# 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

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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
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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-1 Names 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-2 Names of file groups

| Group | Saved from the program |
|---|---|
| A Main data files | ELPLA-Data |
| B 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.

Table D-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 |
| RFT | Design code parameters |
| UNITS | System of units |
| PREFEREN.DAT | FE-Net and calculation preferences |

B Project data files

| 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 result 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 ($w$, $\theta_x$, $\theta_y$) |
| *. PS1 | Deformations of the rigid raft ($w_o$, tan $\theta_{xo}$, tan $\theta_{xo}$) |

D Final result files

| Filename | Contents |
|---|---|
| *. PT3 | Displacements due to temperature change ($s_t$) |
| *. PP3 | Settlements due to neighboring foundations ($s_e$) |
| *. PV2 | Load vector due to additional settlements |
| *. LD1 | Limit depth |
| *. GH1 | Internal forces of girders |
| *. QUN | Ultimate bearing capacities at nodes ($q_{ul}$) |
| *. 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 ($\theta_x$) |
| *. THY | Rotations about y-axis ($\theta_y$) |
| *. THZ | Rotations about z-axis ($\theta_z$) |
| *.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 ($\sigma_x$) |
| *.S_Y | Y-Stresses in soil ($\sigma_y$) |
| *.S_Z | Z-Stresses in soil ($\sigma_z$) |
| *.TXY | XY-Shear stresses in soil ($\tau_{xy}$) |
| *.TXZ | XZ-Shear stresses in soil ($\tau_{xz}$) |
| *.TYZ | YZ-Shear stresses in soil ($\tau_{yz}$) |
| *.VAX | X-Strains in soil ($\varepsilon_x$) |
| *.VAY | Y-Strains in soil ($\varepsilon_y$) |
| *.VAZ | Z-Strains in soil ($\varepsilon_z$) |
| *.VXY | XY-Shear strains in soil ($\gamma_{xy}$) |
| *.VXZ | XZ-Shear strains in soil ($\gamma_{xz}$) |
| *.VYZ | YZ-Shear strains in soil ($\gamma_{yz}$) |
| *. 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.

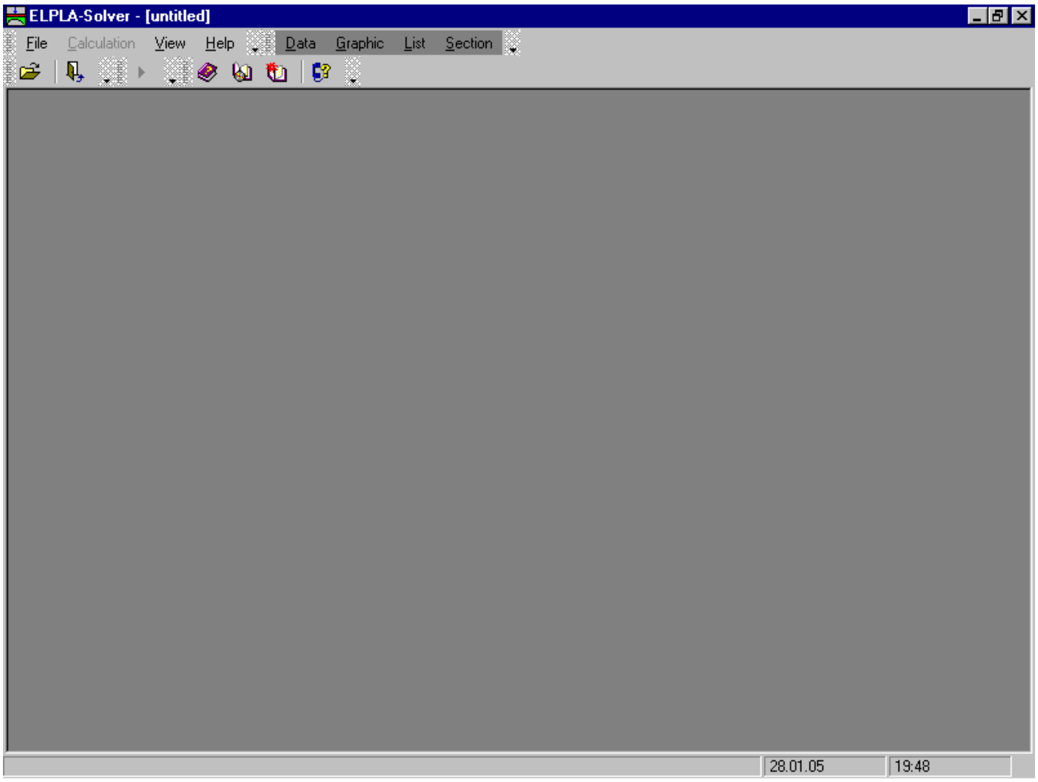


Figure D-1 Introduction screen of the program ELPLA-Solver

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.

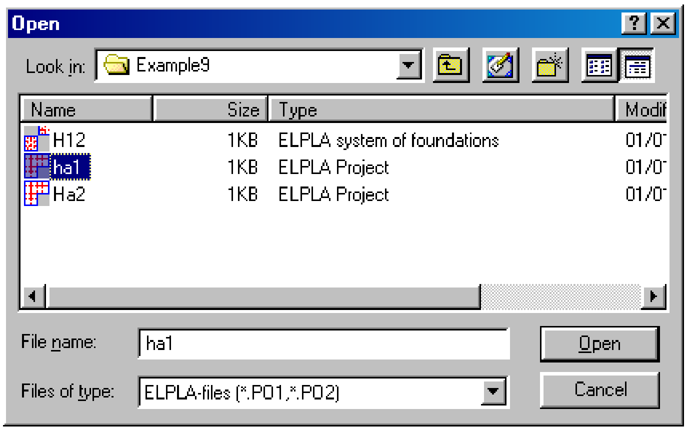


Figure D-2 "Open project" Dialog box

## 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.

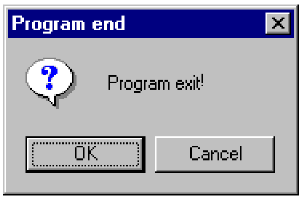


Figure D-3 "Exit" Message box

# 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.

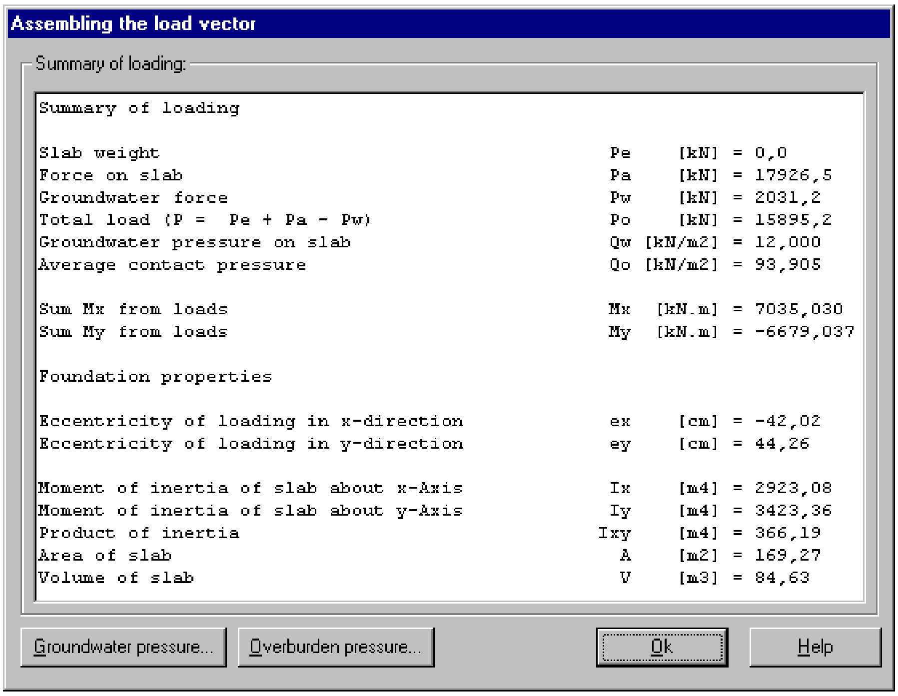


Figure D-4 "Foundation properties" list box

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.

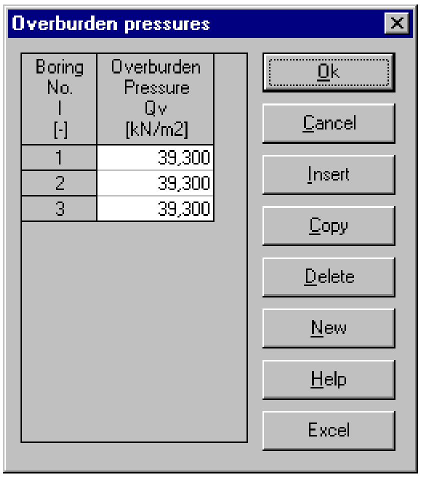


Figure D-5 "Overburden pressures" Dialog box

## 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 are considered. After that the program calculates the 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.

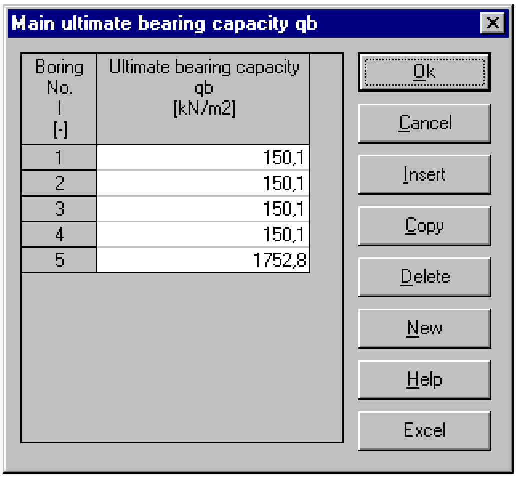


Figure D-6 Main ultimate bearing capacities of borings $q_b$

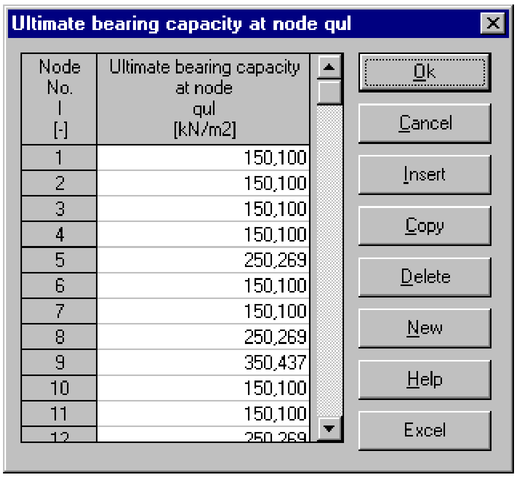


Figure D-7 Ultimate bearing capacities at nodes $q_{ul}$

## 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.

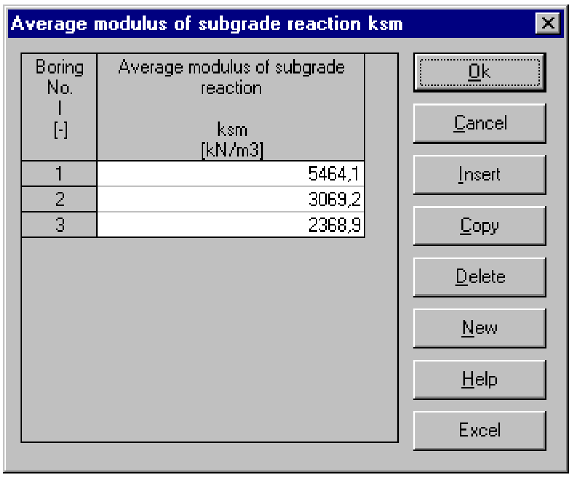


Figure D-8 Average modulus of subgrade reactions of boring $k_{sm}$

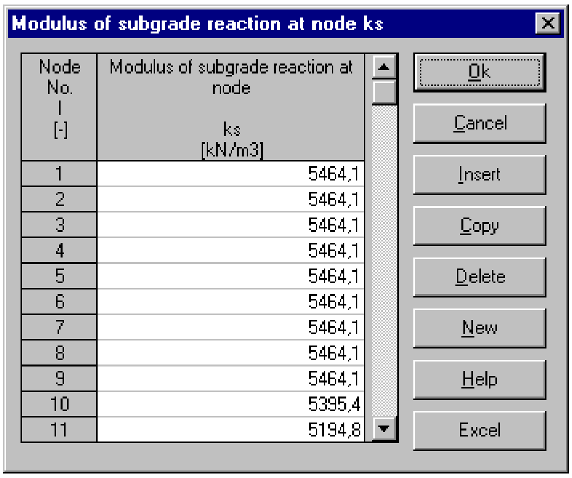


Figure D-9 Modulus of subgrade reactions at node $k_s$

### 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.

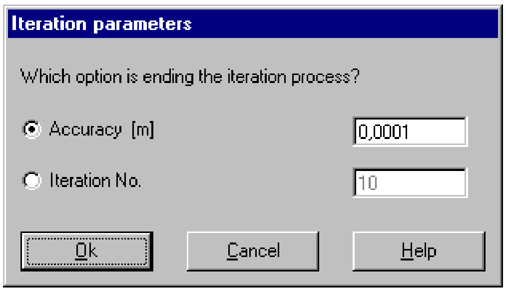

Figure D-10 "Iteration parameters" selection box

**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

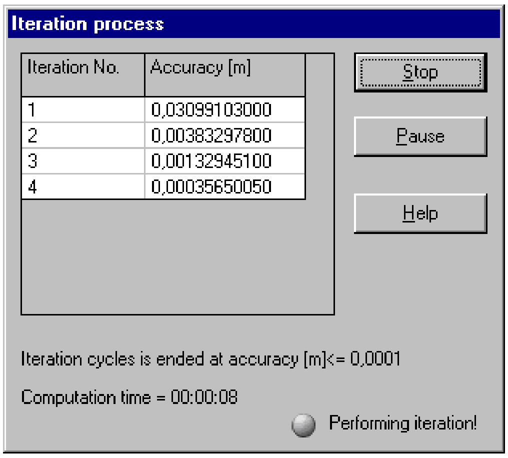


Figure D-11 Menu "Iteration process"

## 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.

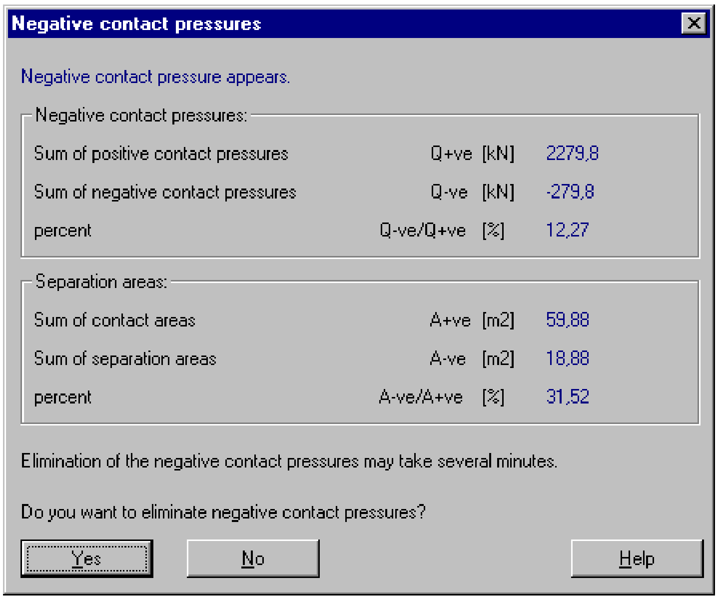


Figure D-12 Menu "Negative contact pressures"

## 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.

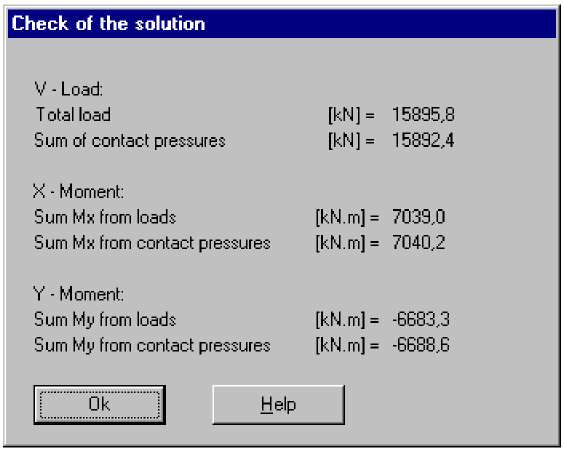


Figure D-13 Menu "Check of the solution"

## 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.

Table D-4 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 | x | x | x | x | x | x | x | x | x | x |
| Determining the ultimate bearing capacity | - | x | x | x | x | x | x | x | - | x |
| Determining the limit depth | - | x | x | x | - | x | x | x | x | x |
| Determining the modulus of subgrade | - | x | x | - | - | - | - | - | - | - |
| Determining flexibility coefficients of piles | - | x | x | x | x | x | x | x | - | - |
| Determining flexibility coefficients | - | - | - | x | x | x | x | x | x | x |
| Determining flexibility coefficients for system of rafts | - | - | - | - | - | - | - | - | - | x |
| Assembling the soil stiffness matrix | - | - | - | * | x | x | x | x | x | x |
| Influence of neighboring foundations on settlements | - | - | - | x | x | x | x | x | x | x |
| Influence of the temperature change on raft | - | x | x | x | x | x | x | - | - | x |
| Influence of additional settlements on raft | - | x | x | x | x | x | x | x | x | x |
| Assembling the girder stiffness matrix | x | x | x | - | x | - | x | - | - | - |
| Assembling the slab stiffness matrix | x | x | x | - | x | - | x | - | - | - |
| Solving system equations (full matrix) | - | - | - | - | x | - | x | - | - | - |
| Solving system equations (banded matrix) | x | x | x | - | - | - | - | - | - | - |
| Analysis of the rigid raft | - | - | - | - | - | - | - | x | - | - |
| Analysis of the flexible foundation | - | - | - | - | - | - | - | - | x | - |
| Iteration process | - | - | - | x | - | x | - | - | - | x |
| Performing the nonlinear analysis | - | x | x | x | x | x | x | x | - | x |
| Performing the nonlinear analysis of piled raft foundation | | | | | | | | | | |
| Determining def., internal forces and contact pressures | x | x | x | x | x | x | x | x | - | x |
| Determining deformation and contact pressures | - | - | - | - | - | - | - | - | x | - |
| Design of the slab | x | x | x | x | x | x | x | - | - | x |
| Determining displacements, stresses and strains in soil | - | - | - | x | x | x | x | x | x | x |
| Computation of all | x | x | x | x | x | x | x | x | x | x |

* 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.

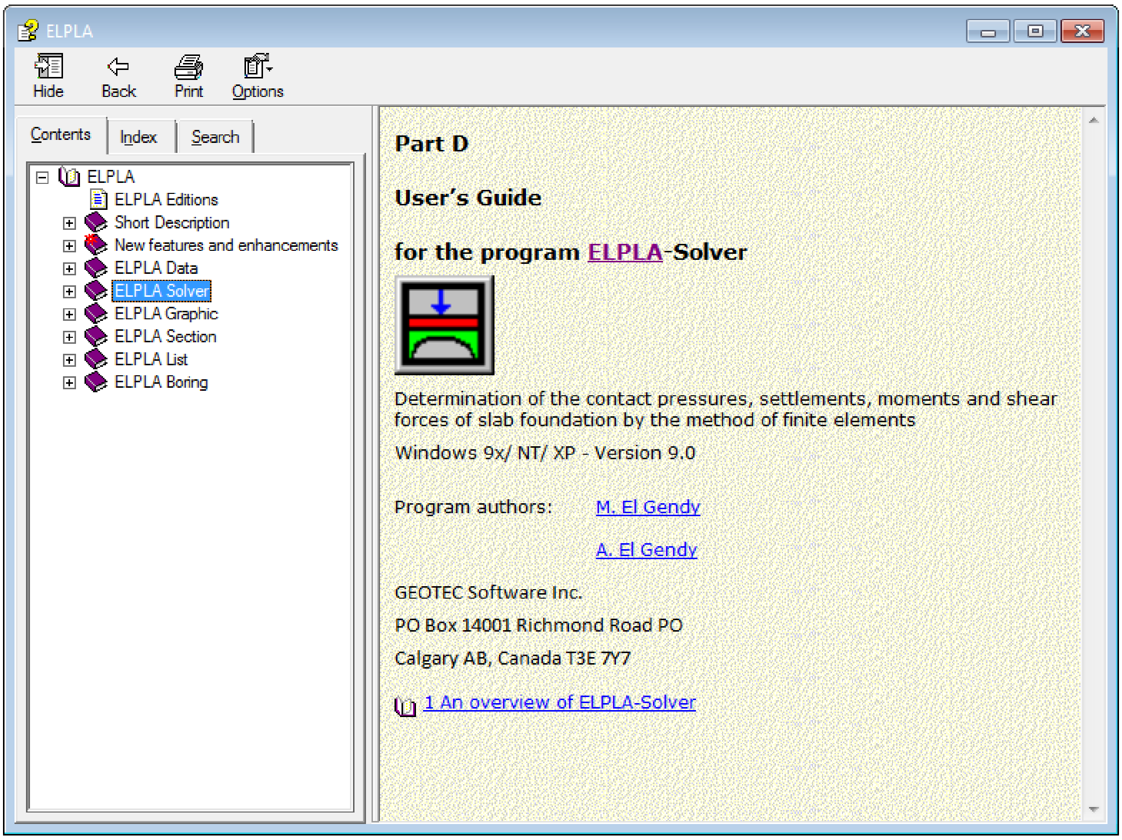

Figure D-14 Menu "Contents"

## 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.

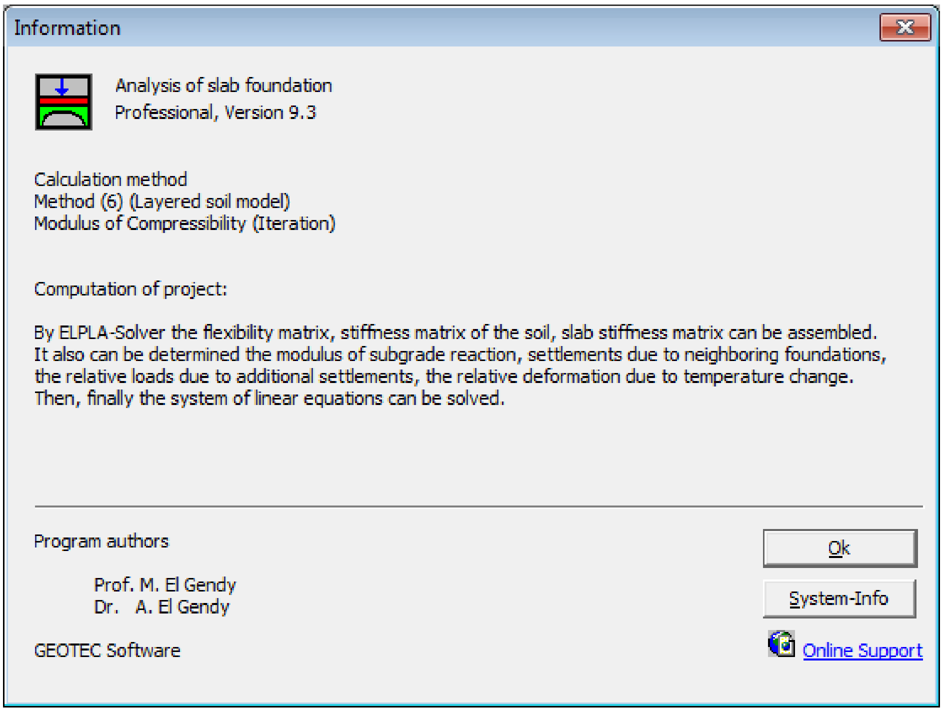


Figure D-15 Information form of ELPLA-Solver

# 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:

Table D-5 Shortcut keys of menu head

| Shortcut keys | Action |
|---|---|
| [Alt+f] | Calling menu head "File" |
| [Alt+v] | "View" |
| [Alt+c] | "Calculation" |
| [Alt+h] | "Help" |

Table D-6 Shortcut keys of File-Command

| 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" |

Table D-7 Shortcut keys of Calculation-Command

| 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-8 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 [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-9 Shortcut 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).

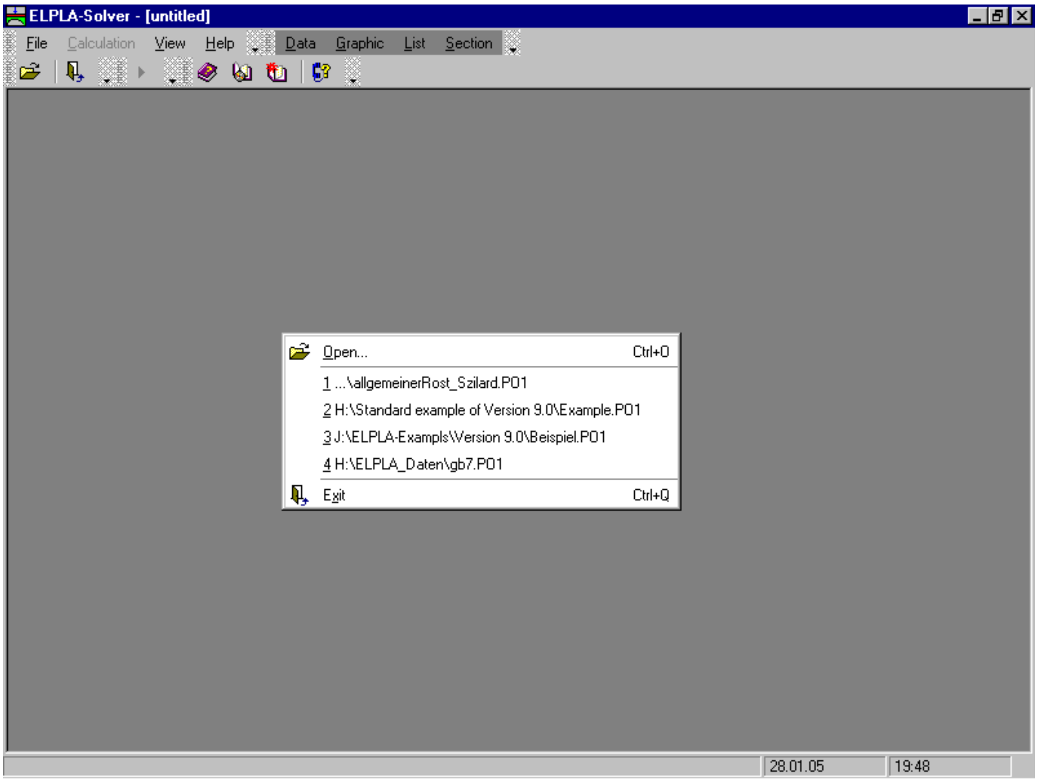


Figure D-16 Menu "Popup-Calculation"

# 9 Index