|-------------------|------|--------------|
| - Size factor | of font | | | |
| Item | Data/ Results | • | Size | 10 + |
| -Sample- | | Default font | | Eont type |
| | ,1922 | | | Courier New |
| <u>k</u> | <u>S</u> a | ve <u>C</u> ancel | | <u>H</u> elp |

Figure G-20 "Font size" Dialog box

| Font | | ? × |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|--------------|
| Eont: Arial T Arabic Transparent T Arial T Arial Black T Arial Narrow Bold Italic Art T Book Antiqua T Bookman Old Style | Font style: Regular Italic Bold Bold Italic | OK Cancel |
| Effects Strikeout Linderline Color: Black This is a TrueType font. This sa your printer and your screen. | Sample AaBbYyZz Script: | |

Figure G-21 "Font type" Dialog box

8 Window Menu

The Window menu has the following commands:

- Cascade
- Tile horizontally
- Tile vertically
- Arrange icons
- Window 1, 2, 3, ...

8.1 Window Menu–"Cascade" command

By "Cascade" command all non-minimized forms are cascaded.

8.2 Window Menu–"Tile horizontally" command

By "Tile horizontally command all non-minimized forms are tiled horizontally.

8.3 Window Menu–"Tile vertically" command

By "Tile vertically" command all non-minimized forms are tiled vertically.

8.4 Window Menu–"Arrange icons" command

When choosing "Arrange icons" command, the icons of minimized forms are arranged.

8.5 Window Menu–"Window 1, 2, 3 ..." command

By "Window 1, 2, 3 ..." command the user can display a list of the previous loaded data or results.

9 Help Menu

The Help Menu commands are:

- Contents
- Short description of ELPLA
- New in ELPLA
- About ELPLA-List

9.1 Help Menu–"Contents" command

"Contents" command displays a help file in HTML-Format containing the complete User's Guide of ELPLA, Figure G-22.



Figure G-22 Menu "Contents"

9.2 Help Menu-"Short description of ELPLA" command

"Short description of ELPLA" command gives a short description of ELPLA package.

9.3 Help Menu–"New in ELPLA" command

"New in ELPLA" command summarizes the new features and enhancements in ELPLA.

9.4 Help Menu–"About ELPLA-List" command

Clicking the command displays the information form of ELPLA-List as shown in Figure G-23, which gives information about ELPLA-List and the calculation method of the loaded project.

| Information | × | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--|--|--|
| Analysis of slab foundation Professional, Version 9.3 | | | | |
| Calculation method Method (6) (Layered soil model) Modulus of Compressibility (Iteration) | | | | |
| Viewing and Printing data and results: | | | | |
| By ELPLA-List, The input data (System data, loading and subsoil) and the calculated results (settlements, contact pressures, deformation, internal forces, modulus of subgrade reaction, support reactions, Rfts, flexibility matrix and soil stiffness matrix) can be viewed and printed. | | | | |
| Listing data and results can be displayed first on the screen, then can be sent to the printer. | | | | |
| | | | | |
| Program authors | Qk | | | |
| Prof. M. El Gendy Dr. A. El Gendy | System-Info | | | |
| GEOTEC Software | Online Support | | | |

Figure G-23 Information form of ELPLA-List

10 Tips and Tricks

10.1 Keyboard

The user can obtain all menu titles and commands also through Shortcut keys. The action of the Shortcut keys is listed in Table G-4 to Table G-10.

| Shortcut keys | Action | |
|---------------|-------------------|----------|
| [Alt+f] | Calling menu head | "File" |
| [Alt+v] | | "View" |
| [Alt+1] | | "List" |
| [Alt+t] | | "Format" |
| [Alt+w] | | "Window" |
| [Alt+h] | | "Help" |

Table G-4Shortcut keys of menu head

| Shortcut keys | Action |
|-------------------------------|---------------------------------------------------------------|
| [Ctrl +o] or [Alt+f] then [o] | Calling command "Open" |
| [Alt+f] then [c] | "Close project" |
| [Alt+f] then [u] | "Print setup" |
| [Alt+f] then [w] | "Send to Word" |
| [Alt+f] then [e] | "Send to Excel" |
| [Alt+f] then [1] | Calling the first project from the last four loaded projects |
| [Alt+f] then [2] | Calling the second project from the last four loaded projects |
| [Alt+f] then [3] | Calling the third project from the last four loaded projects |
| [Alt+f] then [4] | Calling the fourth project from the last four loaded projects |
| [Ctrl+q] or [Alt+f] then [x] | Calling command "Exit" |

 Table G-5
 Shortcut keys of File-Command

 Table G-6
 Shortcut keys of View-Command

| Shortcut keys | Action | |
|----------------------------|-----------------|--------------------|
| [Alt+v] then [x] | Calling command | "Project explorer" |
| [Alt+v] then [b] | | "Status bar" |
| [Alt+v] then [t] | | "Tool bars" |
| [Alt+v] then [t], then [f] | | "Tool bars-File" |
| [Alt+v] then [t], then [l] | | "Tool bars-List |
| [Alt+v] then [t], then [t] | | "Tool bars-Format" |
| [Alt+v] then [t], then [w] | | "Tool bars-Window" |
| [Alt+v] then [t], then [h] | | "Tool bars-Help" |
| [Alt+v] then [t], then [r] | | "Reset Toolbar" |

| | Table G-7 | Shortcut keys of List-Co | ommand |
|--|-----------|--------------------------|--------|
|--|-----------|--------------------------|--------|

| Shortcut keys | Action | |
|------------------|-----------------|----------------------------------------------|
| [Alt+1] then [t] | Calling command | "Display tables of data" |
| [Alt+1] then [a] | | "Print tables of data" |
| [Alt+1] then [b] | | "List tables of data through Text-Editor" |
| [Alt+1] then [e] | | "Display tables of results" |
| [Alt+1] then [p] | | "Print tables of results" |
| [Alt+1] then [1] | | "List tables of results through Text-Editor" |

Table G-8Shortcut keys of Format-Command

| Shortcut keys | Action | |
|------------------|-----------------|---------------|
| [Alt+t] then [p] | Calling command | "Page format" |
| [Alt+t] then [f] | | "Font" |

Table G-9Shortcut keys of Window-Command

| Shortcut keys | Action | |
|-------------------------|-----------------|---------------------|
| [Alt+w] then [c] | Calling command | "Cascade" |
| [Alt+w] then [h] | | "Tile horizontally" |
| [Alt+w] then [v] | | "Tile vertically" |
| [Alt+w] then [a] | | "Arrange icons" |
| [Alt+w] then [1, 2, 3,] | | "Window 1, 2, 3" |

Table G-10Shortcut keys of Help-Command

| Shortcut keys | Action | |
|------------------|-----------------|------------------------------|
| [Alt+h] then [c] | Calling command | "Contents" |
| [Alt+h] then [s] | | "Short description of ELPLA" |
| [Alt+h] then [n] | | "New in ELPLA" |
| [Alt+h] then [a] | | "About ELPLA-List" |

10.2 Mouse

By clicking the right mouse Button on the screen, the user can obtain the Popup-Format-Menu, Figure G-24.



Figure G-24 Menu "Popup-Format"

11 Listing samples for data and results using ELPLA-List

ELPLA-List gives the ability to print data and results in arranged tables. In this paragraph some of the printed text for data and results of example problems gb7, an irregular raft on irregular subsoil, are presented.

The pages 1 to 2 contain some printed text of input project data for the example problem gb7, while pages 3 to 7 contain some printed text of results for the same example problem, according to Table G-11 and Table G-12.

1 - 2

11.1 Listing input project data

| Table G-11 Input project data | |
|---------------------------------|------|
| Presentation | Page |
| Title page of program ELPLA | - |

11.2 Listing of calculated results

Loading

| Presentation | Page |
|--------------|-------|
| Moments m | 3 – 7 |

Title: An irregular raft on irregular subsoilDate: 13.07.1998Project: Method 7File: gb7

Calculation method: Method (7) (Layered soil model) Modulus of Compressibility (Elimination)

> Program authors: M. El Gendy/ A. El Gendy GEOTEC: PO Box 14001 Richmond Road PO - Calgary AB, Canada T3E 7Y7

GEOTEC-Software PO Box 14001 Richmond Road PO - Calgary AB, Canada T3E 7Y7

| Loading | | | | | | | Page |
|----------------------------------|-----------------------------------------------|------------------------------|---------------------------|--------------------------------------------|---------------------|-----------|-------------|
| Title Date Project File | : An ir: : 13.07 : Methoo : gb7 | regular raft .1998 d 7 | on irre | egular subso | il | | |
| | | 2 | Analysis by the p | of slab fou program pack Version 9.0 | Indatior age ELE | ı PLA | |
| Calculat Method (Modulus | ion method: 7) (Layered s of Compressib | oil model) ility (Elimi | .nation) | | | | |
| L o a d Point lo | ing ads: | | | | | | |
| Load No. I | Load val | ue x-pos P N1 | sition x [m] | y-positio | y J | | |
| 1 | 12 12 | 65 00 | 1,5 1,5 | 1, 5, | 4 | | |
| 5 4 5 6 | 13 13 15 15 | 50 68 60 38 | 1,5 1,5 5 5 | 9, 12, 1, 12, | 9 6 4 6 | | |
| 7 8 9 10 | 8 7 15 21 | 00 50 65 50 | 9,2 9,2 9,2 13,4 | 1, 5, 12, 5, | 4 5 6 5 | | |
| 11 12 | 14 | 50 54 | 13,4 13,4 | 9, 12, | 9 6 | | |
| Moments | Mx: | | | | | | |
| Moment No. [1] | Moment value Mx [kN.m] | x-posit | ion x [m] | y-position y [m] | | | |
| 1 1 | 350 | | 5 | 1,4 | | | |
| Moments | My: | | | | | | |
| Moment No. [1] | Moment value My [kN.m] | x-posit | ion x [m] | y-position y [m] | | | |
| 1 | 500 | | 9,2 | 5,5 | | | |
| Line loa | lds: | | | | | | |
| Load No. | Load value | Load start | Load st | tart Load | l end | Load end | - d 2 |
| [1] | [kN/m] | ×⊥ [m] | | y⊥ [m] | [m] | у. [m] | _ |
| 1 | . 89 | 10,5 | | 4,8 | 15 | 2,8 | 8 |
| | | | | | | | _ |

| Loading | | | | | | | Page |
|----------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------------------|-------------------------|----------------------------------|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------|
| Distribut | ed loads: | | | | | | |
| Load No. I [1] | Load value P [kN/m2] | Load start x1 [m] | Load start yl [m] | Lc | ad end x2 [m] | Load enc y2 [m] | |
| 1 | 120 | 0 | 0 | | 0,5 | 14 | |
| Groundwat Total loa Groundwat Average c Sum Mx fr Sum My fr | er force d (P = Pe er pressure contact press com loads com loads | + Pa – Pw) on slab ure | | Pa Pw Qw Qo Mx Mv | [KN] [kN] [kN/m2] [kN/m2] [kN.m] [kN.m] | $\begin{array}{r} - 17927,1 \\ = 2031,2 \\ = 15895,9 \\ = 12,0 \\ = 93,9 \\ = 7039,1 \\ = -6683,2 \end{array}$ | |
| Eccentric Eccentric | ity of loadi ity of loadi | ng in x-dire ng in y-dire | ction | ex ey | [cm] [cm] | = -42,04 = 44,28 | |
| Moment of Moment of Product o Area of s | inertia of inertia of f inertia lab | slab about x slab about y | -Axis -Axis | Ix Iy Ixy A | [m4] [m4] [m4] [m2] | = 2923,08 = 3423,36 = 366,19 = 169,27 | |

GEOTEC-Software PO Box 14001 Richmond Road PO - Calgary AB, Canada T3E 7Y7 GEOTEC-Software PO Box 14001 Richmond Road PO - Calgary AB, Canada T3E 7Y7

| Moments | | Page 3 |
|----------------------------------|---------------------------------------------------------------------------------|--------|
| Title Date Project File | : An irregular raft on irregular subsoil : 13.07.1998 : Method 7 : gb7 | |

Analysis of slab foundation by the program package ELPLA Version 9.0

Calculation method: Method (7) (Layered soil model) Modulus of Compressibility (Elimination)

Moments:

| Node No. | Moment | Moment | Moment | Principal moment | Principal moment |
|-------------|----------------|----------------|-----------------|-----------------------|---------------------|
| I [1] | mx [kN.m/m] | my [kN.m/m] | mxy [kN.m/m] | mhl [kN.m/m] | mh2 [kN.m/m] |
| | · | | | | |
| 2 | -0,2 | 2,4 -1,4 | -5,3 | о , о 34, 1 | -4,4 |
| 3 | 34,9 | -1,9 | -22,2 | 45,4 | -12,3 |
| 4 | -29,2 | 0,6 | -23,4 | 13,4 | -42,0 |
| 5 | -46,1 | -3,2 | -2,3 | -3,1 | -46,2 |
| 6 | -6,9 | -0,9 | 7,9 | 4,6 | -12,3 |
| 7 | -17,3 | 4,0 | 0,6 | 4,0 | -17 , 3 |
| 8 | -87,9 | -5,4 | 5,2 | -5,1 | -88,2 |
| 9 | -154,1 | -0,3 | 25,1 | 3,7 | -158,1 |
| 10 | -102,8 | -1,3 | 33,2 | 8,6 | -112,7 |
| 11 | -25,6 | -4,0 | 24,3 | 11,8 | -41,4 |
| 12 | 5,7 | 7,3 | 13,7 | 20,3 | -7,2 |
| 13 | -0,/ | 31,9 | -13,0 | 36,4 | -5,2 |
| 14 | 01,0 102 4 | 106 5 | -10,2 | 8/,/ 121 / | 51,5 70 C |
| 15 16 | 103,4 -50 1 | 100,J | -20,4 | 131,4 65 1 | 70,0 -563 |
| 17 | -67.6 | 63,3 | -4.8 | 63.5 | -67.7 |
| 18 | 30,5 | 126,5 | 9,7 | 127,4 | 29,5 |
| 19 | 58,0 | 151,8 | -6,7 | 152,3 | 57,5 |
| 20 | -115,9 | 64,8 | -0,8 | 64,8 | -115,9 |
| 21 | -166,9 | 32,6 | 30,4 | 37,1 | -171,4 |
| 22 | -99,7 | 41,4 | 40,6 | 52,3 | -110,5 |
| 23 | 22,5 | 61,3 | 39,1 | 85 , 5 | -1,7 |
| 24 | -6,4 | -0,9 | 33,6 | 30,1 | -37,4 |
| 25 | 0,1 | 14,7 | -31,6 | 39,8 | -25,1 |
| 26 | 61,2 | 57,5 | -36,4 | 95,8 | 22,9 |
| 27 | 99,5 | 88,5 | -30,6 | 125,1 | 62,9 |
| 28 | -56,6 | 44,4 | -31,0 | 53,1 70 0 | -65,3 |
| 29 | -81,6 | 10,5 117 C | -34,8 | 18,0 150 6 | -89,2 |
| 30 | 20,9 50 1 | 14/,0 | -19,7 | 170,6 | 17,9 50.0 |
| 32 | -139 9 | 92 9 | 29 2 | 170 , 5 | -143 5 |
| 22 | -176.7 | 35.5 | 46.9 | 45.4 | -186.6 |
| 34 | -105,7 | 36,2 | 47,2 | 50,5 | -120.0 |
| 35 | 4,9 | 51,6 | 61,0 | 93,5 | -37,0 |
| 36 | 6,3 | -18,5 | 90,6 | 85,4 | -97,5 |
| 37 | -1,3 | -56,0 | -36,0 | 16,6 | -73,9 |
| 38 | 35,6 | -64,0 | -42,4 | 51,2 | -79,7 |

Continue of table at next page

| | 20.2 | 14001 51 1 | GEOTEC-Softwa | are | | - |
|-------------|------------------|----------------|-----------------|---------------------|---------------------|----------|
| | PO Box | 14001 Richmo | nd Road PO - | Calgary AB, C | anada T3E /Y | |
| Moments | | | | | | Page 4 |
| Continue | of table | | | | | |
| Node No. | Moment | Moment | Moment | Principal moment | Principal moment | |
| I [1] | mx [kN.m/m] | my [kN.m/m] | mxy [kN.m/m] | mh1 [kN.m/m] | mh2 [kN.m/m] | |
| 39 | 27,7 | -69,8 | -41,5 | 43,0 | -85,0 | |
| 40 | -39,2 | -40,7 | -52,4 | 12,5 | -92,3 | |
| 41 | -82,9 | -9,8 | -/3,3 | 35,/ | -128,5 | |
| 42 | -64,9 | 3,3 15 0 | -58,5 | 30,9 15 0 | -98,6 | |
| 43 | -167 2 | 1J,2 38 0 | ±,2 57 2 | 1J,2 52 9 | -182 1 | |
| 44 | -178 3 | 5 2 | 57,2 69 5 | 28 5 | -201 7 | |
| 46 | -117 9 | -19 5 | 64 7 | 12 6 | -150 0 | |
| 47 | -52.1 | -45,1 | 83.9 | 35,4 | -132,6 | |
| 48 | -130,8 | -48,6 | 115,7 | 33,1 | -212,5 | |
| 49 | -19,8 | 10,5 | 40,8 | 38,8 | -48,1 | |
| 50 | 50,5 | -1,8 | 17,9 | 56,0 | -7,3 | |
| 51 | 68,3 | 1,8 | 3,8 | 68,5 | 1,6 | |
| 52 | -0,6 | -3,2 | 2,5 | 0,9 | -4,7 | |
| 53 | -2,2 | -76,6 | -27,6 | 6,9 | -85,7 | |
| 54 | 37,4 | -87,1 | -32,0 | 45,1 | -94,9 | |
| 55 | 30,6 | -97,5 | -50,0 | 47,8 | -114,7 | |
| 56 | -21,9 | -92,4 | -75,8 | 26,5 | -140,8 | |
| 57 | -93,2 | -61,4 | -100,7 | 24,7 | -179,3 | |
| 58 | -114,0 | -41,7 | -74,2 | 4,7 | -160,4 | |
| 59 | -180,4 | -10,8 | -25,6 | -/,0 | -184,2 | |
| 6U 61 | -224,0 | 9,9 _10 / | /8,8 9/5 | 33,9 | -248,1 | |
| 62 | -123 3 | -10,4 | 80 9 | 19,0 12 7 | -204,9 | |
| 63 | -72.8 | -38.4 | 84.3 | 30.4 | -141.7 | |
| 64 | -83.3 | -4.7 | 81.3 | 46.3 | -134.3 | |
| 65 | -16,3 | 17,9 | 43,1 | 47,2 | -45,6 | |
| 66 | 77,1 | 32,4 | 24,4 | 87,9 | 21,7 | |
| 67 | 86,3 | 32,0 | -0,2 | 86,3 | 32,0 | |
| 68 | -2,2 | 23,0 | -3,8 | 23,6 | -2,7 | |
| 69 | -1,5 | -32,6 | -13,5 | 3,6 | -37,7 | |
| 70 | 60,2 | -53,2 | -15,6 | 62,3 | -55,3 | |
| 71 | 67,6 | -82,3 | -47,4 | 81,3 | -96,0 | |
| 72 | 6,8 | -94,7 | -84,7 | 54,8 | -142,7 | |
| 73 | -91,3 | -176,1 | -134,9 | 7,7 | -275,1 | |
| 74 | -151,5 | 24,1 | -110,3 | 11,3 | -204,/ | |
| 75 | -185,9 | 4,/ 17 1 | -48,1 140 E | 10,1 | -19/,4 | |
| 70 | -333,0 -154 3 | _35 2 | 140,5 | 18 3 | -207 9 | |
| 78 | -129.0 | -23.6 | 91.0 | 28.9 | -181.5 | |
| 79 | -57.5 | -12.2 | 95.3 | 63.1 | -132.8 | |
| 80 | -39,9 | 41,2 | 49.2 | 64,4 | -63,1 | |
| 81 | 4,5 | 88,3 | 44,2 | 107,3 | -14,5 | |
| 82 | 117,1 | 90,3 | 31,7 | 138,1 | 69,3 | |
| 83 | 123,2 | 83,1 | -7,1 | 124,4 | 81,9 | |
| 84 | 1,4 | 102,7 | -18,2 | 105,9 | -1,7 | |
| 85 | 0,0 | 51,8 | -7,0 | 52,7 | -0,9 | |
| 86 | 111,9 | 100,6 | -7,4 | 115,5 | 96,9 | |
| 87 | 195,3 | 116,3 | -22,2 | 201,1 | 110,5 | |
| 88 | -3,6 | -24,0 | -30,2 | 18,0 | -45,7 | |
| 89 | 15,1 | -73,6 | -33,8 | 26,5 | -85,0 | |
| 90 | 16,3 | -82,6 | 157,7 | 132,1 | -198,4 | |
| 91 | -139,6 | -23,5 | 90,4 | 25,8 | -189,0 | |
| 92 | -101,0 | 10,0 | 11,9 | SU,1 | -141,2 | t |
| | | | | continue | or capie at n | ext page |

| noments | | | | | | Page 5 |
|-------------|----------------|----------------|-----------------|---------------------|---------------------|-----------|
| Continue | of table | | | | | |
| Node No. | Moment | Moment | Moment | Principal moment | Principal moment | |
| I [1] | mx [kN.m/m] | my [kN.m/m] | mxy [kN.m/m] | mh1 [kN.m/m] | mh2 [kN.m/m] | |
| 93 | 12,0 | 98,4 | 71,8 | 139,0 | -28,7 | |
| 94 | -40,8 | 99,1 | 30,7 | 105,6 | -47,2 | |
| 95 | -4,/ | 132,9 | 22,1 | 136,6 | -8,4 | |
| 90 | 200,0 | 2/4,1 320 7 | 14,0 | 270,0 321 6 | 197,5 | |
| 97 | -3 3 | 204 9 | -17 4 | 206 4 | -4 8 | |
| 99 | -0,3 | 39,2 | -9,9 | 41,6 | -2,6 | |
| 100 | 103,2 | 66 . 1 | -10,1 | 105,7 | 63,5 | |
| 101 | 167,2 | 68,9 | 9,8 | 168,2 | 67,9 | |
| 102 | 14,1 | -15,2 | 18,8 | 23,3 | -24,4 | |
| 103 | -0,9 | -58,0 | 13,0 | 1,9 | -60,8 | |
| 104 | -10,6 | -69,4 | 63,2 | 29,8 | -109,7 | |
| 105 | -105,4 | -23,4 | 61,8 | 9,7 | -138,6 | |
| 106 | -97,2 | 14,8 | 47,7 | 32,3 | -114,8 | |
| 107 | 23,4 | 67 , 9 | 24,3 | 78 , 5 | 12,7 | |
| 108 | -8,5 | 68,3 | 22,3 | 74,3 | -14,5 | |
| 109 | 8,6 | 104,2 | -14,9 | 106,4 | 6,3 | |
| 110 | 185,7 | 210,6 | -25,3 | 226,4 | 169,9 | |
| 111 | 214,3 | 248,2 | -7,0 | 249,6 | 212,9 | |
| 112 | -1,4 | 182,6 | -2,3 | 182,7 | -1,5 | |
| 113 | -1,6 | -40,3 | 1,8 | -1,5 50,1 | -40,4 | |
| 114 | 59,0 68 3 | -02,1 | 2,3 | J9,⊥ 71 Q | -02,2 | |
| 116 | 25 5 | -76 4 | 23,5 | 36 1 | -87 0 | |
| 117 | -1.8 | -84.4 | 28.9 | 7.3 | -93.5 | |
| 118 | 7,4 | 12,9 | 33,2 | 43.4 | -23,2 | |
| 119 | -113,5 | -7,6 | 42,9 | 7,6 | -128,7 | |
| 120 | -109,1 | -3,7 | 40,0 | 9,7 | -122,6 | |
| 121 | -9,0 | 0,7 | 22,0 | 18,4 | -26,7 | |
| 122 | 53,6 | -25,8 | 0,0 | 53,6 | -25,8 | |
| 123 | 29,6 | 21,3 | -34,0 | 59 , 7 | -8,8 | |
| 124 | 115,6 | 26,9 | -39,9 | 130,9 | 11,6 | |
| 125 | 119,8 | 33,6 | -18,4 | 123,6 | 29,8 | |
| 126 | 0,2 | 56 , 1 | -15,4 | 60,0 | -3,7 | |
| 127 | -1,7 | -68,3 | 19,3 | 3,4 | -73,5 | |
| 128 | 45,1 | -78,6 | 23,1 | 49,2 | -82,8 | |
| 129 | 47,8 | -86,3 | 22,7 | 51,5 | -90,0 | |
| 130 | 23,5 | -83,5 | 26,1 22.1 | 29,5 | -89,5 | |
| 122 | -4,9 | -83,4 | 33,⊥ 45 2 | /, Z | -95,5 | |
| 132 | -9,1 33 2 | -33,1 | -4J,Z | 23, J 19 0 | -/2, / | |
| 134 | 92 0 | -31 6 | -33,9 | 49,0 100 3 | -40,9 | |
| 135 | 92,5 | -26.5 | -35,6 | 102,3 | -36,4 | |
| 136 | -2,3 | -23,9 | -38,9 | 27,2 | -53,4 | |
| 137 | -1,0 | 26,7 | 36,0 | 51,4 | -25,7 | |
| 138 | 75,1 | 18,4 | 41,1 | 96,7 | -3,1 | |
| 139 | 95,2 | 1,7 | 21,3 | 99,8 | -2,9 | |
| 140 | 16,2 | 9,1 | 18,6 | 31,6 | -6,3 | |
| 141 | 8,0 | -17,9 | 52,4 | 49,0 | -58,9 | |
| 142 | 7,8 | -36,7 | -69,0 | 58,1 | -86,9 | |
| 143 | 8,8 | -2,3 | -36,5 | 40,2 | -33,6 | |
| 144 | 117,5 | 19,7 | -29,4 | 125,7 | 11,5 | |
| 145 | 124,8 | 25,8 | -49,4 | 145,3 | 5,3 | |
| 146 | 0,1 | 34,7 | -57,2 | 77,1 | -42,3 | |
| | | | | Continue | e of table at | next page |

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| Moments | | | | | | Page 6 |
|-------------|----------------|----------------|-----------------|-------------------------|---------------------|----------|
| Continue | of table | | | | | |
| Node No. | Moment | Moment | Moment | Principal moment | Principal moment | |
| [1] | mx [kN.m/m] | my [kN.m/m] | mxy [kN.m/m] | mh1 [kN.m/m] | mh2 [kN.m/m] | |
| 147 | 0,3 | 124,8 | 32,2 | 132,6 | -7,5 | |
| 148 | 122,4 | 204,8 | 36,2 | 218,4 | 108,8 | |
| 149 | 221,0 _10_1 | 232,2 05 1 | 37,5 | 2// , 4 100 3 | 196,4 _24 3 | |
| 151 | -106 0 | 47 9 | 41,2 54 2 | 109 , 3 | -123 1 | |
| 152 | -93,4 | 0,2 | 11,4 | 1,6 | -94,7 | |
| 153 | -103,5 | 2,7 | 0,8 | 2,7 | -103,5 | |
| 154 | -124,9 | -2,4 | -11,9 | -1,2 | -126,1 | |
| 155 | -136,1 | -2,6 | -16,8 | -0,6 | -138,1 | |
| 156 | -110,0 | -1,9 | -26,1 | 4,1 | -115,9 | |
| 157 | -90,7 | 9,3 | -55,7 | 34,2 | -115,6 | |
| 158 | -113,7 | -35,6 | -106,2 | 38,5 | -187,8 | |
| 159 | -13,0 | 36,3 | -71,6 | 87,4 | -64,1 | |
| 160 | 1/1,0 | 187,5 | -54,6 | 234,5 | 124,1 | |
| 161 | 209,9 | 232,3 | -49,5 | 2/2,0 115 6 | 1/U,5 | |
| 163 | -5,5 | 97,8 109.2 | -40,4 | 113,0 | -23,3 | |
| 164 | 92 4 | 86 2 | 36.2 | 125 7 | 52 9 | |
| 165 | 106.8 | 59.9 | 50,0 | 138.6 | 28.1 | |
| 166 | 12,1 | 85,5 | 62,6 | 121.3 | -23,8 | |
| 167 | -65,9 | 69,8 | 62,3 | 94,1 | -90,2 | |
| 168 | -67,1 | 38,8 | 32,8 | 48,1 | -76,5 | |
| 169 | -66,2 | 20,9 | -1,5 | 20,9 | -66,2 | |
| 170 | -108,9 | 30,6 | -19,6 | 33,3 | -111,6 | |
| 171 | -131,4 | 31,9 | -13,7 | 33,0 | -132,5 | |
| 172 | -81,3 | 25,3 | -17,2 | 28,0 | -84,0 | |
| 173 | -48,6 | 13,2 | -55,7 | 46,0 | -81,4 | |
| 174 | -/4,9 | 43,8 | -102,0 | 102,4 | -133,6 | |
| 176 | -18,0 | 54,4 | -93,4 | 118,2 157 / | -82,4 | |
| 177 | 128 7 | 19 3 | -73,3 -50,2 | 153 1 | 25 0 | |
| 178 | 2.2 | 79.0 | -41.8 | 97.3 | -16.1 | |
| 179 | -0,3 | 103,2 | 48,5 | 122,3 | -19,4 | |
| 180 | 96,8 | 130,9 | 47,9 | 164,7 | 63,0 | |
| 181 | 138,9 | 147,8 | 44,8 | 188,3 | 98,3 | |
| 182 | -11,1 | 113,3 | 48,7 | 130,1 | -27,8 | |
| 183 | -54,5 | 116,1 | 57,0 | 133,4 | -71,7 | |
| 184 | 19,0 | 150,3 | 41,5 | 162,3 | 7,0 | |
| 185 | 40,5 | 154,1 | 2,2 | 154,1 | 40,5 | |
| 186 | -102,9 | 101,0 | -18,5 | 102,7 | -104,6 | |
| 187 | -137,1 | 81,4 | -11,7 | 82,0 | -137,7 | |
| 188 | -42,6 | 116,6 156 3 | -14,7 | 117,9 197 / | -43,9 | |
| 190 | -63 0 | 1J0, J QA 5 | -30,3 | 107,4 135 9 | _101 1 | |
| 191 | -43.3 | 71.2 | -81,4 | 113.4 | -85.6 | |
| 192 | 98.4 | 93.6 | -63.9 | 159.9 | 32.0 | |
| 193 | 134,4 | 95,7 | -55,0 | 173,3 | 56,8 | |
| 194 | -1,2 | 53,0 | -55,2 | 87,4 | -35,6 | |
| 195 | -1,3 | 77,6 | 32,3 | 89,1 | -12,8 | |
| 196 | 94,6 | 145,7 | 32,9 | 161,8 | 78,6 | |
| 197 | 156,7 | 182,1 | 44,8 | 216,0 | 122,9 | |
| 198 | -28,2 | 106,8 | 49,4 | 123,0 | -44,3 | |
| 199 | -53,0 | 108,6 | 38,4 | 117,2 | -61,7 | |
| 200 | 61 , 0 | 1/9,0 | 24,6 | 183,9 | 56,1 | |
| | | | | Continue | or table at n | ext page |

GEOTEC-Software PO Box 14001 Richmond Road PO - Calgary AB, Canada T3E 7Y7 Moments

| Moments | | | | | | Page 7 |
|-------------------|------------------------|---------------|-------------------------|----------------------------|----------------------------|--------|
| Continue | of table | | | | | |
| Node No. | Moment | Moment | Moment | Principal moment mb1 | Principal moment mb2 | |
| [1] | [kN.m/m] | [kN.m/m] | [kN.m/m] | [kN.m/m] | [kN.m/m] | |
| 201 | 100,7 | 201,7 | 15,4 | 204,0 | 98,3 | |
| 202 | -98,6 | 106,3 | 3,3 | 106,4 | -98,7 | |
| 203 | -136,6 | 79,1 | -14,6 | 80,1 | -137,6 | |
| 204 | -19,9 | 137,7 | -32,2 | 144,0 | -26,2 | |
| 205 | 156,1 | 212,4 | -46,6 | 238,7 | 129,8 | |
| 208 207 208 | -60,2 88,6 | 61,6 114,1 | -61,1 -71,4 -63,2 | 94,5 165,8 | -82,2 -93,2 36,9 | |
| 209 | 134,9 | 123,9 | -43,7 | 173,4 | 85,4 | |
| 210 | -5,2 | 33,1 | -35,3 | 54,1 | -26,2 | |
| 211 | -1,1 | 4,1 | 20,2 | 21,8 | -18,8 | |
| 212 | 41,6 | -2,3 | 21,5 | 50,3 | -11,1 | |
| 213 | 51,5 | -3,3 | 43,9 | 75,9 | -27,6 | |
| 214 215 216 | -18,1 -39,2 20,1 | -0,1 -1,7 | 27,6 13,4 | 42,6 14,2 26,5 | -53,5 -8,1 | |
| 217 | 16,9 | -3,8 | 18,9 | 28,1 | -15,0 | |
| 218 | -75,7 | 0,6 | 11,5 | 2,3 | -77,4 | |
| 219 | -127,1 | -1,1 | -14,9 | 0,6 | -128,8 | |
| 220 | -20,6 | -0,1 | -37,5 | 28,5 | -49,2 | |
| 221 | 59,9 | -4,0 | -39,9 | 79,1 | -23,2 | |
| 222 | -33,3 | 0,6 | -46,2 | 32,9 | -65,5 | |
| 223 | -61,0 | -0,6 | -66,2 | 41,9 | -103,6 | |
| 224 | 34,1 | -0,7 | -61,2 | 80,3 | -47,0 | |
| 225 | 57,1 | -3,5 | -35,4 | 73,4 | -19,7 | |
| 226 | 5,4 | 4,0 | -21,3 | 26,1 | -16,6 | |

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Part H

User's Guide for the program ELPLA-Boring



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

Version 9.2

Program authors: M. El Gendy A. El Gendy

GEOTEC: GEOTEC Software Inc. PO Box 14001 Richmond Road PO Calgary AB, Canada T3E 7Y7

> http://www.elpla.com geotec@elpla.com

ELPLA-Boring

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1 An overview of ELPLA-Boring

ELPLA-Boring is used to edit and display graphically the boring logs (boring layers, soil material, foundation level and water table). The drawing of the boring logs can be displayed first on the screen, and then can be sent to the printer or plotter. The program draws the soil layers by different symbols according to the German Standard DIN 4023.

ELPLA-Boring can also display the stress in soil under a specified point on the foundation with effective stress beside the corresponding boring log. The stress in soil is used to determine the limit depth of the soil layers.

The drawings, if desired, can be saved as WMF-format files, in which they can be exported to other Windows applications to prepare reports, slide presentations, or add further information.

2 Description of ELPLA-Boring

ELPLA-Boring is a 32-bit, graphical software product that operates under Microsoft Windows 9x/NT/ME/XP. The common "what you see is what you get" of Windows applications makes it easy to learn how to use ELPLA-Boring, especially if you are already familiar with the Windows environment.

The program package ELPLA consists of 7 separate programs. These can be run independently. Name and short description of the seven separate programs are given in Table H-1.

The usage of the program is typically such that first data files are created describing a certain problem by ELPLA-Data, then the project problem is analyzed using ELPLA-Solver. Finally, 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-Editor.

| 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-Editor | A simple text editor program |

Table H-1Names and descriptions of the seven separate programs

In order to use ELPLA-Boring, first the user must define the project data by ELPLA-Data, and then must analyze by ELPLA-Solver. Table H-2 gives a list of files, which are read or created by ELPLA-Boring. The files can be classified in four groups.

Table H-2Names of file groups

| Gr | oup | Saved from the program |
|----|----------------------|------------------------|
| Α | Main data files | ELPLA-Data |
| В | Boring files (*.BOR) | ELPLA-Boring |
| С | Project data files | ELPLA-Data |
| D | Final result files | ELPLA-Solver |

Further more, Table H-3 shows filenames, contents and groups of all files that may be read or created by ELPLA-Boring.

Table H-3Names and contents of files

A Main data files

| Filename | Contents |
|----------|-----------------------------------------------------|
| FIRMA | Firm header |
| STEU | Default directory for files that are saved by ELPLA |
| NOFORMAT | Number formats |
| UNITS | System of units |

B Boring files

| Filename | Contents |
|---------------|------------------------|
| LINEFORM. BOR | Line formats |
| FONT. BOR | Font data |
| LEGENDE. BOR | Legend data |
| PAINT. BOR | Fill color data |
| PLOTPAR. BOR | Plot parameters |
| NODISPLA. BOR | Data of display values |
| ORDINATE. BOR | Max. width data |

C Project data files

| Filename | Contents |
|----------|----------------------------------------------|
| *. AUF | 3 lines text to identify the project |
| *. P21 | Data of slab properties/ levels/ coordinates |
| *. BAU | Soil properties |
| *. LDH | Data of the limit depth |

D Final result files

| Filename | Contents |
|----------|----------------------------|
| *. LD1 | Results of the limit depth |
| | |

The asterisk (*) matches any filename with the specified extension.

3 Starting ELPLA-Boring

Start ELPLA-Boring by clicking on the program icon. The introduction screen (Figure H-1) appears.



Figure H-1 Introduction screen of ELPLA-Boring

The menu head of Figure H-1 contains the following 7 commands:

- File
- View
- Graphic
- Options
- Format
- Window
- Help

After clicking one of the seven menu commands, other sub-commands or options become available. The seven menu commands and their sub-commands are presented and described in the following paragraphs 4 to 11.

4 File Menu

The File Menu commands are:

- Open
- Make WMF-File
- Print
- Page setup
- Files 1, 2, 3, 4
- Exit
4.1 File Menu–"Open" command

By "Open" command the current project is closed, if one is loaded, and an existing project is opened. Figure H-2 shows "Open" Dialog box used to open a specified project.

| Open | | | ?× |
|----------------------------------------|-------------------|-------|--------------|
| Look jn: 🔂 | Example7 | - 🗈 💆 | m 🗐 |
| gb1 gb2 gb3 gb4 gb5 gb6 | gb7 gb8 | | |
| File <u>n</u> ame: | [| | <u>O</u> pen |
| Files of <u>type</u> : | Soil data (*.BAU) | • | Cancel |

Figure H-2 "Open project" Dialog box

4.2 File Menu–''Make WMF-File'' command

By "Make WMF-File" command the drawing can be saved in a format that can be read by other programs. This feature allows you to include your drawing in reports and presentations and to enhance the drawing using other drawing or CAD software packages. The drawing can be exported in the Windows Metafile (WMF) format.

Figure H-3 shows the "Save as" Dialog box used to export the drawing with the filename you wish to give the exported file, including extension and the directory in which to save the file. If the file name already exists, you may select to overwrite the existing file.

| Save As | | | | | ? | × |
|--------------------|----------|---|---------|----------------|--------------|---|
| Save jn: 🔁 | Example7 | • | <u></u> | d * | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| I | | | | | | |
| File <u>n</u> ame: | gb7c | | | | <u>S</u> ave | 1 |
| Save as type: | (*.WMF) | | • | | Cancel | |

Figure H-3 "Save as" Dialog box

4.3 File Menu–"Print" command

By "Print" command data and results can be graphically plotted or printed. Only the objects currently displayed on the drawing are printed. Figure H-4 shows "Print" Dialog box. The printer group box contains controls for selecting the printer and changing its properties. Use "Name" Combo box to select the printer and use "Properties" Button to set printer settings. The number of printing copies can be defined in "Copies" Input box.

| Pri | int | | <u>? ×</u> |
|-----|----------------------------------------|------------------------------------------------------------------|-------------------------------|
| Г | Printer | | |
| | <u>N</u> ame: | HP LaserJet 2100 Series PCL 6 | Properties |
| | Status: Type: Where: Comment: | Default printer; Ready HP LaserJet 2100 Series PCL 6 LPT1: | |
| | Print range | | Copies |
| | ⊛ <u>A</u> l | | Number of <u>c</u> opies: 1 📑 |
| | C Pages C <u>S</u> elect | from: to: | 11 22 33 🗖 Collate |
| | | | OK Cancel |

Figure H-4 "Print" Input box

4.4 File Menu–"Page setup" command

By "Page setup" command the standard "Page setup" Dialog box can be displayed with options to specify the printer, page orientation, paper size, and paper source, as well as other printing options (Figure H-5).

| Page Setup | ? × |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Tendovski udvalju zihu Printarum Tendovski udvalju zihu Printarum Lo za proze za ostava polju zihu Printarum La za ostava polju pol |
| Paper | |
| Size: | 4 |
| Source: | uto Select |
| Orientation | Margins (millimeters) |
| C Portrait | Left: 30mm <u>R</u> ight: 30mm |
| C Landscape | Iop: 30mm Bottom: 30mm |
| | OK Cancel <u>Printer</u> |

Figure H-5 "Page setup" Dialog box

4.5 File Menu–"Files 1, 2, 3, 4" command

By "Files 1, 2, 3, 4" command the user can open one of the last four loaded projects.

4.6 File Menu–''Exit'' command

By "Exit" command the current project is closed and ELPLA-Boring is quitted, Figure H-6.

| Program end 🛛 🗙 | | | |
|-----------------|--------|--|--|
| Program exit! | | | |
| OK | Cancel | | |

Figure H-6 "Exit" Message box

5 View Menu

The View Menu commands are:

- Status bar
- Tool bars

5.1 View Menu–"Status bar" command

"Status bar" command displays a status bar on the screen down. The status bar displays information about the progress of the current operation.

5.2 View Menu–"Tool bars" command

"Tool bars" command displays tool bars located just below the menu head. Tool bars contain icons of program menus.

6 Graphic Menu

The graphic menu is the main menu, used to display the specified drawing. The Graphic Menu command is:

- Drawing boring logs/ Limit depth

6.1 Graphic Menu–"Boring logs/ Limit depth" command

By this command the boring logs (boring layers, soil material, foundation level and water table) can be displayed. The stress in soil under the foundation with effective stress can be displayed beside the corresponding boring log. The stress in soil is used to determine the limit depth of the soil layers.

When "Drawing boring logs/ Limit depth" command is chosen, the selection Dialog box shown in Figure H-7 appears. In this Dialog box select the boring logs or the limit depths to draw, then click "OK" Button. Figure H-8 shows boring logs, while Figure H-9 shows a limit depth of soil layers.

| i <mark>st of b</mark> o −List of s | oring logs elected bo | ring logs to dr | aw: | | | |
|----------------------------------------|--------------------------|-----------------|---------------------|--------------------|----------|-----------------------|
| No. | Boring log l | No. | Label of boring log | Тур | e | <u> </u> |
| 1 | | 1 BPN1 | | Log | | <u>C</u> ancel |
| • | | | | | ۰ | <u>H</u> elp |
| -List of t | he availabl | e boring logs: | | | _ | <u>N</u> ew |
| Boring | g log No. | L | abel of boring log | lype . | <u> </u> | |
| | 2 | BPN2 | | Log | | Boring insert |
| | 1 | BPN1 | | Log Limit depth | - | |
| | | | | Þ | | Bori <u>ng</u> delete |

Figure H-7 "List of borings" Dialog box



Figure H-8 Drawing of 3 borings with multi-layers and different soil material



Figure H-9 Limit depth of the soil layers

7 Options Menu

The Options menu has the following commands:

- Plot parameters
- Display values
- Scale
- Title
- Page No.
- Copy

7.1 Options Menu–"Plot parameters" command

Figure H-10 shows the parameters, set as default values by the program, or specified by the user.

- Color soil layers
- Draw the water table
- Simple drawing of boring logs
- Setting soil colors according to DIN 4023
- Display soil properties C, Phi and Nue
- Color foundation
- Draw foundation
- Draw measurement bar
- Color limit depth
- Page with frame



Figure H-10 "Plot parameters" Dialog box

7.2 Options Menu–"Display values" command

By "Display values" command the values of the following items can be displayed, if desired, on the drawing (Figure H-11):

- Label of the boring
- Layer description
- Layer depth
- Display text of soil symbols
- Measurement bar
- Foundation
- Water level
- Limit depth
- Stress value

| Display values | × |
|-----------------------------------------------------------------------|----------------------|
| ✓ Label of boring ✓ Layer description | <u>0</u> k |
| Layer depth Display text of soil symbols | <u>S</u> ave |
| Measurement bar Foundation | <u>C</u> ancel |
| ✓ Water level ✓ Limit depth | <u>H</u> elp |
| Stress value | ☑ Select <u>A</u> II |

Figure H-11 "Display values" Dialog box

7.3 Options Menu–"Scale" command

By "Scale" command the scale of the drawing can be defined as shown in Figure H-12. The defaulted value for the scale factor is chosen to pass the active printer-paper format.



Figure H-12 "Scale" Dialog box

7.4 Options Menu–"Title" command

By "Title" command the text data (two line texts above the drawing and two line texts under the drawing) can be defined, Figure H-13.

| Title | | | × |
|------------------------|----------------|-------------|--------------|
| _ Title above drawing— | | | |
| A-Title1 | | | |
| A-Title2 | | | |
| | | | |
| Title under drawing | | | |
| U-Title1 Boring logs/ | limit depth | | |
| U-Title2 | | | |
| | | | |
| | <u>C</u> ancel | <u>N</u> ew | <u>H</u> elp |
| | | | |

Figure H-13 "Title" Dialog box

7.5 Options Menu–"Page No." command

By "Page No." command the page No. can be defined, Figure H-14.

| × |
|----------------|
| <u>0</u> k |
| <u>C</u> ancel |
| <u>H</u> elp |
| |

Figure H-14 "Page No. " Dialog box

7.6 Options Menu–"Copy" command

By "Copy" command the current drawing can be copied in Metafile-Format to Clipboard. Then it can be inserted directly to other Windows programs such as Word, WordPerfect and AutoCAD.

8 Format Menu

The Format menu has the following commands:

- Line formats
- Fill color
- Max. width
- Font
- Legend

8.1 Format Menu–"Line formats" command

Color, style and thickness of drawing lines can be defined (Figure H-15). The way a line is drawn depends on the setting of the color and style properties. 15 different colors and 5 styles for line formats are available. The following list shows the available lines, which can be formatted:

- Identification box
- Page boundary
- Boring boundary
- Soil layer levels
- Soil symbols
- Groundwater
- Foundation
- Measurement bar
- Limit depth

| Line formats | | | × |
|--------------------|--------------|----------------|-------|
| Lines | | Color | Style |
| Identification box | • | | |
| | | | [] |
| | | | |
| | | | |
| | | | |
| Ok | Save | | |
| <u>C</u> ancel | <u>H</u> elp | Thickness [mm] | 0,3 + |

Figure H-15 "Line formats" Dialog box

8.2 Format Menu–"Fill color" command

The following list shows available items, which can be filled with a specified color, Figure H-16:

- Groundwater
- Foundation
- Measurement bar
- Stress due to foundation
- Stress from neighboring foundations
- Stress from soil weight

| Fill color | | × |
|------------|-----------------------|--------------------|
| Fill color | | |
| Color | | Set color |
| Item | Groundwater | • |
| <u>k</u> | <u>S</u> ave <u>C</u> | ancel <u>H</u> elp |

Figure H-16 "Fill color" Dialog box

8.3 Format Menu–"Max. width" command

By "Max. width" command the maximum width for the drawing can be defined, Figure H-17.

| Max. ordinate | | | × |
|----------------|------|------|----------------|
| Max. ordinate: | | • | <u>k</u> |
| | | | <u>S</u> ave |
| | [mm] | 10 🕂 | <u>C</u> ancel |
| | | | <u>H</u> elp |

Figure H-17 "Max. width" Dialog box

8.4 Format Menu–"Font" command

By "Font" command the font size (Figure H-18) and font type (Figure H-19) for the drawing can be defined.

| Font | | | | × |
|---------------------|----------------------|----------------|------|--------------|
| Size factor of font | | | | |
| Item Geotechnic | al data of the layer | - | Size | 3 + |
| Sample | | | | Eont type |
| AaBbYyZz | | | | Courier New |
| | | | | |
| | <u>S</u> ave | <u>C</u> ancel | | <u>H</u> elp |

Figure H-18 "Font size" Dialog box

| Font | | ? × |
|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|--------------|
| Eont: Arial Arabic Transparent Arial Arial Black Arial Narrow Bold Italic Art Book Antiqua Bookman Old Style | Font style: Regular Italic Bold Bold Italic | OK Cancel |
| Effects Strikeout Underline Color: Black This is a TrueType font. This sa your printer and your screen. | Sample AaBbYyZz Script: | |

Figure H-19 "Font type" Dialog box

8.5 Format Menu–"Legend" command

By "Legend" command height and width of legends can be specified as shown in Figure H-20. Also the legend that you wish to display can be chosen.

| Legend | × |
|-----------------------------|------------------|
| Legend | |
| Identification box | Legend size: |
| | Height[cm] 3,00 |
| | Width[cm] |
| Ok Save | |
| | |
| <u>C</u> ancel <u>H</u> elp | 🗖 Display Legend |

Figure H-20 "Legend" Dialog box

9 Window Menu

The Window menu has the following commands:

- Zoom in
- Zoom out
- Zoom window
- Zoom %
- Original size

9.1 Window Menu-"Zoom in" command

By "Zoom in" command the size of the drawing on the screen can be reduced.

9.2 Window Menu-"Zoom out" command

By "Zoom out" command the size of the drawing on the screen can be increased.

9.3 Window Menu-"Zoom window" command

By "Zoom window" command the size of the drawing on a specified area can be increased.

9.4 Window Menu–"Zoom %" command

By "Zoom %" command the size of drawing on the screen can be specified (Figure H-21). Choosing "Zoom %" allows you to increase or decrease the size at which the drawing is displayed. Choosing 100% displays the drawing at its original size. Clicking on the percentage, changes the drawing size to the specified percentage. The drawing can be displayed at any size by typing the desired percentage in the specified Edit box.

| Zoom 🔀 |
|----------------------------------------|
| Zoom % |
| C 50% C 75% C 125% C 150% C 175% |
| • Another 100 |
| <u>O</u> k <u>C</u> ancel <u>H</u> elp |

Figure H-21 "Zoom %" Dialog box

9.5 Window Menu–"Original size" command

The commands "Zoom in", "Zoom out" and "Zoom %" can change the size of drawing on the screen. The drawing can be displayed in its original size again using "Original size" command.

10 Help Menu

The Help Menu commands are:

- Contents
- Short description of ELPLA
- New in ELPLA
- About ELPLA-Boring

10.1 Help Menu–"Contents" command

"Contents" command displays a help file in HTML-Format containing the complete ELPLA User's Guide, Figure H-22.

ELPLA-Boring



Figure H-22 Menu "Contents"

10.2 Help Menu-"Short description of ELPLA" command

"Short description of ELPLA" command gives a short description of ELPLA package.

10.3 Help Menu-"New in ELPLA" command

"New in ELPLA" command summarizes the new features and enhancements in ELPLA.

10.4 Help Menu–"About ELPLA-Boring" command

The command, as shown in Figure H-23, gives information about ELPLA-Boring.

ELPLA-Boring

| Information | | × |
|-----------------------------|-----------------------------------------------------------------------------|--------------------|
| Draw | of soil layers according to DIN 4023 ssional, Version 9.3 | |
| The program is DIN 4023. | used to draw the soil layers by different symbols according to the German s | specification code |
| | | |
| | | |
| | | |
| Program author | s [| <u>O</u> k |
| Prof. M. Dr. A. I | El Gendy El Gendy | System-Info |
| GEOTEC Softwa | re | Online Support |

Figure H-23 Information form of ELPLA-Boring

11 Tips and Tricks

11.1 Keyboard

The user can obtain all menu titles and commands also through Shortcut keys. The action of the Shortcut keys is listed in Table H-4 to Table H-11:

Table H-4Shortcut keys of menu head

| Shortcut keys | Action | |
|---------------|-------------------|-----------|
| [Alt+f] | Calling menu head | "File" |
| [Alt+v] | | "View" |
| [Alt+g] | | "Graphic" |
| [Alt+o] | | "Options" |
| [Alt+t] | | "Format" |
| [Alt+w] | | "Window" |
| [Alt+h] | | "Help" |

| Shortcut keys | Action |
|-------------------------------|---------------------------------------------------------------|
| [Ctrl +o] or [Alt+f] then [o] | Calling command "Open" |
| [Alt+f] then [w] | "Make WMF-File" |
| [Ctrl +p] or [Alt+f] then [p] | "Print" |
| [Alt+f] then [u] | "Page setup" |
| [Alt+f] then [1] | Calling the first project from the last four loaded projects |
| [Alt+f] then [2] | Calling the second project from the last four loaded projects |
| [Alt+f] then [3] | Calling the third project from the last four loaded projects |
| [Alt+f] then [4] | Calling the fourth project from the last four loaded projects |
| [Ctrl+q] or [Alt+f] then [x] | Calling command "Exit" |

 Table H-5
 Shortcut keys of File-Command

Table H-6Shortcut keys of View-Command

| Shortcut keys | Action | |
|----------------------------|-----------------|---------------------|
| [Alt+v] then [b] | Calling command | "Status bar" |
| [Alt+v] then [t] | | "Tool bars" |
| [Alt+v] then [t], then [f] | | "Tool bars-File" |
| [Alt+v] then [t], then [g] | | "Tool bars-Graphic" |
| [Alt+v] then [t], then [o] | | "Tool bars-Options" |
| [Alt+v] then [t], then [t] | | "Tool bars-Format" |
| [Alt+v] then [t], then [w] | | "Tool bars-Window" |
| [Alt+v] then [t], then [h] | | "Tool bars-Help" |
| [Alt+v] then [t], then [r] | | "Reset Toolbar" |

| Table H-7 | Shortcut keys of Graphic-Command |
|-----------|----------------------------------|
|-----------|----------------------------------|

| Shortcut keys | Action | |
|------------------|-----------------|------------------------------------|
| [Alt+g] then [0] | Calling command | "Drawing boring logs/ Limit depth" |

| Shortcut keys | Action | |
|------------------|-----------------|-------------------|
| [Alt+o] then [l] | Calling command | "Plot parameters" |
| [Alt+o] then [d] | | "Display values" |
| [Alt+o] then [s] | | "Scale" |
| [Alt+o] then [t] | | "Title" |
| [Alt+o] then [p] | | "Page No." |
| [Alt+o] then [c] | | "Copy" |

Table H-8Shortcut keys of Options-Command

Table H-9Shortcut keys of Format-Command

| Shortcut keys | Action |
|------------------|--------------------------------|
| [Alt+t] then [1] | Calling command "Line formats" |
| [Alt+t] then [i] | "Fill color" |
| [Alt+t] then [x] | "Max. width" |
| [Alt+t] then [f] | "Font" |
| [Alt+t] then [d] | "Legend" |

Table H-10 Shortcut keys of Window-Command

| Shortcut keys | Action | |
|------------------|-----------------|-----------------|
| [Alt+w] then [i] | Calling command | "Zoom in" |
| [Alt+w] then [0] | | "Zoom out" |
| [Alt+w] then [w] | | "Zoom window" |
| [Alt+w] then [z] | | "Zoom %" |
| [Alt+w] then [r] | | "Original size" |

| Shortcut keys | Action | |
|------------------|-----------------|------------------------------|
| [Alt+h] then [c] | Calling command | "Contents" |
| [Alt+h] then [s] | | "New in ELPLA" |
| [Alt+h] then [n] | | "Short description of ELPLA" |
| [Alt+h] then [a] | | "About ELPLA-Boring" |

11.2 Mouse

By double-clicking the left mouse Button on a specified screen position, the user can obtain the almost menu of the program.

- By double-clicking on *legend*, *firm header*, *title* or *project identification*, the corresponding menu appears
- By double-clicking on *scale* in the identification box, "Scale"-Menu appears
- By double-clicking on *file name* in the identification box, "Open"-Menu appears
- By double-clicking on *page No*. in the identification box, "Page No."-Menu appears
- By clicking the right mouse Button at any position on the screen, the user can also obtain the "Popup-Options"-Menu, Figure H-24



Figure H-24 Menu "Popup-Options"

12 Samples for graphical drawings using ELPLA-Boring

ELPLA-Boring draws the soil layers by different symbols, where the same layers are presented with the same symbols for easy identification. For drawing the boring logs, the main symbols of German specification code are considered in ELPLA-Boring. It is possible to draw a total number of 46 soil and rock arts in boring logs according to German Standard DIN 4023.

Samples for symbols of soil layers according to German Standard DIN 4023 are presented in page P1. The pages P2 to P3 show also some graphical presentations of boring logs and limit depth according to Table H-12 and Table H-13.

12.1 Graphical drawings of boring logs

| Table H-12Boring logs | | |
|------------------------------------|------|--|
| Presentation | Page | |
| Boring logs according to DIN 4023 | P1 | |
| Simple presentation of boring logs | P2 | |

12.2 Graphical drawings of limit depth

| Table H-13 | Limit depth | |
|--------------|-------------|------|
| Presentation | | Page |
| Limit depth | | P3 |

13 Reference

[1] DIN 4023. Baugrund- und Wasserbohrungen. Zeichnerische Darstellung der Ergebnisse Beuth-Verlag, Berlin 1984

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Part I

User's Guide for the program GEOTEC-Editor



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

Version 9.2

Program authors: M. El Gendy A. El Gendy

GEOTEC: GEOTEC Software Inc. PO Box 14001 Richmond Road PO Calgary AB, Canada T3E 7Y7

> http://www.elpla.com geotec@elpla.com

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1 An overview of GEOTEC-Editor

GEOTEC-Editor is a simple word processing program. The project data or results can be displayed, changed or printed through GEOTEC-Editor. Data or results, if desired, can be saved as ASCII-format or RTF-Format files. These files can be exported to other Windows-applications (for example WordPerfect or Word) to prepare reports or add further information.

2 Description of GEOTEC-Editor

GEOTEC-Editor is a 32-bit software product that operates under Microsoft Windows 9x/ NT/ ME/ XP. The common "what you see is what you get" of Windows applications makes it easy to learn how to use GEOTEC-Editor, especially if you are already familiar with the Windows environment.

The program package ELPLA consists of 7 separate subprograms. The seven separate subprograms can be run independently. The name and short description of the seven separate subprograms are given in Table I-1.

The usage of ELPLA is typically such that first data files are created describing a certain problem by ELPLA-Data. Then the project problem is analyzed by using ELPLA-Solver. Finally, the results can be presented as graphical drawings, graphs and tables using the five separate subprograms ELPLA-Graphic, ELPLA-Section, ELPLA-List, ELPLA-Boring and GEOTEC-Editor.

| Program name | Description of the program | |
|---------------|------------------------------------------------------|--|
| ELPLA-Data | Editing the project data | |
| ELPLA-Solver | Analyzing the project problem | |
| ELPLA-Graphic | Displaying data and results graphically | |
| ELPLA-List | Listing data and calculated results | |
| ELPLA-Section | Displaying results graphically at specified sections | |
| ELPLA-Boring | Editing and displaying boring logs graphically | |
| GEOTEC-Editor | A simple text editor program | |

 Table I-1
 Names and descriptions of the seven separate programs

The next paragraphs describe the purpose and function of each GEOTEC-Editor command.

3 Starting GEOTEC-Editor

Start GEOTEC-Editor by clicking the program icon in the Windows "Start"-Menu. The introduction screen (Figure I-1) appears.

GEOTEC-Editor

| ELPLA-Text - [untitled1] | |
|-------------------------------------------|------------------|
| Die Edit View Format Window Help | X |
|] 🗅 🖆 🖬 🖨 🗋 🔍 -] 🗟 🗄 🗂 -] 🕔 🖗 🛍 💱 | |
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| | 14/12/01 09:40 e |

Figure I-1 Introduction screen of GEOTEC-Editor

The menu head of Figure I-1 contains the following 6 commands:

- File
- Edit
- View
- Format
- Window
- Help

After clicking a command, other sub-commands or options become available. These commands and their sub-commands are presented and described in the following paragraphs 4 to 10.

4 File Menu

The File Menu commands are:

- New
- Open
- Close
- Save
- Save as
- Print
- Page setup
- Files 1, 2, 3, 4
- Exit

4.1 File Menu –''New'' command

By "New" command a new file is created.

4.2 File Menu –''Open'' command

By "Open" command an existing file is opened. Figure I-2 shows "Open" Dialog box used to open a specified file.

| Open | | | | | | ? × | 1 |
|--------------------|-----------------------|------|----------|---|---|--------------|---|
| Look in: 🔁 | HTML Help Workshop | 0 | • | | ď | | |
| | | | | | | | |
| Lib | | | | | | | l |
| Redist | | | | | | | l |
| | | | | | | | l |
| I | | | | | | | J |
| File <u>n</u> ame: | | | | | | <u>O</u> pen | |
| Files of type: | ELPLA-files (*.RTF,*. | TXT) | | • | | Cancel | |

Figure I-2 "Open" Dialog box

4.3 File Menu –''Close'' command

By "Close" command the current file is closed.

4.4 File Menu –''Save'' command

By "Save" command the current file is saved.

4.5 File Menu –''Save as'' command

By "Save as" command the current file is saved under a new file name.

4.6 File Menu–"Print" command

By "Print" command text can be printed. Only the text file currently displayed is printed. Figure I-3 shows "Print" Dialog box. The printer group box contains controls for selecting the printer and changing its properties. Use "Name" Combo box to select the printer and use "Properties" Button to set printer settings. The number of printing copies can be defined in "Copies" Input box (Figure I-3). For more information about printer settings, see your Windows documentation.

| Print | | <u>? ×</u> |
|----------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------|
| Printer — | | |
| <u>N</u> ame: | HP LaserJet 2100 Series PCL 6 | ▼ <u>P</u> roperties |
| Status: Type: Where: Comment: | Default printer; Ready HP LaserJet 2100 Series PCL 6 LPT1: | |
| Print range <u>All</u> C Pages <u>C S</u> elect | : from: to: | Copies Number of <u>c</u> opies: 1 = 1 2 3 T Collate |
| | | OK Cancel |

Figure I-3 "Print" Input box

4.7 File Menu–"Page Setup" command

By "Page setup" command the standard "Page setup" Dialog box can be displayed with options to specify the printer, page orientation, paper size, and paper source, as well as other printing options. Figure I-4 shows "Page setup" Dialog box.

| Page Setup | |
|---------------------|--------------------------------|
| Paper | 4 |
| Source: | uto Select |
| Orientation | Margins (millimeters) |
| C P <u>o</u> rtrait | Left: 30mm <u>R</u> ight: 30mm |
| Landscape | Iop: 30mm Bottom: 30mm |
| | OK Cancel <u>P</u> rinter |

Figure I-4 "Page setup" Dialog box

4.8 File Menu –''Files 1, 2, 3, 4'' command

By "Files 1, 2, 3, 4" command the user can open one of the last loaded four files.

4.9 File Menu –''Exit'' command

By "Exit" command all files are closed and GEOTEC-Editor is quitted, Figure I-6.

GEOTEC-Editor



Figure I-5 "Exit" Message box

5 Edit Menu

The Edit Menu commands are:

- Undo
- Redo
- Cut
- Copy
- Paste
- Clear
- Select all
- Find
- Find next
- Replace

5.1 Edit Menu–"Undo" command

By "Undo" command the user can undo the last action.

5.2 Edit Menu–''Redo'' command

By "Redo" command the user can redo the last action.

5.3 Edit Menu–"Cut" command

Here the selected text can be removed, so that it can be placed in another part of the text file.

5.4 Edit Menu–"Copy" command

By "Copy" command the selected text is copied in the Clipboard so that it can be placed in another part of the text file.

5.5 Edit Menu–"Paste" command

By "Paste" command the contents of the Clipboard are placed in the text file.

5.6 Edit Menu–"Clear" command

By "Clear" command the selected text can be removed from the text file.

5.7 Edit Menu–"Select all" command

By "Select all" command all text at once can be selected.

5.8 Edit Menu–''Find'' command

By "Find" command the user can search for a specified text. Figure I-6 shows "Find" Dialog box. In "Find what" Text box the user enters the text to search for. Then click "Find next" Button. GEOTEC-Editor will start searching according to the following options:

Match case

Finds only text that has the same pattern of uppercase and lowercase characters as the text was specified in "Find what" Text box

Find whole words only

Finds only whole words instead of searching for text inside longer words

Find in selection only

Searches inside only the selected text instead of searching for text inside all file

| Find and repl | ace | | × |
|---------------|-----------------------------------------------------------------|---|-------------------|
| Find what: | foundation | • | Find <u>n</u> ext |
| | | | Cancel |
| | Match case Find whole words only Find in selection only | | <u>R</u> eplace |

Figure I-6 "Find" Message box

5.9 Edit Menu–"Find next" command

By "Find next" command the user can search for more instances of the same text that was specified in "Find what" Text box of Figure I-6.

5.10 Edit Menu–"Replace" command

By "Replace" command the user can search for and replace a specified text. Figure I-7 shows "Replace" Dialog box. In "Find what" Text box the user enters the text to search for. In "Replace with" Text box the user enters the text to replace with "Find what" Text box. Then click "Replace" Button. GEOTEC-Editor searches for the next instance of the text that matches the text in "Find what" Text box and replaces it with the text in "Replace with" Text box according to the following options:

Match case

Finds and replaces only text that has the same pattern of uppercase and lowercase characters as the text was specified in "Find what"

Find whole words only

Finds and replaces only whole words instead of searching for text inside longer words

Find in selection only

Searches and replaces inside only the selected text instead of searching for text inside all file

Note

By "Replace All" command all instances of the text can be replaced

| Find and replac | ce | | X |
|------------------------|------------------------|---|---------------------|
| Find what: | foundation | • | Find <u>n</u> ext |
| Replace wi <u>t</u> h: | | • | Cancel |
| | F Match case | | <u>R</u> eplace |
| | Find in selection only | | Replace <u>a</u> ll |

Figure I-7 "Replace" Message box

6 View Menu

The View Menu commands are:

- Status bar
- Tool bars

6.1 View Menu–"Status bar" command

"Status bar" command displays a status bar on the screen down. The status bar displays information about the progress of the current operation.

6.2 View Menu-"Tool bars" command

"Tool bars" command displays tool bars located just below the menu head. Tool bars contain icons of program menus.

7 Format Menu

The Format Menu commands are:

- Font
- Paragraph
- Numbering
- Bullets
- Protect

7.1 Format Menu –"Font" command

By "Font" command the font type, style, or size (Figure I-8) for the selected text, if existing, or new text can be defined.

GEOTEC-Editor



Figure I-8 "Font" Dialog box

7.2 Format Menu –"Paragraph" command

By "Paragraph" command the paragraphs (Figure I-9) for the selected text, if existing, or new text can be formatted.

The following formats can be defined:

Left

Specifies the number of units (inches) to indent text from the left margin

Right

Specifies the number of units (inches) to indent text from the right margin

First line

Specifies the number of units (inches) to indent text from the left margin of the first line

Alignments

The alignments that are available for the selected paragraph can be listed as follows:

| Left | Aligns text at the left indent |
|-----------|------------------------------------|
| Right | Aligns text at the right indent |
| Centered | Centers the text between margins |
| Justified | Justifies the text between margins |

Before

Specifies the number of units (Twips) to leave before the paragraph

After

Specifies the number of units (Twips) to leave after the paragraph

Line spacing

The line spacing that is available for the selected paragraph can be listed as follows:

SingleThe line spacing is single space1.5 singleThe line spacing is 1.5 single spaceDoubleThe line spacing is double space

| Paragraph | | × |
|--------------------------|-----------------|---|
| Indents and alignm | ent (In Inches) | |
| <u>L</u> eft: | 0 | |
| <u>R</u> ight: | 0 | |
| Fir <u>s</u> t line | 0 | |
| <u>A</u> lignment: | Left | [|
| <u>Spacing (In Twips</u> | = Inches/1440) | |
| <u>B</u> efore: | 0 | - |
| A <u>f</u> ter: | 0 | |
| Line spacing: | Single | 1 |
| | | |

Figure I-9 "Paragraph" Dialog box

7.3 Format Menu –"Numbering" command

By "Numbering" command the selected text can be numbered.

7.4 Format Menu –''Bullets'' command

By "Bullets" command the selected text can be bulleted.

7.5 Format Menu –''Protect'' command

By "Protect" command the text file can be protected from any editing process. Before applying any editing process a message will appear as shown in Figure I-10.

| ELPLA-T | ext 🗾 |
|---------|---------------------------------------------------|
| ? | Are you sure you want to edit this modified text? |
| | Yes <u>N</u> o |

Figure I-10 Edit Message box

8 Window Menu

The Window menu has the following commands:

- Cascade
- Tile horizontally
- Tile vertically
- Arrange icons
- Window 1, 2, 3, ...

8.1 Window Menu–"Cascade" command

By "Cascade" command all non-minimized forms are cascaded.

8.2 Window Menu–"Tile horizontally" command

By "Tile horizontally" command all non-minimized forms are tiled horizontally.

8.3 Window Menu–"Tile vertically" command

By "Tile vertically" command all non-minimized forms are tiled vertically.

8.4 Window Menu–"Arrange icons" command

When choosing "Arrange icons" command, the icons of minimized forms are arranged.

8.5 Window Menu–"Window 1, 2, 3, ..." command

By this command the user can display one list of the pervious loaded data or results.

9 Help Menu

The Help Menu commands are:

- Contents
- Short description of ELPLA
- New in ELPLA
- About GEOTEC-Editor

9.1 Help Menu–"Contents" command

"Contents" command displays a help file in HTML-Format containing the complete ELPLA User's Guide .

9.2 Help Menu–"Short description of ELPLA" command

"Short description of ELPLA" command gives a short description of ELPLA package.

9.3 Help Menu–"New in ELPLA" command

"New in ELPLA" command summarizes the new features and enhancements in ELPLA.

9.4 Help Menu–"About GEOTEC-Editor" command

Clicking the command "About GEOTEC-Editor" displays the information form of GEOTEC-Editor, which gives information about GEOTEC-Editor.

10 Tips and Tricks

10.1 Keyboard

The user can obtain all menu titles and commands also through Shortcut keys. The action of the Shortcut keys is listed in Tables I-2 to I-8:

| Table 1.2 Shorteut Reys of menu nead | | |
|--------------------------------------|-------------------|----------|
| Shortcut keys | Action | |
| [Alt+f] | Calling menu head | "File" |
| [Alt+e] | | "Edit" |
| [Alt+v] | | "View" |
| [Alt+f] | | "Format" |
| [Alt+w] | | "Window" |
| [Alt+h] | | "Help" |

Table I-2Shortcut keys of menu head

Table I-3Shortcut keys of File-Command

| Shortcut keys | Action |
|-------------------------------|---------------------------------------------------------|
| [Ctrl +n] or [Alt+f] then [n] | Calling command "New" |
| [Ctrl +o] or [Alt+f] then [o] | "Open" |
| [Alt+f] then [c] | "Close" |
| [Ctrl +s] or [Alt+f] then [s] | "Save" |
| [Alt+f] then [a] | "Save as" |
| [Ctrl +p] or [Alt+f] then [p] | "Print" |
| [Alt+f] then [u] | "Page setup" |
| [Alt+f] then [1] | Calling the first file from the last four loaded files |
| [Alt+f] then [2] | Calling the second file from the last four loaded files |
| [Alt+f] then [3] | Calling the third file from the last four loaded files |
| [Alt+f] then [4] | Calling the fourth file from the last four loaded files |
| [Ctrl+q] or [Alt+f] then [x] | Calling command "Exit" |

| Shortcut keys | Action |
|------------------------------|------------------------|
| [Ctrl+z] or [Alt+e] then [u] | Calling command "Undo" |
| [Ctrl+y] or [Alt+e] then [r] | "Redo" |
| [Ctrl+x] or [Alt+e] then [t] | "Cut" |
| [Ctrl+c] or [Alt+e] then [c] | "Copy" |
| [Ctrl+v] or [Alt+e] then [p] | "Paste" |
| [Del] or [Alt+e] then [c] | "Clear" |
| [Alt+e] then [a] | "Select all" |
| [Ctrl+f] or [Alt+e] then [f] | "Find" |
| [F3] or [Alt+e] then [n] | "Find next" |
| [Ctrl+h] or [Alt+e] then [r] | "Replace" |

Table I-4Shortcut keys of Edit-Command

 Table I-5
 Shortcut keys of View-Command

| Shortcut keys | Action | |
|----------------------------|-----------------|-------------------------------|
| [Alt+v] then [b] | Calling command | "Status bar" |
| [Alt+v] then [t] | | "Tool bars" |
| [Alt+v] then [t], then [f] | | "Tool bars-File" |
| [Alt+v] then [t], then [e] | | "Tool bars-Edit" |
| [Alt+v] then [t], then [t] | | "Tool bars-Format" |
| [Alt+v] then [t], then [w] | | "Tool bars-Window" |
| [Alt+v] then [t], then [h] | | "Tool bars-Help" |
| [Alt+v] then [t], then [s] | | "Tool bars-Style-Transparent" |

| Table I-6 | Shortcut keys of Format-Command |
|-----------|---------------------------------|
|-----------|---------------------------------|

| Shortcut keys | Action |
|------------------|------------------------|
| [Alt+t] then [f] | Calling command "Font" |
| [Alt+t] then [p] | "Paragraph" |
| [Alt+t] then [n] | "Numbering" |
| [Alt+t] then [b] | "Bullets" |
| [Alt+t] then [r] | "Protect" |
| Shortcut keys | Action |
|----------------------------|---------------------------|
| [Alt+w] then [c] | Calling command "Cascade" |
| [Alt+w] then [h] | "Tile horizontally" |
| [Alt+w] then [v] | "Tile vertically" |
| [Alt+w] then [a] | "Arrange icons" |
| [Alt+w] then [1, 2, 3,] | "Window 1, 2, 3," |

Table I-7Shortcut keys of Window-Command

Table I-8Shortcut keys of Help-Command

| Shortcut keys | Action | |
|------------------|-----------------|------------------------------|
| [Alt+h] then [c] | Calling command | "Contents" |
| [Alt+h] then [s] | | "New in ELPLA" |
| [Alt+h] then [n] | | "Short description of ELPLA" |
| [Alt+h] then [a] | | "About GEOTEC-Editor" |

10.2 Mouse

By clicking the right mouse Button on the screen the user can also obtain the Popup-Format-Menu, Figure I-13.

| 📥 ELF | PLA-Text - [u | intitled1] | | | | | | | |
|----------------|-----------------------------|------------------------------|----------------------------|------------------|-------------|--------------------------|---|----------|---------|
| 🗋 <u>F</u> ile | e <u>E</u> dit <u>V</u> iew | <u>F</u> ormat <u>W</u> indo | w <u>H</u> elp | | | | | | |
| l n ı | 2 🖬 🔲 | 🔿 🗅 👢 | | i 🧼 ն | 🕅 😭 | | | | |
| 1 2 . | | | | л н А С — | | = 1:= := | | | |
|] • / (| 一市唱 | | | · U 🖄 🗐 | | | | | |
| 1 | File | : gb7 | | | | | | | |
| | | | Ana | lysis of sla | ah foundati | an | | | |
| | | | by | the program | n package E | LPLA | | | |
| | | | | Versior | 1 8.0 | | | | |
| | | | | | | | | | |
| | Calculati | ion method: | | | | | | | |
| | Method (7 | 7) . 6. Common a si h | | | | | | | |
| | Hodulus c | or compressir | Fault (KIIMI | nacion) | | | | | |
| | | | <u>r</u> oriu Paragraph | | | | | | |
| | Logdi | na | Numberina | | | | | | |
| | | | <u>B</u> ullets | | | | | | |
| | | | Protect | | | | | | |
| | Distribut | ed loads . | | | | | | | |
| | Load No. | Load value | Load start | Load start | Load en | d Load end | L | | |
| | I | P | ×1 | yl (m) | x | 2 y2 | | | |
| | [1] | [RN/m2] | [m] | [m] | נש. | iwi | | | |
| | 1 | 1000 | 0 | 5 | | 5 C | I | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | Loading d | lata: | | | | | | | |
| | Slab weig | nht | | | Pe [kN | 1 = 352.0 | | | |
| | Force on | slab | | | Pa [kN |] = 25000.0 | | | |
| | Groundwat | er force | 1 D | | Pw [kN |] = 350.0 | | | |
| | Groundwat | er pressure | - ra - ro) on slab | | gw [kN/ | , = 23002.0 m2]= 14.0 | | | |
| | Average o | contact press | sure | | Qo [kN/ | m2]= 1000.1 | | | • |
| p | | | | | | | | 15/12/01 | 01,20 |

Figure I-13 Menu "Popup-Format"

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U

| Undo8, | 1 | 16 |
|--------|---|----|
|--------|---|----|

V

| View |
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|------|

W

| Window | 5, | 13 |
|--------|----------|----|
| Window | 1, 2, 3, | 13 |