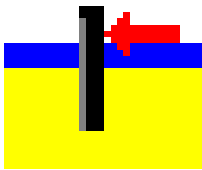


Analysis and design of dolphins

GGU-DOLPHIN

VERSION 2



Last revision:
Copyright:
Technical implementation, layout and sales:

February 2022
Prof. Dr.-Ing. Johann Buß
Civilserve GmbH, Steinfeld

Contents:

1	Preface.....	5
2	Licence protection	6
3	Language selection	6
4	Starting the program	7
5	Description of menu items	8
5.1	File menu.....	8
5.1.1	"New" menu item.....	8
5.1.2	"Load" menu item	8
5.1.3	"Save" menu item	8
5.1.4	"Save as" menu item	8
5.1.5	"Export to GGU-LATPILE" menu item	8
5.1.6	"Print output table" menu item.....	9
5.1.6.1	Selecting the output format	9
5.1.6.2	Button "Output as graphics"	10
5.1.6.3	Button "Output as ASCII"	12
5.1.7	"Output preferences" menu item.....	13
5.1.8	"Print and export" menu item.....	13
5.1.9	"Batch print" menu item	15
5.1.10	"Exit" menu item	15
5.1.11	"1, 2, 3, 4" menu items.....	15
5.2	Editor 1 menu	16
5.2.1	"Analysis options" menu item.....	16
5.2.2	"System" menu item	18
5.2.3	"Soils" menu item	19
5.2.4	"General load cases" menu item	21
5.2.5	"Fenders" menu item.....	23
5.2.6	"Passive earth pressure" menu item	24
5.2.7	"Seismic acceleration" menu item	24
5.2.8	"Sum V analysis" menu item	25
5.3	Editor 2 menu	26
5.3.1	"Section list" menu item	26
5.3.2	"Differing sections" menu item.....	28
5.3.3	"Young's modulus/Specific weight" or "Specific weight" menu items.....	28
5.4	System menu	29
5.4.1	"Info" menu item	29
5.4.2	"Special preferences" menu item	29
5.4.3	"Depth subdivisions" menu item.....	29
5.4.4	"Length surcharge" menu item	30
5.4.5	"Analyse" menu item	31
5.4.5.1	Analysing several load cases in a single computation	31
5.4.5.2	Analyse fenders	33
5.4.5.3	Analysis of a selected load case	34
5.4.6	"Design defaults" menu item	36
5.4.7	"Graph positioning preferences" menu item	39

5.4.8	"Graphics output preferences" menu item	40
5.4.9	"Labelling preferences" menu item.....	40
5.4.10	"Dimension line" menu item.....	41
5.4.11	"Display system" menu item.....	41
5.4.12	"Display results" menu item	41
5.5	Evaluation menu.....	42
5.5.1	"Main output summary" menu item.....	42
5.5.2	"Results" menu item	42
5.5.3	"Sum V" menu item.....	43
5.5.4	"Length surcharge" menu item	45
5.5.5	"Move section bases" menu item	45
5.5.6	"Earth support analysis" menu item.....	45
5.6	Graphics preferences menu	46
5.6.1	"Refresh and zoom" menu item	46
5.6.2	"Zoom info" menu item	46
5.6.3	"Legend font selection" menu item.....	46
5.6.4	"Pen colour and width" menu item	46
5.6.5	"Mini-CAD toolbar" and "Header toolbar" menu items	47
5.6.6	"Toolbar preferences" menu item	47
5.6.7	"Soil properties legend" menu item	49
5.6.8	"General legend" menu item.....	51
5.6.9	"Results legend" menu item.....	52
5.6.10	"Design legend" menu item	52
5.6.11	"Sections legend" menu item	53
5.6.12	"Section visualisation" menu item	54
5.6.13	"p-y curves legend" menu item.....	55
5.6.14	"Move objects" menu item.....	56
5.6.15	"Save graphics preferences" menu item.....	56
5.6.16	"Load graphics preferences" menu item	56
5.7	Page size + margins menu	57
5.7.1	"Auto-resize" menu item.....	57
5.7.2	"Manual resize (mouse)" menu item.....	57
5.7.3	"Manual resize (editor)" menu item.....	57
5.7.4	"Font size selection" menu item.....	58
5.7.5	"Page size and margins" menu item.....	58
5.7.6	"Undo" menu item	59
5.7.7	"Restore" menu item	59
5.7.8	"Preferences" menu item.....	59
5.8	Info menu	60
5.8.1	"Copyright" menu item.....	60
5.8.2	"GGU on the web" menu item	60
5.8.3	"GGU support" menu item.....	60
5.8.4	"Compare earth pressure coefficients" menu item.....	60
5.8.5	"Help" menu item	60
5.8.6	"What's new?" menu item	60
5.8.7	"Language preferences" menu item	60

6	Tips and tricks.....	61
6.1	"?" buttons	61
6.2	Keyboard and mouse	62
6.3	Function keys	63
6.4	"Copy/print area" icon.....	64
7	Literature.....	65
8	Index.....	66

1 Preface

The **GGU-DOLPHIN** program allows the analysis and design of dolphin piles. The fundamental principles are included in the Recommendations of the Committee for Waterfront Structures (EAU 2012) [1]. Comparative studies with numerous examples can be found in "*Rudolph inter alia: Vergleichsberechnungen zur Dalbenbemessung nach Blum und mit der p-y-Methode*" (Comparative analyses for dolphin design after Blum and using the p-y method). Geotechnik 34 (2011) Issue 4, pp. 237-251" [2].

Depending on the application, dolphin piles are exposed to different actions. Breasting dolphins must be capable of accepting the actions exerted by the mooring process. Design is performed by specifying the ship's mooring energy to be accepted by the dolphin pile, which is referred to as required working capacity. In the **GGU-DOLPHIN** program, the required working capacity can be determined by specifying characteristic ship and structure parameters (see EAU 2012, Section 6.15.4). The actions to be transferred by mooring dolphins result from the rope tension and berthing forces, which can be regarded as static loads.

An essential parameter in dolphin pile design is their stiffness or the stiffness of the overall system resulting from the interaction between the dolphin, any fender and the ground. To model the deformation-dependent interaction between dolphins and ground, the **GGU-DOLPHIN** program utilises Blum's classical method, which adopts the spatial passive earth pressure E_{ph} in front of the dolphin (see EAU 2012, Section 13.2.1.2).

In the **GGU-DOLPHIN** program you have any specified load cases analysed consecutively in a single computation and thus to determine the load case with the greatest steel utilisation. It is also possible to analyse and design selected sections and load cases, e.g. rope tension, wind and flow pressure or ice loads. In addition, you can carry out a fender analysis.

The application is designed to allow simple data input or modification. The input is immediately shown on the screen, giving you optimum control over what you are doing. Reading of the manual can mostly be dispensed with, because

"?" buttons 

dealing with almost all geotechnical and program-specific problems are available in the dialog boxes. You are presented with the necessary information by clicking the "?" button (see also Section 6.1).

Graphics output supports the true-type fonts supplied with WINDOWS, so that excellent layout is guaranteed. Colour output and any graphics (e.g. files in formats BMP, JPG, PSP, TIF, etc.) are supported. PDF and DXF files can also be imported by means of the integrated **Mini-CAD** module (see the "**Mini-CAD**" manual).

The program has been thoroughly tested. No faults have been found. Nevertheless, liability for completeness and correctness of the program and the manual, and for any damage resulting from incompleteness or incorrectness, cannot be accepted.

2 Licence protection

To protect the GGU software from unauthorised access, each GGU program is equipped with the *CodeMeter software protection system* from WIBU-Systems. Each GGU programme is bound to a so-called *CmContainer* via a licence with the corresponding product code.

We use 3 alternative CmContainer types, which are stored on your PC, the so-called *CodeMeter licence server*:

- CmStick
The licence is stored in a USB dongle.
- CmActLicense (soft licence, not for virtual PC/servers)
The licence is stored in a licence file that is bound to the hardware of a computer.
- CmCloudContainer
The licence is located on a CmCloud server of WIBU-Systems and is mirrored to your CodeMeter licence server.

For the CodeMeter protection system, the driver software *CodeMeter Runtime Kit* must be installed on your PC (CodeMeter licence server). The GGU program checks at start-up and during running time whether a licence is present on a CmContainer.

3 Language selection

GGU-DOLPHIN is a bilingual program. The program always starts with the language setting applicable when it was last ended.

The language preferences can be changed at any time in the "**Info**" menu, using the menu item "**Spracheinstellung**" (for German) or "**Language preferences**" (for English) (see Section 5.8.7).

4 Starting the program

After starting the program, you will see two menus at the top of the window:

- File
- Info

By going to the "**File**" menu, a previously analysed system can be loaded by means of the "**Load**" menu item, or a new one created using "**New**". After clicking the "**New**" menu item a dialog box opens for specifying several preferences for your new system. After confirming with "**OK**" your system with the corresponding legends is displayed on the screen. Now eight menus appear at the top of the window:

- File
- Editor 1
- Editor 2
- System
- Evaluation
- Graphics preferences
- Page size + margins
- Info

After clicking one of these menus, the so-called menu items roll down, allowing you access to all program functions.

The program works on the principle of *What you see is what you get*. This means that the screen presentation represents, overall, what you will see on your printer. In the last consequence, this would mean that the screen presentation would have to be refreshed after every alteration you make. For reasons of efficiency and as this can take several seconds for complex screen contents, the **GGU-DOLPHIN** screen is not refreshed after every alteration.

If you would like to refresh the screen contents, press either [**F2**] or [**Esc**]. The [**Esc**] key additionally sets the screen presentation back to your current zoom, which has the default value 1.0, corresponding to an A3 format sheet.

5 Description of menu items

5.1 File menu

5.1.1 "New" menu item

You can enter a new system using this menu item. The dialog box corresponds to the box in the menu item "**Editor 1/Analysis options**" (see description in Section 5.2.1).

5.1.2 "Load" menu item

You can load a file with system data, which was created and saved at a previous sitting, and then edit the data.

5.1.3 "Save" menu item

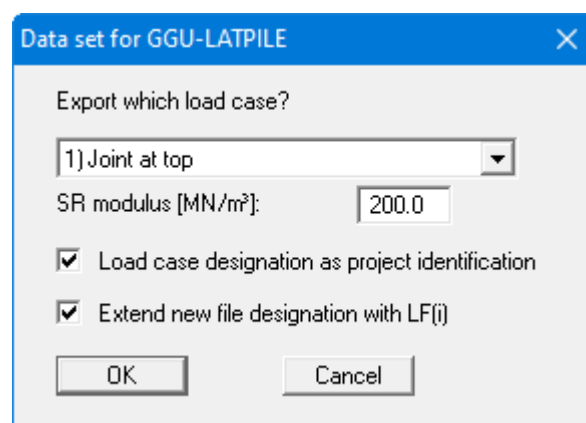
You can save data entered or edited during program use to a file, in order to have them available at a later date, or to archive them. The data is saved without prompting with the name of the current file. Loading again later creates exactly the same presentation as was present at the time of saving.

5.1.4 "Save as" menu item

You can save data entered during program use to an existing file or to a new file, i.e. using a new file name. For reasons of clarity, it makes sense to use ".**ggu_dlb**" as file suffix, as this is the suffix used in the file requester box for the menu item "**File/Load**". If you choose not to enter an extension when saving, ".**ggu_dlb**" will be used automatically. If the current system has been analysed at the time of saving, the analysis results are saved in the file.

5.1.5 "Export to GGU-LATPILE" menu item

You can export an analysed load case as a file for use in **GGU-LATPILE** using this menu item. You will see the following dialog box:



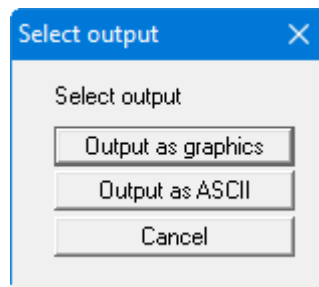
The file name used in **GGU-DOLPHIN** is proposed as the new file name. Here, you can have the program automatically supplement the load case number by activating the lower check box; i.e. "**LC 1**" in the example above. The load case designation ("**Joint at top**") can be saved in the data record as the dataset designation for **GGU-LATPILE**.

5.1.6 "Print output table" menu item

5.1.6.1 *Selecting the output format*

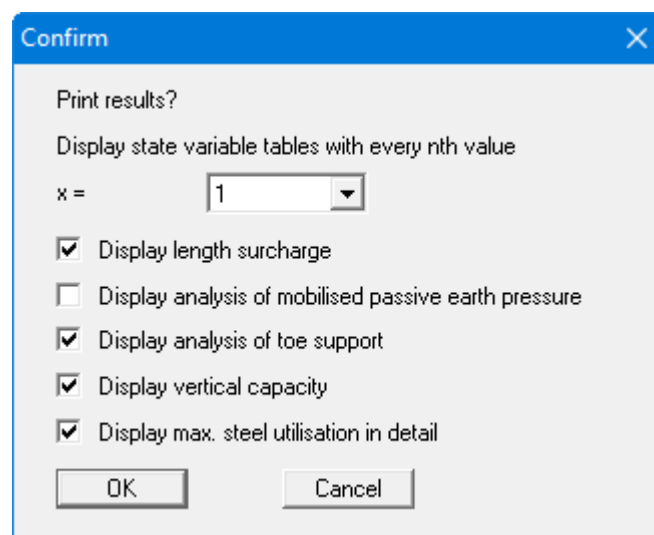
You can have a table printed containing the current analysis results. The results can be sent to the printer or to a file (e.g. for further editing in a word processor). The output contains all information on the current state of analysis, including the system data.

You have the option of designing and printing the output table as an annex to your report within the **GGU-DOLPHIN** program. To do this, select "**Output as graphics**" from the following options.



If you prefer to easily print or process the data in a different application, you can send them directly to the printer or save them to a file using the "**Output as ASCII**" button.

For both options, you will see an additional dialog box prior to output table visualisation, in which you specify how detailed the output is for the analysis results and which is shown below for an analysis after Blum:

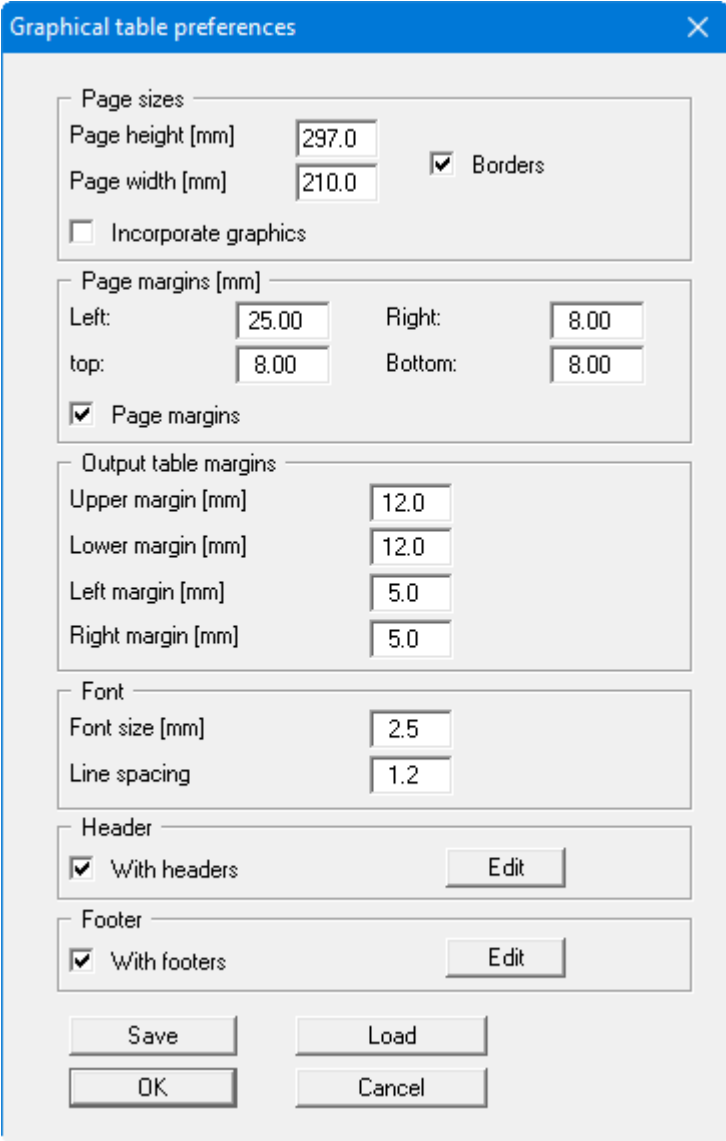


To shorten the output table slightly, you can reduce the number of output values by outputting only every nth value.

In addition to the information that is generally displayed in the output table (for example, the required working capacity and, if applicable, the associated equation used for analysis), you can use the lower check boxes in the dialog box to activate the additional display of selected parameters according to the selected type of analysis.

5.1.6.2 Button "Output as graphics"

If you selected the "Output as graphics" button in the previous dialog box a further dialog box opens, in which you can define further preferences for result visualisation.



The dialog box is titled "Graphical table preferences" and contains several sections for configuring table output:

- Page sizes:** Includes input fields for "Page height [mm]" (297.0) and "Page width [mm]" (210.0). There is a checked checkbox for "Borders" and an unchecked checkbox for "Incorporate graphics".
- Page margins [mm]:** Includes input fields for "Left" (25.00), "Right" (8.00), "top" (8.00), and "Bottom" (8.00). There is a checked checkbox for "Page margins".
- Output table margins:** Includes input fields for "Upper margin [mm]" (12.0), "Lower margin [mm]" (12.0), "Left margin [mm]" (5.0), and "Right margin [mm]" (5.0).
- Font:** Includes input fields for "Font size [mm]" (2.5) and "Line spacing" (1.2).
- Header:** Includes a checked checkbox for "With headers" and an "Edit" button.
- Footer:** Includes a checked checkbox for "With footers" and an "Edit" button.

At the bottom of the dialog box are four buttons: "Save", "Load", "OK", and "Cancel".

In the various group boxes of the dialog box, you can define preferences for the table output and layout. By activating the "Incorporate graphics" button, a sketch of the system is integrated in the output table. If you need to add a header or footer (e.g. for page numbering), activate the appropriate check boxes "With headers" and/or "With footers" and click on the "Edit" button. You can then edit as required in a further dialog box. You can save your settings for the graphical output table presentation in a "Protokoll.pin_ggu" file at the program level so that they are loaded when the program starts. Using the "Load" button, the output table settings can also be subsequently loaded into an existing file, including that of another GGU program.

Footers

Height + Font size

Height Footers [mm]

Font size [mm]

☒ With frame

Texts

☐ Left justified ☒ Centered ☐ Right justified

1

2

3

4

5

6

7




Info

= placeholder for page number; \$ = placeholder for number of pages
(e.g. Page # of a total of \$ pages)

Offset

Offset for page number

Offset for number of pages

Automatic pagination can also be employed here if you work with the placeholders as described. After closing the dialog box using "OK" the output table is shown page by page on the screen. To navigate between the pages, use the arrow tools   in the toolbar. If you need to jump to a given page or back to the graphical visualisation, click on the  tool. You will then see the following box:

Select page

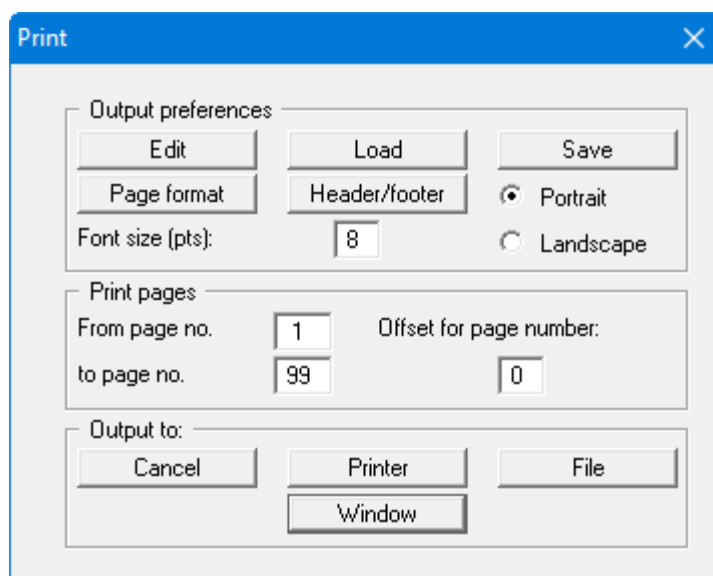
Current page = 1

New page:

☐ To normal view

5.1.6.3 Button "Output as ASCII"

You can have your analysis data sent to the printer, without further work on the layout, or save it to a file for further processing using a different program, e.g. a word processing application.



In the dialog box you can define output preferences.

- **"Output preferences"** group box
Using the **"Edit"** button the current output preferences can be changed or a different printer selected. Using the **"Save"** button, all preferences from this dialog box can be saved to a file in order to have them available for a later session. If you select **"GGU-DOLPHIN.drk"** as file name and save the file in the program folder (default), the file will be automatically loaded the next time you start the program.

Using the **"Page format"** button you can define, amongst other things, the size of the left margin and the number of lines per page. The **"Header/footer"** button allows you to enter a header and footer text for each page. If the **"#"** symbol appears within the text, the current page number will be entered during printing (e.g. **"Page #"**). The text size is given in **"Pts"**. You can also change between **"Portrait"** and **"Landscape"** formats.
- **"Print pages"** group box
If you do not wish pagination to begin with **"1"** you can add an *offset number* to the check box. This offset will be added to the current page number. The output range is defined using **"From page no."** **"to page no."**.
- **"Output to:"** group box
Start output by clicking on **"Printer"** or **"File"**. The file name can then be selected from or entered into the box. If you select the **"Window"** button the results are sent to a separate window. Further text editing options are available in this window, as well as loading, saving and printing.

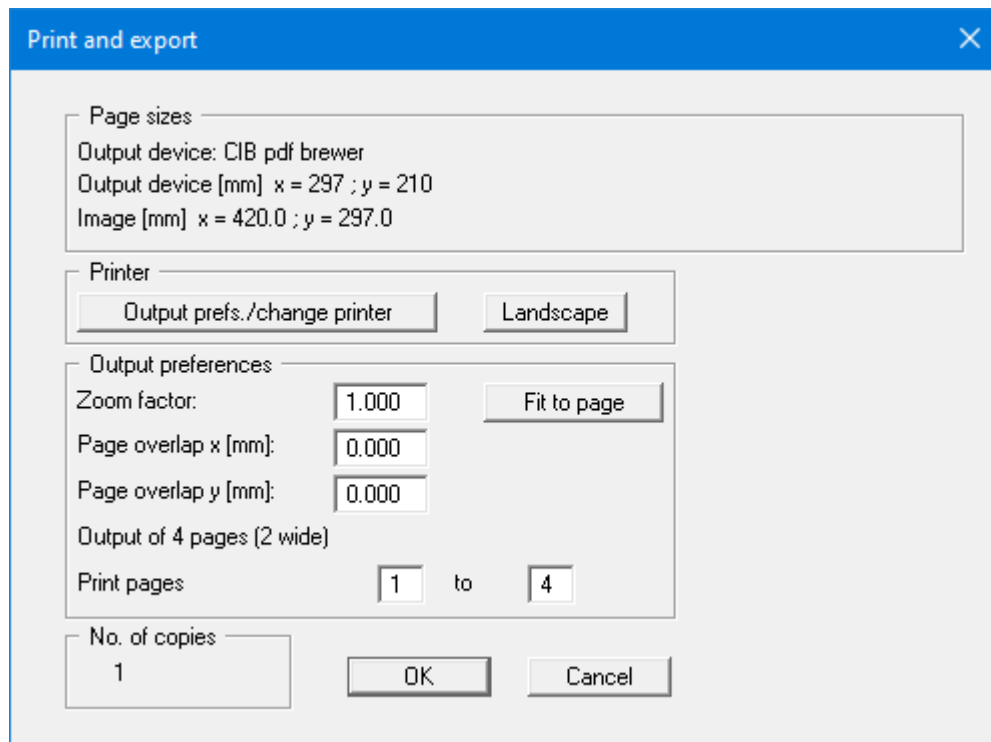
5.1.7 "Output preferences" menu item

You can edit output preferences (e.g. swap between portrait and landscape) or change the printer in accordance with WINDOWS conventions.

5.1.8 "Print and export" menu item

You can select your output format in a dialog box. You have the following options:

- **"Printer"**
allows graphic output of the current screen contents (*graphical representation*) to the WINDOWS default printer or to any other printer selected using the menu item **"File/Output preferences"**. But you may also select a different printer in the following dialog box by pressing the **"Output prefs./change printer"** button.




In the upper group box, the maximum dimensions which the printer can accept are given. Below this, the dimensions of the image to be printed are given. If the image is larger than the output format of the printer, the image will be printed to several pages (in the above example, 4). In order to facilitate better re-connection of the images, the possibility of entering an overlap for each page, in x and y direction, is given. Alternatively, you also have the possibility of selecting a smaller zoom factor, ensuring output to one page ("**Fit to page**" button). Following this, you can enlarge to the original format on a copying machine, to ensure true scaling. Furthermore, you may enter the number of copies to be printed.

If you have activated the *table representation* on the screen, you will see a different dialog box for output by means of the **"File/Print and export"** menu item button **"Printer"**. Here, you can select the table pages to be printed.

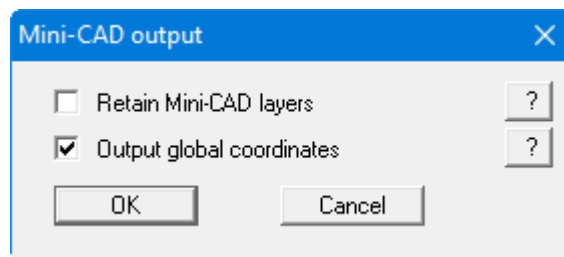
- **"DXF file"**
allows output of the graphics to a DXF file. DXF is a common file format for transferring graphics between a variety of applications.

- **"GGU-CAD file"**
allows output of the graphics to a file, in order to enable further processing with the **GGU-CAD** program. Compared to output as a DXF file this has the advantage that no loss of colour quality occurs during export.
- **"Clipboard"**
The graphics are copied to the WINDOWS clipboard. From there, they can be imported into other WINDOWS programs for further processing, e.g. into a word processor. In order to import into any other WINDOWS program, you must generally use the *"Edit/Paste"* function of the respective application.
- **"Metafile"**
allows output of the graphics to a file to be further processed with third party software. Output is in the standardised EMF format (Enhanced Metafile format). Use of the Metafile format guarantees the best possible quality when transferring graphics.

If you select the **"Copy/print area"** tool  from the toolbar, you can copy parts of the graphics to the clipboard or save them to an EMF file. Alternatively you can send the marked area directly to your printer (see **"Tips and tricks"**, Section 6.4).

Using the **"Mini-CAD"** program module you can also import EMF files generated using other GGU applications into your graphics (see Section 5.6.5).

- **"Mini-CAD"**
allows export of the graphics to a file in order to enable importing to different GGU applications with the **Mini-CAD** module.



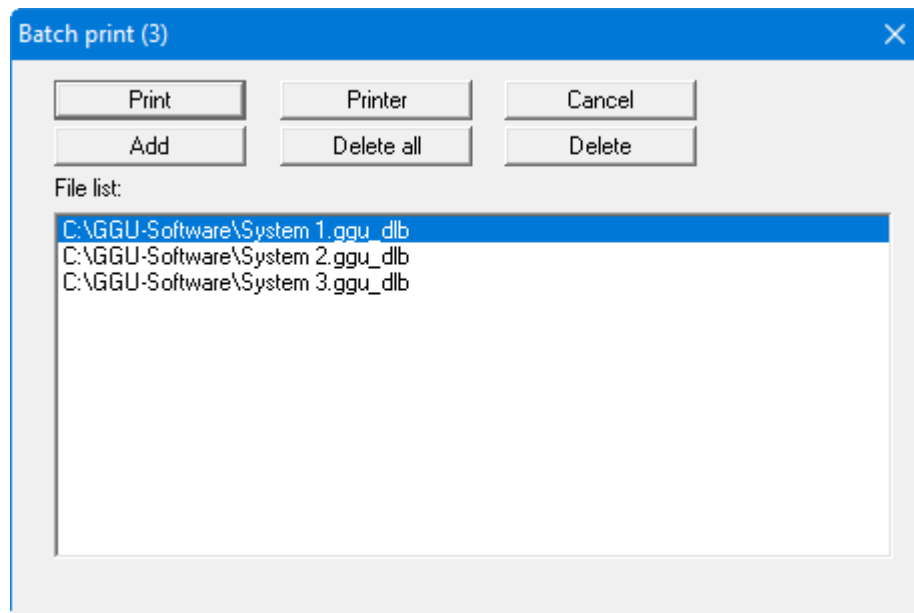
If the **"Retain Mini-CAD layers"** check box is activated, the layer allocations for any existing **Mini-CAD** elements are saved. Otherwise, all **Mini-CAD** elements are saved on Layer 1 and are also inserted into Layer 1 in other GGU programs via the **"Load"** function in the **Mini-CAD** pop-up menu.

By activating the **"Output global coordinates"** check box, the present graphics are saved in the system coordinates [m]. Otherwise they are saved in the page coordinates [mm]. If you import the **Mini-CAD** file saved using **"Global coordinates"** into a different GGU program, the coordinates are also transferred. If a system is transferred from **GGU-STABILITY** to **GGU-2D-SSFLOW**, for example, the system coordinates and scale are corrected compliant with the transferred global coordinates, after importing the file and pressing the function key [F9] (menu item **"Page size + margins/Auto-resize"**).

- **"GGUMiniCAD"**
allows export of the graphics to a file in order to enable processing in the **GGUMiniCAD** program.
- **"Cancel"**
Printing is cancelled.

5.1.9 "Batch print" menu item

If you would like to print several annexes at once, select this menu item. You will see the following dialog box:



Create a list of files for printing using "Add" and selecting the desired files. The number of files is displayed in the dialog box header. Using "Delete" you can mark and delete selected individual files from the list. After selecting the "Delete all" button, you can compile a new list. Selection of the desired printer and output preferences is achieved by pressing the "Printer" button.

You then start printing by using the "Print" button. In the dialog box which then appears you can select further preferences for printer output such as, e.g., the number of copies. These preferences will be applied to all files in the list.

5.1.10 "Exit" menu item

After a confirmation prompt, you can quit the program.

5.1.11 "1, 2, 3, 4" menu items

The "1, 2, 3, 4" menu items show the last four files worked on. By selecting one of these menu items the listed file will be loaded. If you have saved files in any other folder than the program folder, you can save yourself the occasionally onerous *rummaging* through various sub-folders.

5.2.1 "Analysis options" menu item

Using this menu item, you can edit the default preferences of the current system. The dialog box that then opens corresponds to the box that you see when you create a new system via the "File/New" menu item.

The "New data set" dialog box is shown. It contains the following fields and options:

- Project identification:** Text field with "Example 1".
- Type of analysis:** Radio buttons for "Blum's method" (selected) and "p-y method". A checkbox for "Passive earth pressure compliant with GEO-3" is present with a "?" button.
- Type of load:** Radio buttons for "Static" (selected) and "Cyclic".
- General:** Checkboxes for "Use absolute heights", "Show passive side on right", and "Label passive and active sides in graphics". A text field for "Designation for abs. height" contains "mNHN".
- Steel design:** Radio buttons for "With section list" (selected) and "Differing sections". A dropdown for "Numerical dolphin width" is set to "Minimum diameter". A checkbox for "User-defined yield stress $f_{y,k}$ (steel)" is present.
- Recalculate image coordinates after each analysis:** Checked checkbox.
- Buttons:** "OK" and "Cancel".

You can enter a dataset description ("**Project identification**") of the problem going to process, which will then be used in the *General legend* (see Section 5.6.8)

The analysis can be carried out using either the Blum method or the p-y method. Using the p-y method, you also select the type of load (static or cyclic). If the "**Passive earth pressure compliant with GEO-3**" check box is deactivated, the p-y curves are compressed using the partial safety factor for the passive earth pressure. Internationally, a GEO-3 analysis is generally performed. The shear parameters are reduced using partial safety factors and the system is analysed with the resulting 'softer' p-y curves.

If you select the "**Use absolute heights**" check box you can enter all depths or heights in **m AD** (heights are positive upwards). If you leave this box unselected, the dolphin head is assumed at **0.0** (height/depth) and all input of layer depths etc. is positive downwards. Thanks to **WYSIWYG** there is no danger of using incorrect data since all input is immediately visible on the screen.

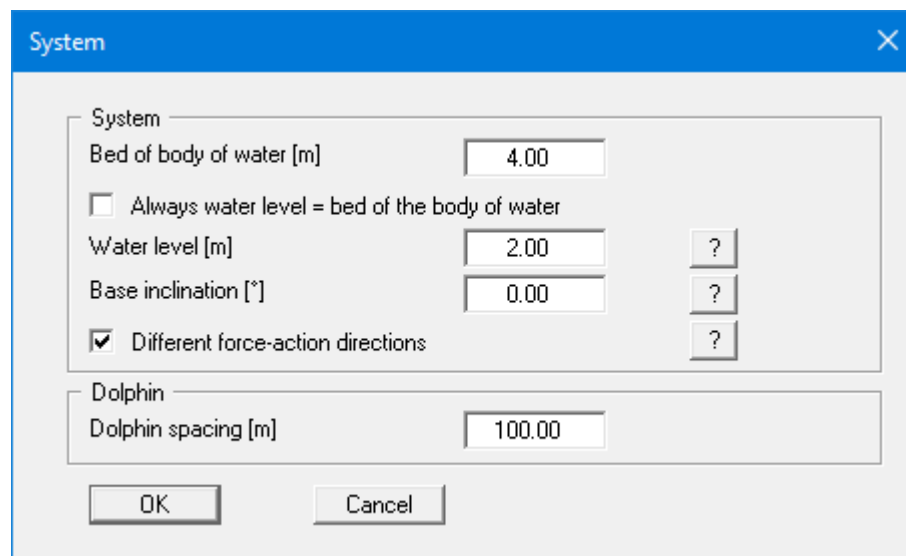
Next, you can activate visualisation of the passive side at the right. If the "**Label passive and active sides in graphics**" check box is activated, both sides are labelled at the bottom of the system.

In the "**Steel design:**" group box, you can choose whether a section from the section list loaded by the program should be selected to design a dolphin pile, or whether you wish to design a dolphin pile with differing sections in different depth ranges. If you work with the **section list**, you can automatically search for the optimal section for some load cases. You can read more detailed information by clicking the "?" buttons. A uniform dolphin width is required to calculate the three-dimensional earth pressure. If **differing sections** are selected, use the pull-down menu on the right to specify which value should be used for the dolphin width. If you do not want to perform the analysis using the specified yield strength $f_{y,k}$, but with your own data instead, activate the corresponding check box in the lower group box for steel design.

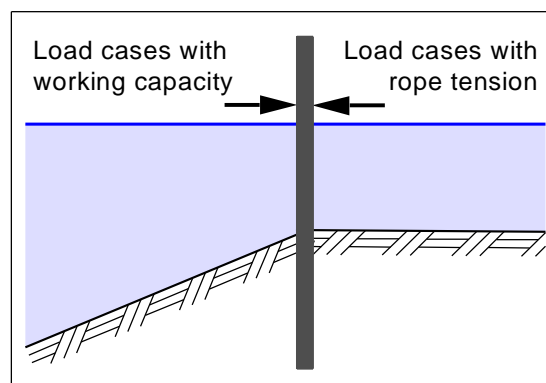
The "**Recalculate image coordinates after each analysis**" check box should always be activated to allow the result visualisation in the graphics to always be optimally displayed following design for different load situations.

5.2.2 "System" menu item

Your system is defined using this menu item. Enter the bed of the water body and the water level positive downwards in m below top of dolphin (= 0.00 m).



A base inclination can be entered on the passive side. By activating the "**Different force-action directions**" check box below, the passive earth pressure is calculated differently depending on the base inclination. In the case of negative base inclination, the passive earth pressure is calculated with flat terrain for load cases **WITH** working capacity (see following sketch). In the case of positive base inclination, the passive earth pressure is calculated with flat terrain for load cases **WITHOUT** working capacity.



You can find an example with an inclined base in the "**Example Base inclination.ggu_dlb**" file in the program's examples folder.

For analysis using Blum's method, you can define a dolphin spacing at the bottom of the dialog box. The spatial passive earth pressure may overlap where the dolphins are closely spaced. This is investigated in appropriate cases. Analysis may be performed using the passive earth pressure for a hypothetical continuous wall.

If you checked the **"Use absolute heights"** box when defining the system, an additional entry, **"Top of dolphin"**, appears in the dialog box for specifying the absolute position of the dolphin head. In this case, all elevations are entered in line with your stipulations in **"Editor 1/Analysis options"**; e.g. in [m AD].

System	
Top of dolphin [m:AD]	0.00
Bed of body of water [m:AD]	-4.00

If the height of a previously defined system is subsequently set to absolute heights, a query follows leaving the dialog box above asking for confirmation of whether soil strata should be adapted to the new dolphin top. Adaptation would mean that the depth of a soil layer entered as a positive value would be converted from, for example, 30.0 m to an absolute height of -30.0 m AD. If then, you only convert your system to [m AD], do not select any elements in the query box and press the **"OK"** button.

5.2.3 "Soils" menu item

You can define the soil properties in the following dialog box. The dialog box shown below opens when analysing using the Blum method. In stratified soils first the number of layers must be entered under **"Edit no. of soils"**.

No.	Depth [m]	gamma [kN/m²]	gamma' [kN/m²]	phi [°]	cu [kN/m²]	d(pas)/phi [-]	qc MN/m²	cu,k kN/m²	Designation
1	30.000	19.00	10.000	32.50	0.00	0.000	10.00	0.00	Sand

Using the **"Common soils"** button, you can easily select the soil properties of many common soils from a database or determine intermediate values. In the dialog box, which you open by pressing the **"Common soils"** button, open the **"Soils_english.gng_ggu"** file when first starting the program in English (**"Edit table"/"Load"** buttons). Then save the data set in the **"Soils.gng_ggu"** file on the program level in order to open your modified database file when the program starts. You can also enter your own data (**"Edit table"/"x soils to edit"** button) and save it in the **"Soils.gng_ggu"** file.

Layer depths are always with reference to the top of dolphin, or are in absolute values (m AD), if this was selected in the initial dialog box of the **"File/New"** menu item.

To analyse the vertical capacity to EAU, EAB and EAP, enter the cone resistance q_c and the shear strength of the undrained soil $c_{u,k}$. When using empirical data, enter the values for $q_{b,k}$ and $q_{s,k}$ instead of q_c and $c_{u,k}$. To do this, activate the **"Use own empirical data"** check box in the **"Editor 1/Sum V analysis"** menu item dialog box (see Section 5.2.8).

Clicking the **"Sort"** button sorts the soil layers according to depth; however, this is performed automatically when you click **"OK"** to leave the dialog box. This eliminates the possibility of input errors.

You can also use this function to eliminate a soil from the table.

Simply assign the soil to be eliminated a greater layer depth and then click the "**Sort**" button. The corresponding soil is now the last soil in the table and can be *deleted* by reducing the number of soils.

If you select analysis using the p-y method, you will see an adapted dialog box for entering the soil properties:

No.	Depth [mAD]	gamma [kN/m²]	gamma' [kN/m²]	phi [°]	cu [kN/m²]	d(pas)/phi [-]	qc [MN/m²]	cu,k [kN/m²]	eps 50% [-]	Type [-]	Designation
1	-18.500	19.00	9.000	0.00	200.00	0.000	10.00	0.00	0.0050	cohesive stiff	Clay-silt alternating layers
2	-22.000	18.00	8.000	0.00	75.00	0.000	10.00	0.00	0.0050	cohesive soft	Clay
3	-34.000	19.00	9.000	28.00	0.00	0.000	10.00	0.00	0.0050	non-cohesive	Sand-silt-clay alternating layers
4	-40.000	21.00	11.000	37.50	0.00	0.000	10.00	0.00	0.0050	non-cohesive	Dense to very dense

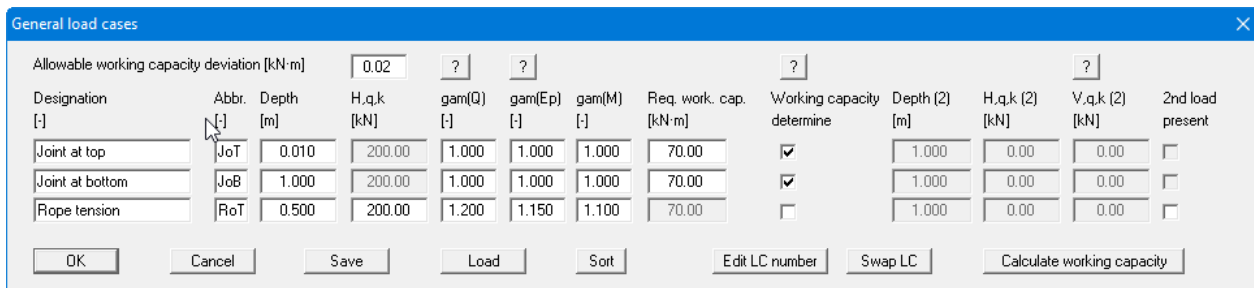
Entries are made compliant with [2]. Three types of soil are differentiated:

- non-cohesive
- cohesive stiff
- cohesive soft

An eps(50) value can also be defined for cohesive soils. More detailed explanations can be found by clicking the "?" button.

5.2.4 "General load cases" menu item

Using this menu item, you can define up to 10 load cases, which are consecutively computed during the subsequent analysis. You will also see the same dialog box if you begin analysis using **General load cases**. This means you can still adapt the load cases even after starting the analysis (see Section 5.4.5.1).

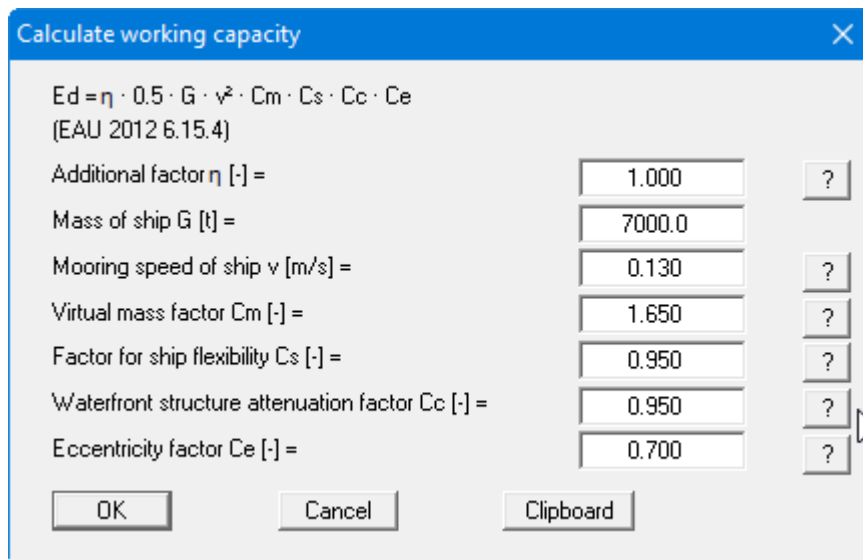


The "General load cases" dialog box contains a table for defining load cases. At the top, there are input fields for "Allowable working capacity deviation [kN·m]" (0.02), "H,q,k [kN]" (?), "gam(Q) [-]" (?), "gam(Ep) [-]" (?), and "Req. work. cap. [kN·m]" (?). The table has columns: Designation [-], Abbr. [-], Depth [m], H,q,k [kN], gam(Q) [-], gam(Ep) [-], gam(M) [-], Req. work. cap. [kN·m], Working capacity determine, Depth (2) [m], H,q,k (2) [kN], V,q,k (2) [kN], and 2nd load present. Three load cases are listed: "Joint at top" (JoT, 0.010, 200.00, 1.000, 1.000, 1.000, 70.00, checked), "Joint at bottom" (JoB, 1.000, 200.00, 1.000, 1.000, 1.000, 70.00, checked), and "Rope tension" (RoT, 0.500, 200.00, 1.200, 1.150, 1.100, 70.00, unchecked). At the bottom are buttons: OK, Cancel, Save, Load, Sort, Edit LC number, Swap LC, and Calculate working capacity.

Designation [-]	Abbr. [-]	Depth [m]	H,q,k [kN]	gam(Q) [-]	gam(Ep) [-]	gam(M) [-]	Req. work. cap. [kN·m]	Working capacity determine	Depth (2) [m]	H,q,k (2) [kN]	V,q,k (2) [kN]	2nd load present
Joint at top	JoT	0.010	200.00	1.000	1.000	1.000	70.00	<input checked="" type="checkbox"/>	1.000	0.00	0.00	<input type="checkbox"/>
Joint at bottom	JoB	1.000	200.00	1.000	1.000	1.000	70.00	<input checked="" type="checkbox"/>	1.000	0.00	0.00	<input type="checkbox"/>
Rope tension	RoT	0.500	200.00	1.200	1.150	1.100	70.00	<input type="checkbox"/>	1.000	0.00	0.00	<input type="checkbox"/>

If you activate the "**Working capacity determine**" check box after the load case, the working capacity is determined by varying H,q,k. If the check box is deactivated, the working capacity is determined using the value you enter in the "**H,q,k**" box, which is then active. Given a fixed value for "**H,q,k**" an additional H-load and/or V-load can be defined at the end of the line after activating the "**2nd load present**" check box.

The **required working capacity** can be entered directly or determined and entered by the program using the "**Calculate working capacity**" button. After clicking the button you will next see a dialog box in which you can select analysis using a "**Simple equation**" or an "**Expert equation**" (see EAU 2012 Section 6.15.4). If the "**Simple equation**" is selected the following dialog box opens:



The "Calculate working capacity" dialog box shows the formula $E_d = \eta \cdot 0.5 \cdot G \cdot v^2 \cdot C_m \cdot C_s \cdot C_c \cdot C_e$ (EAU 2012 6.15.4). It contains input fields for: Additional factor η [-] (1.000), Mass of ship G [t] (7000.0), Mooring speed of ship v [m/s] (0.130), Virtual mass factor C_m [-] (1.650), Factor for ship flexibility C_s [-] (0.950), Waterfront structure attenuation factor C_c [-] (0.950), and Eccentricity factor C_e [-] (0.700). Each field has a "?" button to the right. At the bottom are buttons: OK, Cancel, and Clipboard.

You can view information on the parameters and input value recommendations by pressing the "?" buttons. If the "**Expert equation**" is adopted you will see the following dialog box, in which you can enter additional parameters for determining the working capacity:

Calculate working capacity ✕

$$E_d = \eta \cdot (G \cdot C_m \cdot C_s \cdot C_c) / (2 \cdot (k^2 + r^2)) \cdot [v^2 \cdot (k^2 + r^2 \cdot \cos^2(\alpha)) + 2 \cdot v \cdot \omega \cdot r \cdot k^2 \cdot \sin(\alpha) + \omega^2 \cdot k^2 \cdot r^2]$$

(EAU 2012 6.15.4)

Additional factor η [-] =	<input type="text" value="1.000"/>	<input style="width: 30px;" type="button" value="?"/>
Mass of ship G [t] =	<input type="text" value="7000.0"/>	
Length of ship L [m] =	<input type="text" value="100.0"/>	
Mass radius of inertia of ship k [m] =	<input type="text" value="25.00"/>	<input style="width: 30px;" type="button" value="?"/>
Mooring speed of ship v [m/s] =	<input type="text" value="0.13"/>	<input style="width: 30px;" type="button" value="?"/>
Distance to centre of mass r [m] =	<input type="text" value="0.00"/>	<input style="width: 30px;" type="button" value="?"/>
Rotating speed ω [rad/s] =	<input type="text" value="0.00"/>	
Angle α between v and r [°] =	<input type="text" value="84.00"/>	<input style="width: 30px;" type="button" value="?"/>
Virtual mass factor C_m [-] =	<input type="text" value="1.650"/>	<input style="width: 30px;" type="button" value="?"/>
Factor for ship flexibility C_s [-] =	<input type="text" value="0.950"/>	<input style="width: 30px;" type="button" value="?"/>
Waterfront structure attenuation factor C_c [-] =	<input type="text" value="0.950"/>	<input style="width: 30px;" type="button" value="?"/>

After entering your data and exiting the respective dialog box via "OK", the calculated working capacity is shown in a message box. By clicking "Yes", the value in the above load case dialog box is adopted as the "**Req. working capacity**".

If you have calculated the *required working capacity* using one of the equations, the input data and the result are also shown in the output table (menu item "**File/Print output table**", Section 5.1.6.1).

5.2.5 "Fenders" menu item

The program includes a database containing commercially available fenders, which is loaded when you start the program. In the table shown in this menu item, the working capacity EA and the failure load RF are given for each fender.

The 'Fenders' dialog box contains a table with the following data:

No.	Designation	Grade	EA [kN·m]	RF [kN]
1	SPC 300	G 0.9	8.1	55.0
2	SPC 300	G 1.0	8.1	57.0
3	SPC 300	G 1.1	9.0	60.0
4	SPC 300	G 1.2	9.0	62.0

Additional controls in the dialog include: 'Forw.', 'Back', 'Cancel', 'Done', 'Load', 'Save', 'Sort', 'Delete', 'Delete doubles', 'Go to no.: 1', '391 Fenders to edit', 'Info', and 'Manipulate values'.

The following options are available:

- **"Forw.", "Back", "Go to no."**
You can navigate through the list using **"Forw."** and **"Back"**. **"Go to no."** allows you to jump to the fender specified.
- **"Cancel", "Done"**
Exit the dialog box either saving or rejecting your modifications using these buttons.
- **"x Fenders to edit", "Info"**
Using this button you may expand or reduce the list of fenders. New fenders are added to the end of the list. A description of the abbreviations used to enter the fender data is available via the **"Info"** button.
- **"Load", "Save", "Sort", "Delete doubles"**
A different fender list can be opened by pressing the **"Load"** button. It is then possible to append the new list to an already open fender list. After appending fenders, it may be expedient to delete any double fenders in the list by pressing the **"Delete doubles"** button. The fenders can then be sorted by different characteristics (e.g. moment of inertia or name) by pressing the **"Sort"** button. The modified fender list may then be saved to the program folder as **".ggu_fen"** file for subsequent analyses by pressing the **"Save"** button.
- **"Delete"**
Any number of fenders in a sequence in the list can be deleted using this button.

The 'Delete fenders' dialog box shows the selection of fenders to be deleted:

from fender: [1] SPC 300/G 0.9

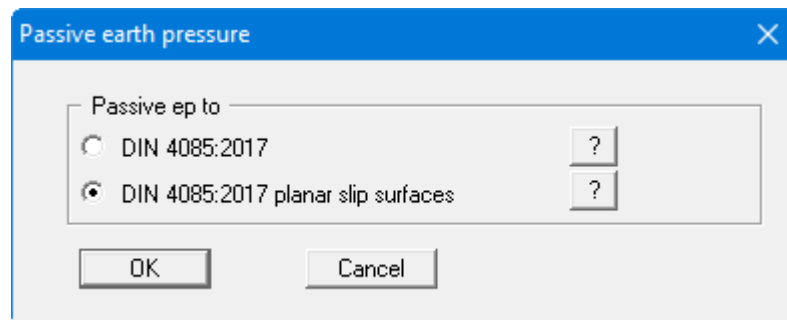
to fender: [6] SPC 300/G 1.4

Buttons: OK, Cancel

- **"Manipulate values"**
Either the working capacity EA or the failure load RF of all stored fenders can be modified using multiplication by, or addition to, a constant.

5.2.6 "Passive earth pressure" menu item

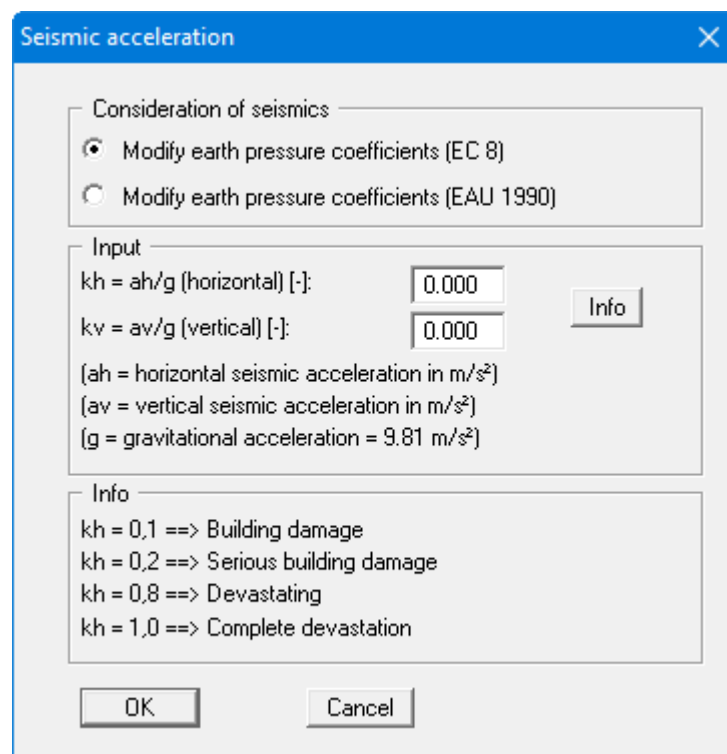
You can specify passive earth pressure preferences using this dialog box:



Larger passive earth pressures are calculated using planar slip surfaces. Compliant with EAB R 89 the friction angle should then be no greater than 35° and the wall friction angle should adhere to the following condition " $|\delta| \leq \frac{2}{3} \phi$ ".

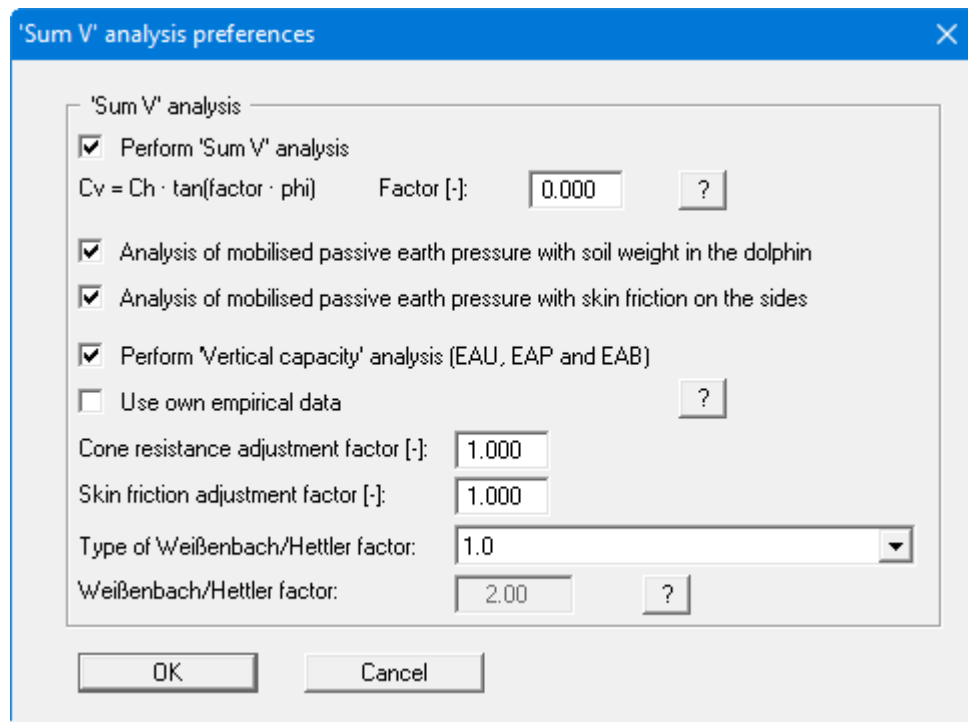
5.2.7 "Seismic acceleration" menu item

Seismic loads can be taken into consideration as described in EC 8 or EAU 1990, Section 2.14, by increasing the active earth pressure coefficients and reducing the passive earth pressure coefficients. Seismic loads are given in multiples of gravitational acceleration (g).



5.2.8 "Sum V analysis" menu item

In the dialog box activate required Sum V analyses using the check boxes. When the check boxes are activated analysis is performed automatically following your system analysis and design.



The screenshot shows a dialog box titled "'Sum V' analysis preferences" with a close button (X) in the top right corner. The dialog contains the following settings:

- 'Sum V' analysis**
 - ☒ Perform 'Sum V' analysis
 - $C_v = C_h \cdot \tan(\text{factor} \cdot \phi)$ Factor [-]:
 - ☒ Analysis of mobilised passive earth pressure with soil weight in the dolphin
 - ☒ Analysis of mobilised passive earth pressure with skin friction on the sides
 - ☒ Perform 'Vertical capacity' analysis (EAU, EAP and EAB)
 - ☐ Use own empirical data
 - Cone resistance adjustment factor [-]:
 - Skin friction adjustment factor [-]:
 - Type of 'Weissenbach/Hettler' factor:
 - Weissenbach/Hettler factor:

At the bottom of the dialog are two buttons: **OK** and **Cancel**.

On a previously analysed system, you can perform the analyses with a variety of settings via the menu item "**Evaluation/Sum V**" (see Section 5.5.3), without having to reanalyse the system.

5.3 Editor 2 menu

5.3.1 "Section list" menu item

If you want to design a dolphin via the section list, this menu item will open a dialog box containing the current list of dolphin sections.

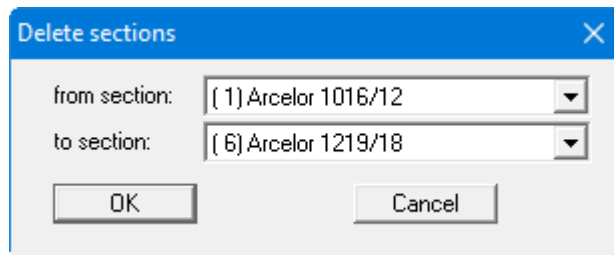
No.	Designation	D [mm]	t [mm]	W,el [cm²]	W,pl [cm²]	A [cm²]	I [cm⁴]	Available steel grades									
								235	275	355	420	460	240	270	320	390	430
1	Arcelor 1016/12	1016.0	12.0	9389.5	12096.8	378.5	476984.5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Arcelor 1016/14	1016.0	14.0	10889.6	14057.0	440.7	553192.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Arcelor 1016/16	1016.0	16.0	12371.6	16001.4	502.7	628479.4	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Arcelor 1219/14	1219.0	14.0	15784.6	20329.3	530.0	962072.2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Arcelor 1219/16	1219.0	16.0	17950.6	23156.7	604.7	1094091.3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Arcelor 1219/18	1219.0	18.0	20094.9	25965.2	679.1	1224782.5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Arcelor 1422/16	1422.0	16.0	24565.3	31630.7	706.7	1746594.4	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Arcelor 1422/18	1422.0	18.0	27519.2	35483.8	793.9	1956613.7	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Arcelor 1422/20	1422.0	20.0	30447.6	39314.7	880.9	2164822.5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Arcelor 1524/16	1524.0	16.0	28279.9	36386.4	758.0	2154928.1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Arcelor 1524/18	1524.0	18.0	31689.4	40826.6	851.6	2414734.3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	Arcelor 1524/20	1524.0	20.0	35071.6	45243.0	945.0	2672453.6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Arcelor 1626/18	1626.0	18.0	36153.8	46543.9	909.3	2939306.9	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Arcelor 1626/20	1626.0	20.0	40022.4	51587.4	1009.1	3253822.5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Arcelor 1626/22	1626.0	22.0	43861.8	56605.5	1108.6	3565967.3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	Arcelor 1829/18	1829.0	18.0	45914.2	59036.9	1024.1	4198852.7	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Arcelor 1829/20	1829.0	20.0	50848.1	65452.3	1136.6	4650061.1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	Arcelor 1829/22	1829.0	22.0	55749.1	71839.0	1248.9	5098253.1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Arcelor 2032/20	2032.0	20.0	62968.5	80965.5	1264.2	6397594.7	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	Arcelor 2032/22	2032.0	22.0	69060.4	88885.7	1389.2	7016536.1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The following options are available:

- **"Forw.", "Back", "Go to no."**
You can navigate through the list using **"Forw."** and **"Back"**. **"Go to no."** allows you to jump to the section specified.
- **"Cancel", "Done"**
Exit the dialog box either saving or rejecting your modifications using these buttons.
- **"x Sections to edit", "Info"**
Using this button you may expand or reduce the list of sections. New sections are added to the end of the list. A description of the abbreviations used to enter the section data is available via the **"Info"** button.
- **"Load", "Save", "Sort", "Delete doubles"**
A different section list can be opened by pressing the **"Load"** button. It is then possible to append the new list to an already open section list. After appending sections it may be expedient to delete any double sections in the list by pressing the **"Delete doubles"** button. The sections can then be sorted by different characteristics (e.g. moment of inertia or name) by pressing the **"Sort"** button. The modified section list may then be saved to the program folder as **".rohr_ggu"** file for subsequent analyses by pressing the **"Save"** button.

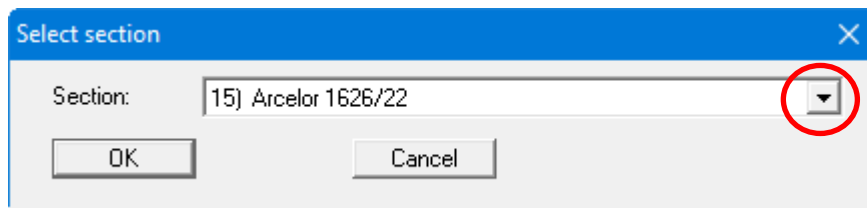
- **"Delete"**

Any number of sections in a sequence in the list can be deleted using this button.



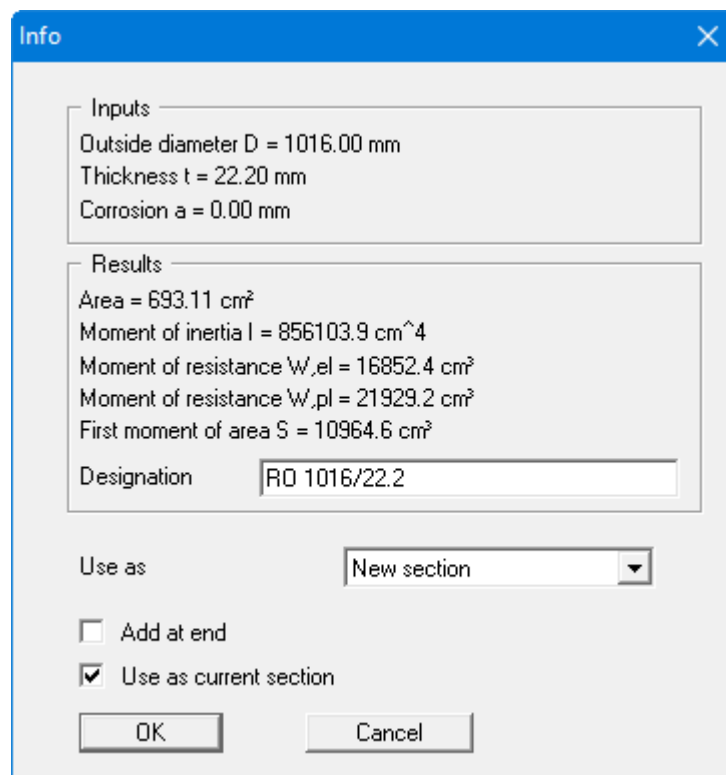
- **"Select section"**

A dialog box opens in which you select the required section for design.



- **"Create tubular section"**

A new tubular section can be generated. A dialog box opens for entering the dimensions and identification. In the following dialog box you can then save the section as a new section, or using a previously allocated name:



5.3.2 "Differing sections" menu item

If you want to design a dolphin using differing sections at different depths, you can use this menu item to define the different individual sections for the dolphin. The program first automatically sets the depth of the lowest section in the analysis to the base of the system and determines the required length of the lowest section.

No.	Depth [m]	Section	Steel grade	
1	4.000	Arcelor 1524/16	S 355	Buckling analysis with $f_{y,k}$ reduction
2	7.000	Arcelor 1524/16	S 355	No buckling analysis

First, define the required number of sections using the "**x individual sections to edit**" button. After clicking the button with the section designation you will see a dialog box in which you can select the required section from the section list. You can save your section compilation in a ".sol_rohr" file and load it again when needed using the "**Load**" and "**Save**" buttons. The sections are sorted according to depth using "**Sort**".

If you are working with differing sections, you specify the steel grade and buckling analysis for the individual sections in the dialog box for this menu item.

If you exit this menu item and have previously selected "**With section list**" in "**Editor 1/Analysis options**", you will be asked whether you wish to convert to steel design using differing sections. You will see a similar question if the case is vice versa. If you have already selected "**Differing sections**" and would like to add a section (e.g. with corrosion), you can go to the "**Editor 2/Steel sections**" and add the required section without having to immediately move back to "**With section list**" again. When you exit this menu item you will see the reverse question: whether to change to steel design using the section list. In this case, respond negatively and supplement your new section using the menu item "**Editor 2/Differing sections**".

5.3.3 "Young's modulus/Specific weight" or "Specific weight" menu items

Using this menu item you must enter Young's modulus and specific weight of the dolphin. From the former the bending line is calculated, from the latter the self-weight of the dolphin.

5.4 System menu

5.4.1 "Info" menu item

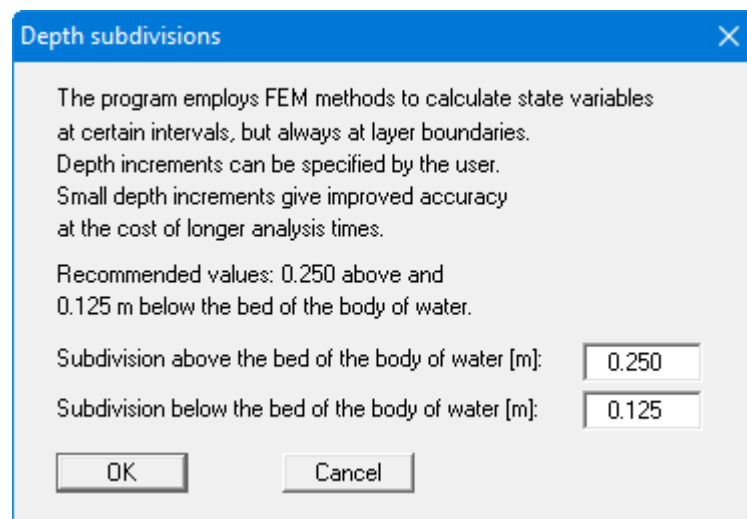
You will see information on the current system in a message box.

5.4.2 "Special preferences" menu item

The program performs a multitude of plausibility checks. After starting the analysis the preferences specified by the user are displayed in a message box; for problematical preferences separate information or warning are displayed. It is therefore recommended to leave the **"Show warnings in future"** check box activated. If you do not want to see the automatic display when the analysis starts, deactivate the check box. You can subsequently view your special preferences using this menu item.

5.4.3 "Depth subdivisions" menu item

GGU-DOLPHIN uses the finite element method, which requires the system to be divided into a number of finite elements (rods). You can specify the size of these depth increments for the region above and below the bed of the body of water.



5.4.4 "Length surcharge" menu item

Here you can specify the way in which length surcharge is calculated.

Length surcharge

Determine length surcharge dx

Length surcharge with % value

☐ Use length surcharge dx with % value

Length surcharge [%]: 20.0 ?

Length surcharge via equation

☒ Calculate length surcharge dx via equation

☐ Wall friction angle delta,p in accord. with Piling Handbook 2007 ?

OK Cancel

A length surcharge for the theoretically determined embedment depth is required for dolphins. In accordance with the EAB, this surcharge can be adopted at 20% of the theoretically determined embedment depth. Alternatively, the length multiplier Δx can also be calculated in accordance with the EAU:

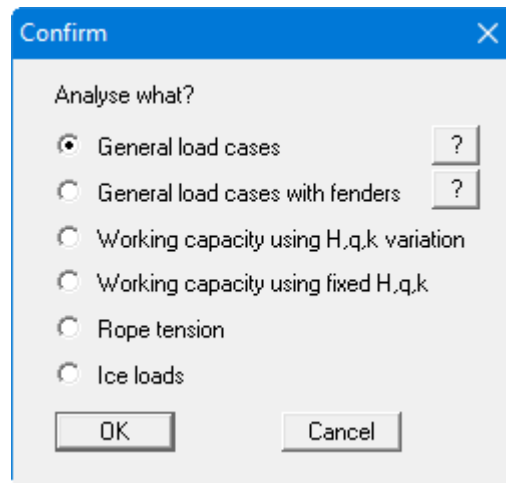
$$\Delta x \geq C_h / e_{phC}$$

C_h = equivalent force after Blum (horizontal component)
 e_{phC} = passive earth pressure stress at the theoretical toe TF

Opinions differ in terms of adopting the wall friction angle of the equivalent force after Blum. If you activate the check box "**Wall friction angle delta,p in accordance with Piling Handbook 2007**", the passive earth pressure value is used. Otherwise, the value given in the "**Editor 1/Sum V analysis**" menu item is used.

5.4.5 "Analyse" menu item

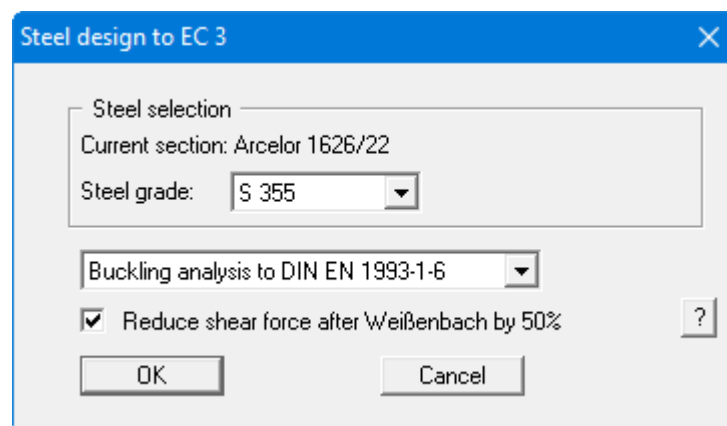
Once you have entered all data required to fully describe the system it can be analysed. You can also initiate the analysis using the [F5] function key. You will see the following dialog box, in which you now select the required load case or cases.



5.4.5.1 Analysing several load cases in a single computation

You can find the following example in the "Example General load cases_3 cases.ggu_dlb" file in the program's examples folder.

If you wish to analyse the "General load cases", you should first select a design section from the section list in the "Editor 2" menu. Next, the following dialog box for steel design compliant with EC3 opens for the selected section:



When using several sections for a dolphin, you make the decision on steel grade and buckling analysis when selecting the sections in the "Editor 2/Differing sections" menu item. The steel design dialog box is then reduced to the shear force reduction check box.

After accepting your specifications, you will see the same dialog box for defining the desired load cases as previously described for the "Editor 1/General load cases" menu item (see Section 5.2.4):

General load cases

Allowable working capacity deviation [kN·m] 0.02 ? ? ?

Designation [-]	Abbr. [-]	Depth [m]	H,q,k [kN]	gam(Q) [-]	gam(Ep) [-]	gam(M) [-]	Req. work. cap. [kN·m]	Working capacity determine	Depth (2) [m]	H,q,k (2) [kN]	V,q,k (2) [kN]	2nd load present
Joint at top	JoT	0.010	200.00	1.000	1.000	1.000	70.00	<input checked="" type="checkbox"/>	1.000	0.00	0.00	<input type="checkbox"/>
Joint at bottom	JoB	1.000	200.00	1.000	1.000	1.000	70.00	<input checked="" type="checkbox"/>	1.000	0.00	0.00	<input type="checkbox"/>
Rope tension	RoT	0.500	200.00	1.200	1.150	1.100	70.00	<input type="checkbox"/>	1.000	0.00	0.00	<input type="checkbox"/>

OK Cancel Save Load Sort Edit LC number Swap LC Calculate working capacity

Start the analysis by pressing "OK". The program analyses the defined load cases consecutively. If the steel design cannot be verified, the analysis is aborted with a note on the load case in which the steel failed.

Following a successful computation, the results are displayed in an additional message box and then in the results legend on the screen after information about the computations and the analysis time.

Results

No. [-]	Load-case [-]	Hq,k [kN]	Depth [m]	Section length [m]	$\mu(\text{steel})$ [-]	Working capacity [kN·m] Req./Curr.
1	Joint at top	1550.88	0.01	15.49	0.735	70.00 / 70.01
2	Joint at bottom	1766.17	1.00	15.69	0.749	70.00 / 72.15
3	Rope tension	200.00	0.50	10.17	0.087	- / 0.32

Greatest steel utilisation = 0.749 (Load-case: Joint at bottom)

OK

In the graphics, the load case with the greatest steel utilisation is highlighted and labelled accordingly.

5.4.5.2 Analyse fenders

The program includes a database containing commercially available fenders, for which the working capacity EA and the failure load RF are given. The fender analysis first demands that the **required working capacity** be determined. The failure load RF of the fender is then adopted as a horizontal load and the resulting working capacity Ed determined. The sum of **EA** and **Ed** must be greater than the **required working capacity**.

If you select "**General load cases with fenders**" in the dialog box shown above you will initially also see the dialog box for the steel design settings compliant with EC3 (see Section 5.4.5.1). Following this, the almost identical dialog box for specifying the load cases is displayed. In contrast here, though, you can select a fender analysis by activating the check box at the end of each load case line.

Designation [-]	Abbr. [-]	Depth [m]	H,q,k [kN]	gam(Q) [-]	gam(Ep) [-]	gam(M) [-]	Req. work. cap. [kN·m]	Fenders analysis	Depth [2] [m]	H,q,k [2] [kN]	V,q,k [2] [kN]	2nd load present
Joint at top	JoT	0.010	200.00	1.000	1.000	1.000	70.00	<input checked="" type="checkbox"/>	1.000	0.00	0.00	<input type="checkbox"/>
Joint at bottom	JoB	1.000	200.00	1.000	1.000	1.000	70.00	<input checked="" type="checkbox"/>	1.000	0.00	0.00	<input type="checkbox"/>
Rope tension	RoT	0.500	200.00	1.200	1.150	1.100	70.00	<input type="checkbox"/>	1.000	0.00	0.00	<input type="checkbox"/>

For fender analysis, the **Req. working capacity** must first be entered or determined by pressing the "**Calculate working capacity**" button (also see Section 5.2.4). In order to optimise the analysis procedure you will see the following dialog box, in which you can delineate the fenders to be analysed, when you exit the above box:

☐ Use only one fender

One fender
Use this fender: 1) SPC 300/G 0.9/EA=9.0

Working capacity
Only use fenders with working capacity EA between
min. EA = 100.0
max. EA = 600.0

Correction factor EA + RF
Correction factor EA [-] 1.000
Correction factor RF [-] 1.000

OK Cancel

In the default setting, the program analyses all fenders with a working capacity EA in the specified range. However, you can also analyse a specific fender if you activate the "**Use only one fender**" check box and then select the required fender from the fender database provided.

Analysis begins after you exit the dialog box. The results are then initially displayed in a message box and then in the graphics and the results legend.

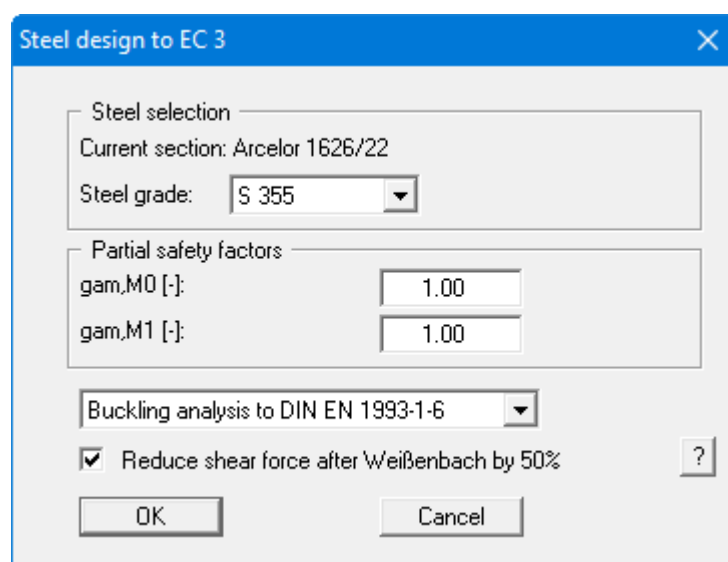
You can find another example with fender analysis in the "**Example General load cases_Fenders.ggu_dlb**" file in the program's examples folder.

5.4.5.3 Analysis of a selected load case

You can find the following example in the "**Example Load case Working capacity.ggu_dlb**" file in the program's examples folder.

If you select a single load case for the analysis in the dialog box shown above, you will see the respective customised dialog boxes.

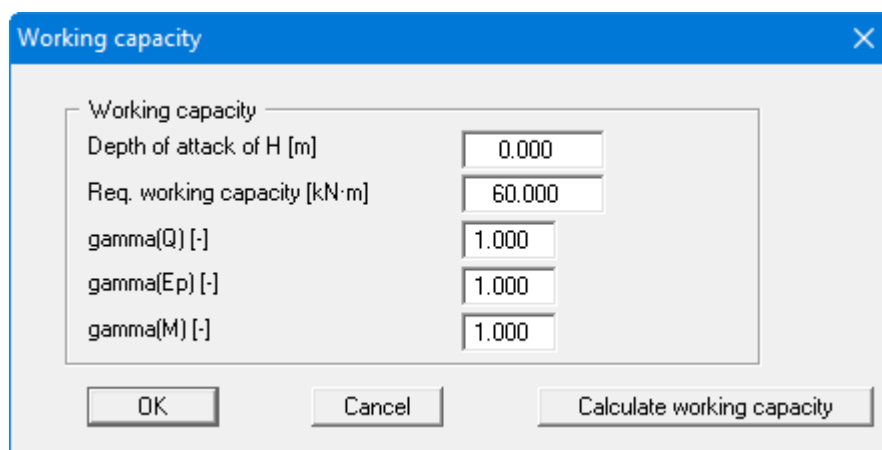
In the "**Working capacity....**" load cases, a dialog box for steel design compliant with EC3 opens first, shown below as an example for the "**Working capacity using H,q,k variation**" load case:



The "Steel design to EC 3" dialog box contains the following fields and controls:

- Steel selection**
 - Current section: Arcelor 1626/22
 - Steel grade: S 355 (dropdown menu)
- Partial safety factors**
 - gam,M0 [-]: 1.00
 - gam,M1 [-]: 1.00
- Buckling analysis to DIN EN 1993-1-6 (dropdown menu)
- ☒ Reduce shear force after Weißenbach by 50% (checkbox with a help icon ?)
- OK and Cancel buttons

You then see a dialog box for defining settings for determining the working capacity.



The "Working capacity" dialog box contains the following fields and controls:

- Working capacity**
 - Depth of attack of H [m]: 0.000
 - Req. working capacity [kN·m]: 60.000
 - gamma(Q) [-]: 1.000
 - gamma(Ep) [-]: 1.000
 - gamma(M) [-]: 1.000
- OK, Cancel, and Calculate working capacity buttons

Here, too, you can either enter the required working capacity or have it determined and entered by the program using the "**Calculate working capacity**" button (see descriptions in Section 5.2.4). In this example, the program then performs an analysis by varying H,q,k and displays the results in a message box:

Results					
No.	Working capacity [-] [kN·m]	Hq,k [kN]	Section length [m]	$\mu(\text{steel})$ [-]	Mob. Ep met [-]
1	0.07	100.00	8.55	0.033	Yes
2	0.34	200.00	9.64	0.069	Yes
3	0.97	300.00	10.49	0.109	Yes
4	1.99	400.00	11.16	0.151	Yes
5	3.56	500.00	11.75	0.195	Yes
6	5.86	600.00	12.30	0.242	Yes
7	8.50	700.00	12.70	0.288	Yes
8	11.82	800.00	13.08	0.334	Yes
9	16.88	900.00	13.54	0.389	Yes
10	22.10	1000.00	13.88	0.439	Yes
11	28.32	1100.00	14.21	0.491	Yes
12	35.66	1200.00	14.52	0.544	Yes
13	44.23	1300.00	14.83	0.598	Yes
14	54.16	1400.00	15.12	0.654	Yes
15	62.18	1500.00	15.29	0.700	Yes
16	58.10	1450.00	15.21	0.677	Yes
17	62.18	1500.00	15.29	0.700	Yes
18	60.12	1475.00	15.25	0.689	Yes
19	59.11	1462.50	15.23	0.683	Yes
20	60.12	1475.00	15.25	0.689	Yes
21	59.61	1468.75	15.24	0.686	Yes
22	60.12	1475.00	15.25	0.689	Yes
23	59.87	1471.88	15.24	0.687	Yes
24	60.12	1475.00	15.25	0.689	Yes
25	59.99	1473.44	15.25	0.688	Yes
26	60.12	1475.00	15.25	0.689	Yes
27	60.06	1474.22	15.25	0.688	Yes
28	60.02	1473.83	15.25	0.688	Yes

Available working capacity = 60.02 kN·m
Required working capacity = 60.00 kN·m achieved!

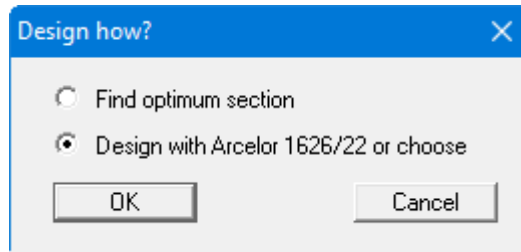
OK

In this case, the required working capacity has just been reached. If the steel cannot be verified, the analysis is aborted.

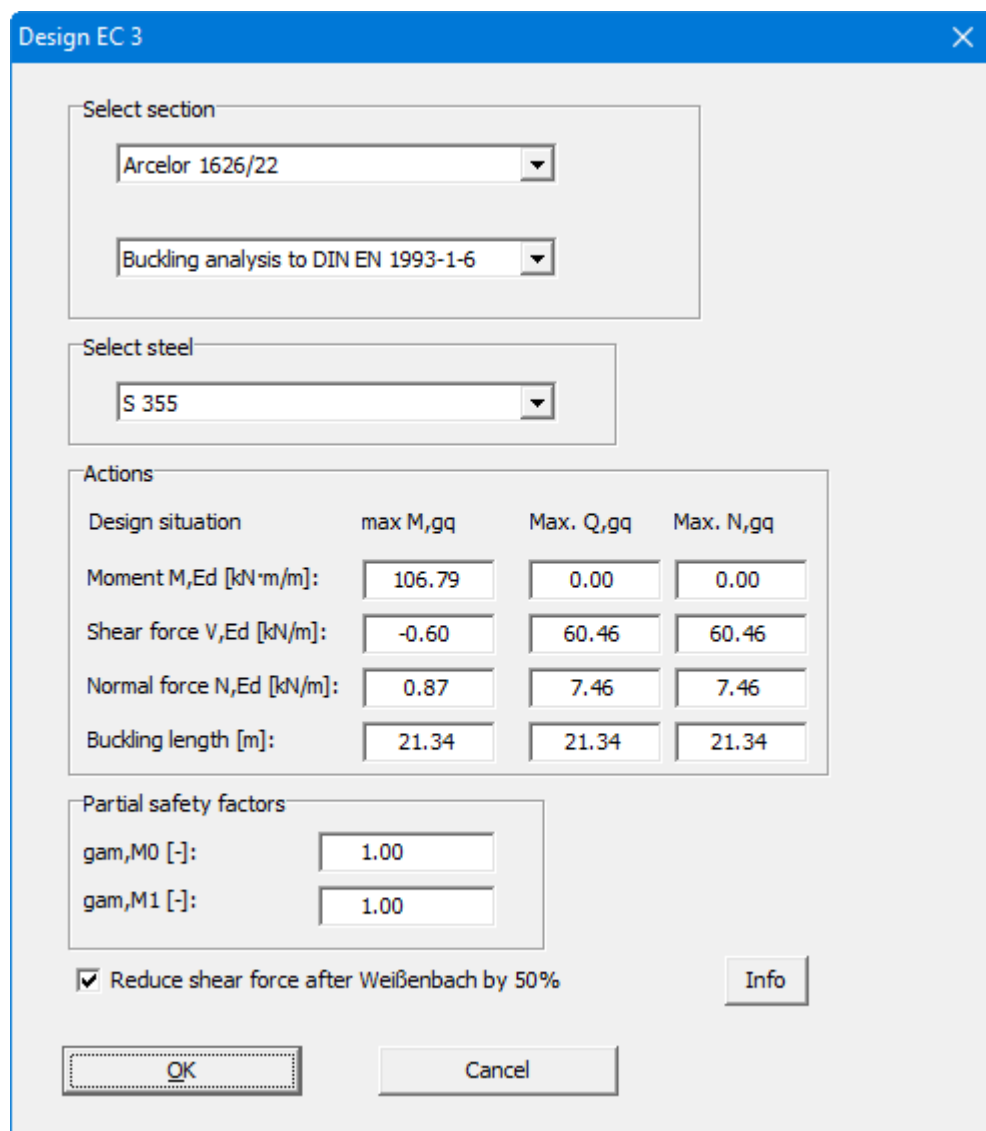
If the steel design has not already been requested in the analysis boxes, you will see a query on the steel design after the analysis is complete. In some of the load cases, you can carry out the design for the selected section or have the program search for the optimum section. You will see the dialog boxes that can also be accessed via the "**System/Design defaults**" menu item (see following Section 5.4.6).

5.4.6 "Design defaults" menu item

If this has not already been done during the analysis, you can subsequently design the steel using this menu item. If you use a selected section, you may also be able to have the program search for an optimal section:



If you confirm the option below, you will see the following dialog box in which you can define the desired settings, or alternatively select a different section:

A dialog box titled "Design EC 3" with a close button (X) in the top right corner. It contains several sections for configuring design parameters.
Select section: A dropdown menu showing "Arcelor 1626/22" and another dropdown menu showing "Buckling analysis to DIN EN 1993-1-6".
Select steel: A dropdown menu showing "S 355".
Actions: A table with four columns: "Design situation", "max M,gq", "Max. Q,gq", and "Max. N,gq".

Design situation	max M,gq	Max. Q,gq	Max. N,gq
Moment M,Ed [kN·m/m]:	106.79	0.00	0.00
Shear force V,Ed [kN/m]:	-0.60	60.46	60.46
Normal force N,Ed [kN/m]:	0.87	7.46	7.46
Buckling length [m]:	21.34	21.34	21.34

Partial safety factors: Two input fields: "gam,M0 [-]:" with value "1.00" and "gam,M1 [-]:" with value "1.00".
At the bottom, there is a checked checkbox "Reduce shear force after Weißenbach by 50%", an "Info" button, and "OK" and "Cancel" buttons.

When design is complete you are informed of the verification results in a message box and are presented with the principal data on which the design was based. After exiting the message box, the analysis results are displayed in your system both graphically and in the **Design legend**.

If you have selected the "**Find optimum section**" option 1, you will see the following dialog box in which you can define your search settings:

Find optimum section

Section selection
 Buckling analysis to DIN EN 1993-1-6

☒ Reduce yield point for class 4 or during shear crimping analysis
☐ No test for shear crimping analysis ?
☒ Search criterion: "Find smallest section area"

Steel selection
 Steel grade S 355

Actions

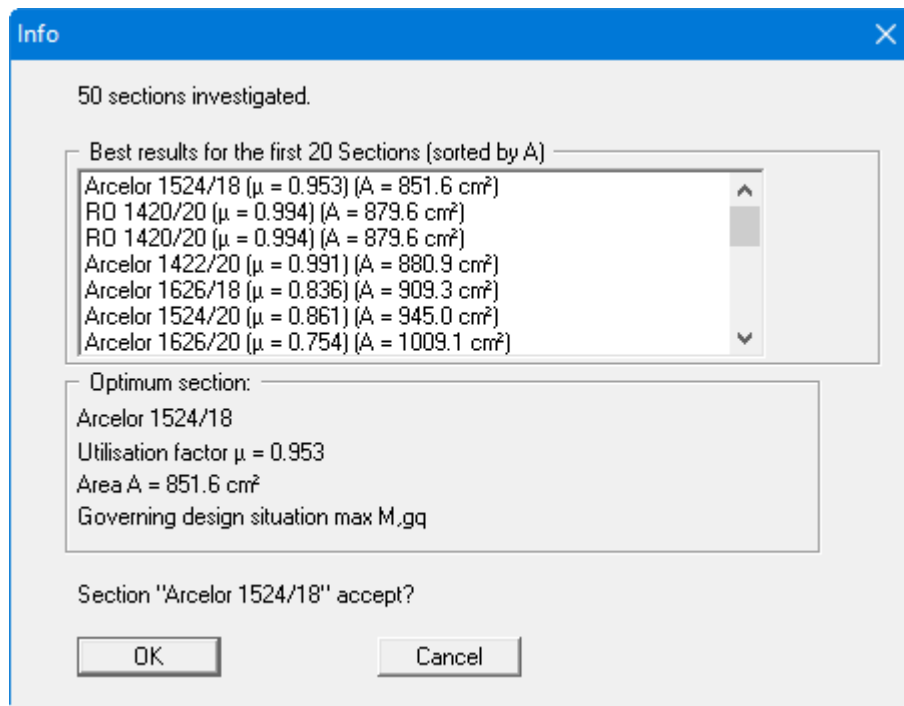
Design situation	max M	Max. Q	Max. N
Moment M,Ed [kN·m/m]:	106.8	0.0	0.0
Shear force V,Ed [kN/m]:	-0.6	60.5	60.5
Normal force N,Ed [kN/m]:	0.9	7.5	7.5
Buckling length L [m]:	21.3	21.3	21.3

Partial safety factors
 gam,M0 [-]: 1.00
 gam,M1 [-]: 1.00

☒ Reduce shear force after Weißenbach by 50% ?

OK Cancel

You will then be shown information on the optimum section and can accept it if desired:



After accepting the section, the design results are first displayed in message boxes and then displayed graphically in the system and in the **Design legend**. If you alter the section, you should have your system reanalysed with the new section.

5.4.7 "Graph positioning preferences" menu item

If you are not happy with the automatic graph arrangement you can arrange them to suit your needs using this menu item. First, activate the "**Manual graph positioning**" radio button.

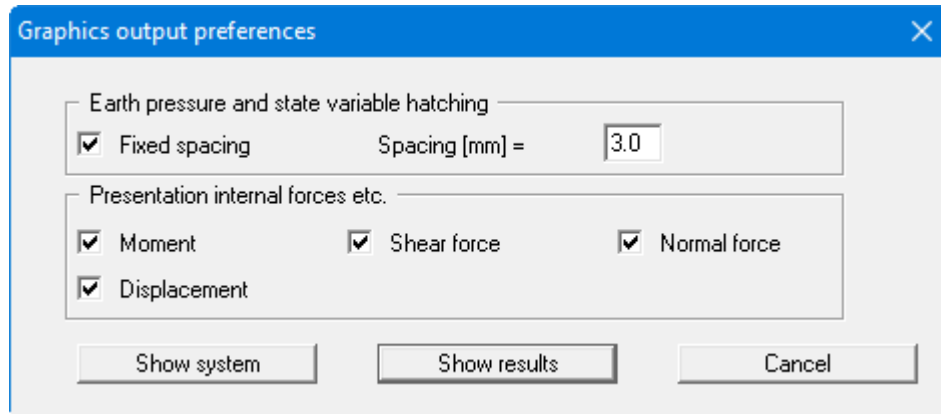
Graph name	x [m]	Width [m]
$\mu(\text{steel})$	0.00	2.00
Passive earth pressure	5.00	2.00
Moment	10.00	2.00
Shear force	15.00	2.00
Normal force	20.00	2.00
Displacement	25.00	2.00

The diagrams will then be shown central at the position "**x**" with the specified "**Width**".

The fastest way to modify the position of a graph is to press the **[F11]** function key and then to pull the graph to the new position holding the left mouse button pressed.

5.4.8 "Graphics output preferences" menu item

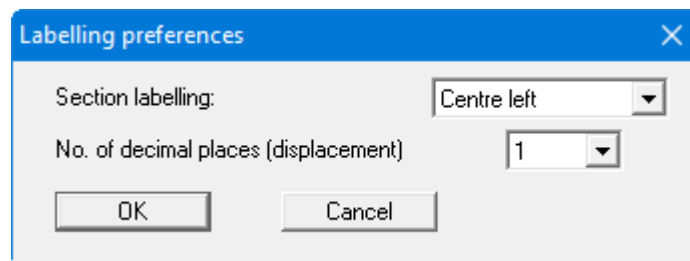
Among other things, the screen graphics consist of several graphs, presenting depth-oriented results. This menu item opens a dialog box which allows you to visualise the selected state variables on the screen by activating the corresponding check boxes. On the whole, the dialog box is self-explanatory.



Leave the dialog box by pressing "**Show system**". If the system has already been analysed you can leave the box by pressing "**Show results**" and then view the result graphics on the screen.

5.4.9 "Labelling preferences" menu item

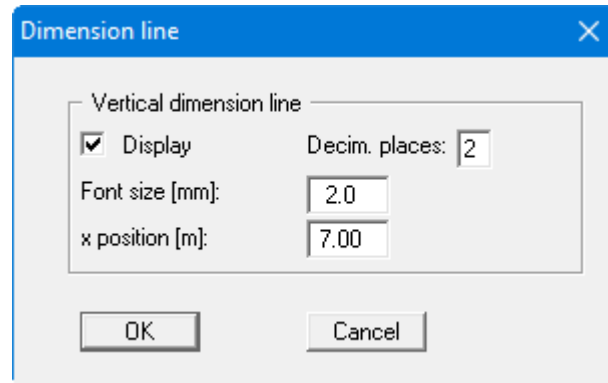
This menu item allows you to specify labelling preferences for the result graphics.



You can position the section labelling at the desired position. You can also specify the number of decimal places for the displacement shown in the graphics.

5.4.10 "Dimension line" menu item

You can define a vertical dimension line for the graphics in order to emphasise and clarify the system dimensions. If the dimension line is displayed on the screen, the following dialog box can also be accessed directly by double-clicking the dimension line.



The distance to the dolphin is defined by means of the "**x position**" in metres in the scale selected (see the menu item "**Page size + margins/Manual resize (editor)**" in Section 5.7.3). Negative values define a position to the left of the dolphin. In addition, you can specify the font size and the number of decimal places.

The fastest way to modify the position of a dimension line is to press the **[F11]** function key and then to pull the dimension line to the new position with the left mouse button pressed.

5.4.11 "Display system" menu item

Once a system has been analysed, all the state variables are automatically shown as graphics on screen. If you want to view the system without state variables, clicking this menu item will enable you to do so.

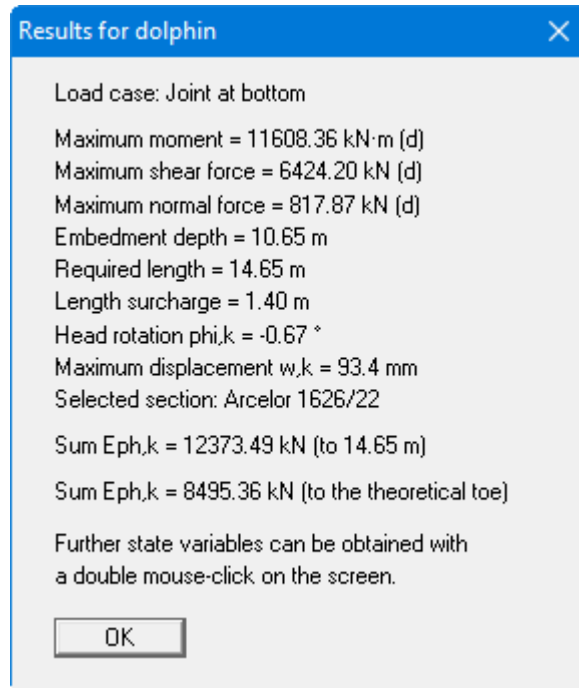
5.4.12 "Display results" menu item

After a system has been analysed, all state variables are automatically presented as graphics on the screen. If you used the menu item "**System/Display system**" to return to the system visualisation, you can go to this menu item to return to the result presentation without renewed analysis. Of course, this only works if the system has already been analysed.

5.5 Evaluation menu

5.5.1 "Main output summary" menu item

After selecting this menu item or pressing the [F6] key, you will see a message box containing governing system analysis variables. If analysing using "**General load cases**", the result of the load case with the greatest steel utilisation is shown.



You are also informed that double-clicking the left mouse button (after you have closed the message box) on any part of the graphics will cause the corresponding state variables to be shown on screen.

5.5.2 "Results" menu item

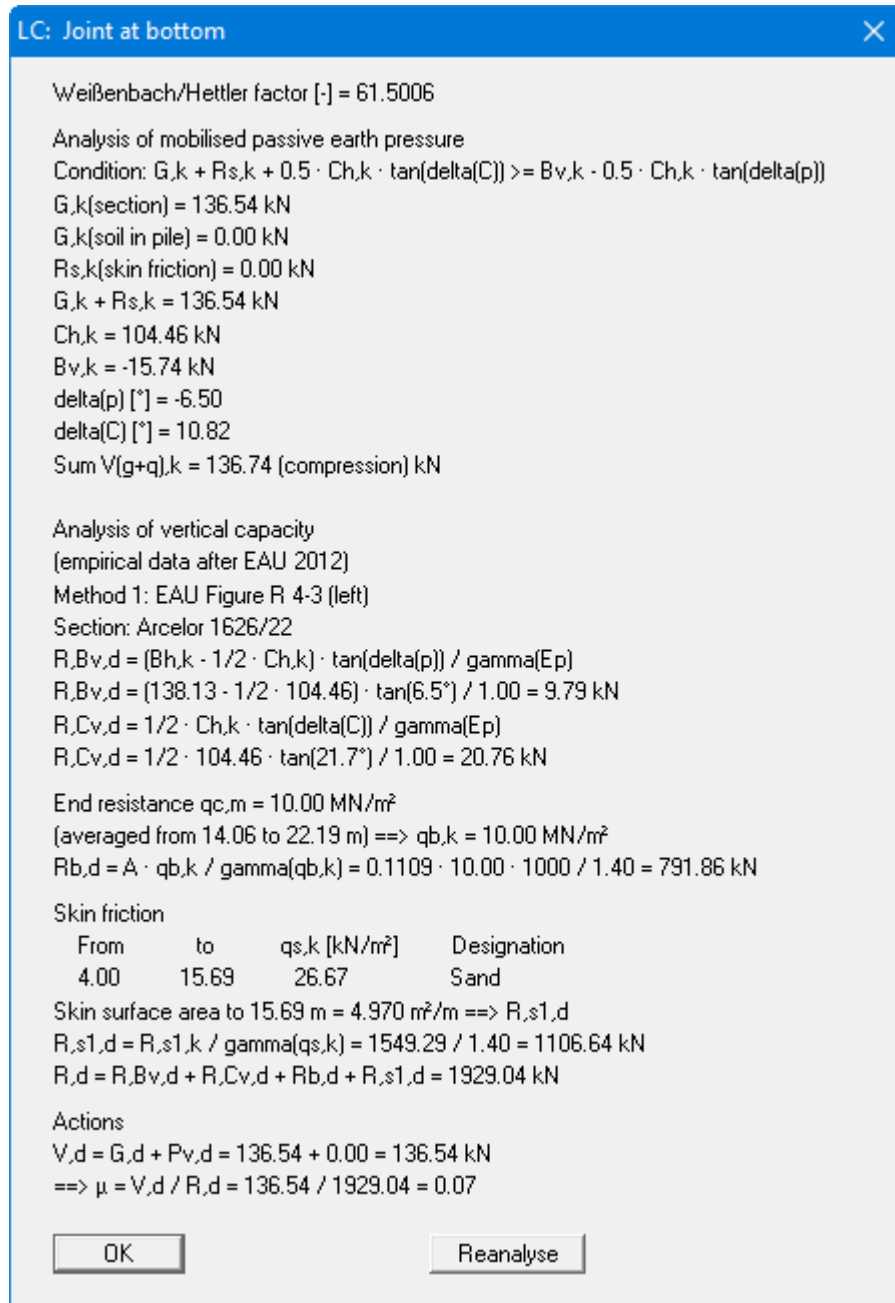
If analysing using "**General load cases**", you will see a message box with the results of all analysed load cases. This function can also be accessed by pressing [F7].

When analysing a single load case, the message box shows the analysis result at the point with the greatest steel utilisation, which is indicated graphically in the system view by the force arrow on the dolphin.

5.5.3 "Sum V" menu item

You will see all information about the verification of sum V in a message box. This dialog box always opens immediately following the analysis and design of specific load cases:

If the verifications have not yet been activated, activate them in the "Editor 1/Sum V analysis" dialog box (see Section 5.2.8) and have the system reanalysed. After selecting this menu item, you will see the following result box, for example:



By clicking the "Reanalyse" button, you can edit the settings in the following dialog box and re-calculate the sum V verifications:

Analysis of vertical capacity

Empirical data

☐ Use own empirical data

?

Analysis method

☒ Method 1
☐ Method 2

?

Partial safety factors

End resistance $\gamma(q_{b,k})$ [-]:
1.400

Skin friction $\gamma(q_{s,k})$ [-]:
1.400

?

Adjustment factors

Cone resistance adjustment factor [-]:
1.000

Skin friction adjustment factor [-]:
1.000

Extension

Extension below TF [m]:
0.00

?

Minimum embedment in load-bearing strata

Minimum value [m]:
2.50

Angle of equivalent force C_k

$\delta(C) / \phi_{i,k}$ [-]:
-0.667

?

Cohesive soils

EAU defines no values for $q_{b,k}$ and $q_{s,k}$ for cohesive soils ($q_c = 0$; $c_{u,k} > 0$).

☐ Adopt values taken from Piling Recommendations

?

Analysis without end resistance

☐ Allow analysis without end resistance

?

Piling Recommendations input data

Ratio (min., max.) =
0.00

?

☐ Allow interpolation for $q_c < 7.5 \text{ MN/m}^2$ (Skin friction)

☐ Allow interpolation for $c_{u,k} < 60 \text{ kN/m}^2$ (Skin friction)

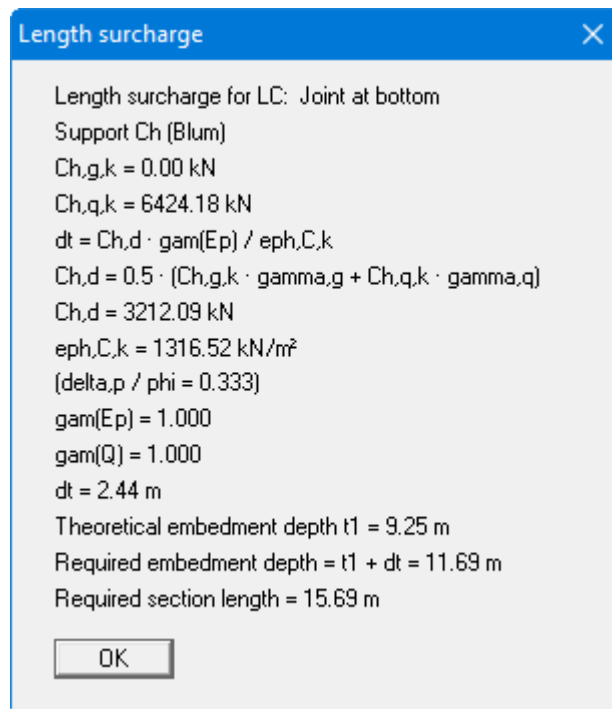
OK

Cancel

Once the modifications are confirmed by pressing "**OK**" the data is displayed in a message box. After closing the box the results for analysis of Sum V are displayed in the *General legend*, if the appropriate check box is activated (see Section 5.6.8).

5.5.4 "Length surcharge" menu item

A message box appears containing the result of the length analysis:

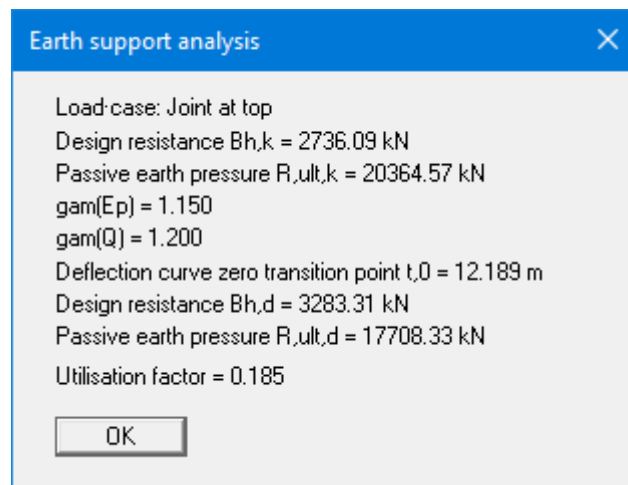


5.5.5 "Move section bases" menu item

If you are analysing using several sections, you can move the bottom edges of the sections using the mouse to achieve optimised section utilisation. The system is recalculated immediately after moving the bottom edge. You can also activate movement by pressing the [F8] function key.

5.5.6 "Earth support analysis" menu item

When calculating with the *p-y method*, the earth support is verified by default. The result is displayed in a message box.

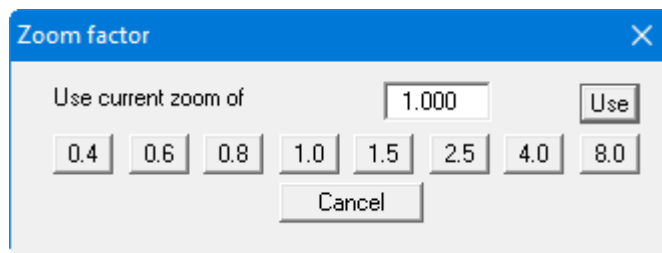


5.6 Graphics preferences menu

5.6.1 "Refresh and zoom" menu item

The program works on the principle of *What you see is what you get*. This means that the screen presentation represents, overall, what you will see on your printer. In the last consequence, this would mean that the screen presentation would have to be refreshed after every alteration you make. For reasons of efficiency and as this can take several seconds for complex screen contents, the screen is not refreshed after every alteration.

If, e.g., after using the zoom function (see below), only part of the image is visible, you can achieve a complete view using this menu item.



A zoom factor between 0.4 and 8.0 can be entered in the input box. By then clicking on "Use" to exit the box the current factor is accepted. By clicking on the "0.4", "0.6", etc. buttons, the selected factor is used directly, and the dialog box closed.

It is much simpler, however, to get a complete overview using [Esc]. Pressing [Esc] allows a complete screen presentation using the zoom factor specified in this menu item. The [F2] key allows screen refreshing without altering the coordinates and zoom factor.

5.6.2 "Zoom info" menu item

By clicking two diametrically opposed points you can enlarge a section of the screen in order to view details better. An information box provides information on activating the zoom function and on available options.

5.6.3 "Legend font selection" menu item

With this menu item you can switch to a different true-type font. All available true-type fonts are displayed in the dialog box.

5.6.4 "Pen colour and width" menu item

In order to enhance the clarity of the graphics you can edit the pen settings for various graphic elements (e.g. moment, shear force, water, load cases, etc.). You can edit the pen widths for the elements shown in the dialog box; by clicking on the button with the element designation you can also edit the pen or fill colours.

On *monochrome printers* (e.g. laser printers), colours are shown in a corresponding grey scale. Graphic elements employing very light colours may be difficult to see. In such cases it makes sense to edit the colour preferences.

5.6.5 "Mini-CAD toolbar" and "Header toolbar" menu items

Using these two menu items you can add free text to the graphics and add lines, circles, polygons and images (e.g. files in formats BMP, JPG, PSP, etc.). PDF files can also be imported as images. The same pop-up menu opens for both menu items, the icons and functions used are described in more detail in the **Mini-CAD** manual saved in the 'C:\Program Files (x86)\GGU-Software\Manuals' folder during installation. The differences between the Mini-CAD and Header CAD are as follows:

- Objects created with "**Mini-CAD**" are based on the coordinate system (generally in metres), in which the drawing is produced, and are shown accordingly. You should use the "**Mini-CAD toolbar**" when you wish to add information to the system (for example, labelling of slope inclinations or the location of any foundations).
- Objects created with the "**Header CAD**" are based on the page format (in mm). This makes you independent of the coordinate system and keeps you in the same position on the page. You should select the "**Header toolbar**" if you wish to place general information on the drawing (company logo, report numbers, plan numbers, stamp etc.). Once you have saved the header information to disk (see "**Mini-CAD**" user manual), you can load it into completely different systems (with different system coordinates). The saved header information will appear in the same position on the page, which greatly simplifies the creation of general page information.

5.6.6 "Toolbar preferences" menu item

After starting the program, a horizontal toolbar for menu items appears below the program menu bar. If you would rather work with a popup window with several columns, you can specify your preferences using this menu item. The smart icons can also be switched off.

At the bottom of the program window, you find a status bar with further information. You can also activate or switch off the status bar here. The preferences will be saved in the "**GGU-DOLPHIN.alg**" file (see menu item "**Graphics preferences/Save graphics preferences**") and will be active at the next time the program is started.

By clicking on the tools (smart icons) for the menu items you can directly reach most of the program functions. The meaning of the smart icons appears as a text box if you hover with the mouse pointer over the tools. Some of the tool functions can be activated from the normal menu items.



"Next page"/"Previous page"

Using this icon, you can navigate between the individual pages in the *tabular representation*.



"Select page"

If you are in the *tabular representation*, you can use this icon to jump to a specific page or to return to the *normal representation*, that is, to the graphics.



"Zoom out"

If you have previously *zoomed in*, this tool returns to a full screen display.



"Zoom (-)"/"Zoom (+)"

With the zoom functions you can zoom in or out of parts of the image, by clicking the left mouse button.



"Colour on/off"

If you need to remove the colour from the system presentation, to create a black and white printout, for example, use this on/off switch.



"Move object"

Use this icon to position legends and diagrams at the desired position on the output sheet.



"Copy/print area"

Use this tool to copy only parts of the graphics in order to paste them, e.g. to a report. You will see information on this function and can then mark an area, which is copied to the clipboard or can be saved in a file. Alternatively you can send the marked area directly to your printer (see "**Tips and tricks**", Section 6.4).



"Undo"

By clicking this icon the last performed change (e.g. movement of graphical elements made using the [F11] function key or the menu item "**Graphics preferences/Move objects**") can be undone.

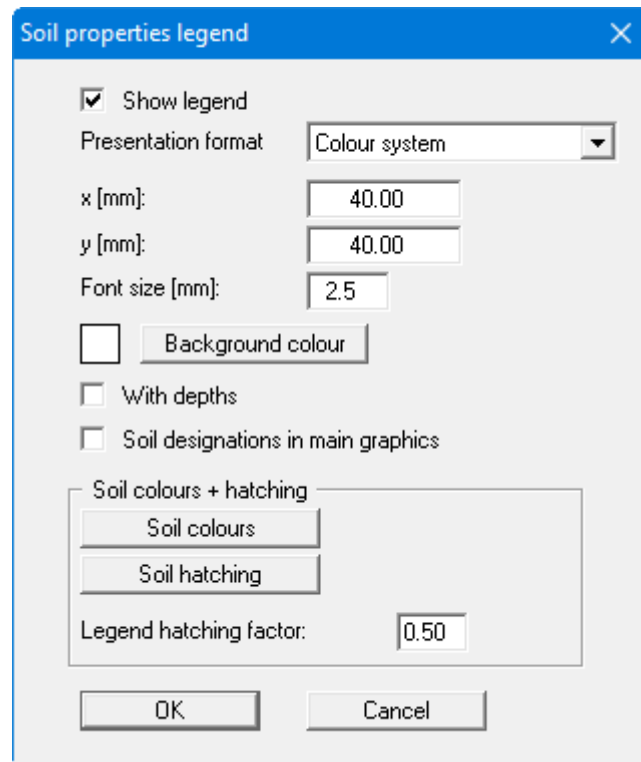


"Restore "

By clicking this symbol, the last change undo carried out using "**Undo**" can be restored.

5.6.7 "Soil properties legend" menu item

If the "**Show legend**" check box is activated, a legend with the soil properties of the individual layers will be displayed on your output sheet. You can alter the type of visualisation using the dialog box of this menu item.



You can define and edit the position of the legend using the values "**x**" and "**y**". The size of the legend is controlled by the values for "**Font size**". You can define a background colour.

The fastest way to modify the position of the legend is to press the [F11] function key and then to pull the legend to the new position with the left mouse button pressed.

By activating the "**With depths**" check box the values of the individual soil layers will be shown in the legend. The designations entered for the individual ground layers are displayed in the system graphics adjacent to the layer depths if the "**Soil designations in main graphics**" check box is activated.

If "**System coloured**" is activated in the combo box, the soils will be displayed coloured both in the soil properties legend and in the system graphics. You can also define either hatching or colour fill and hatching for the different soil types in the combo box. If you select "**System without all**", the soils are merely numbered. The various settings can also be accessed via the "**Colour/Hatch**" tool in the menu items toolbar (see Section 5.6.6).

The required settings can be made in the "**Soil colours + hatching**" group box:

- "**Colours**"
You will see a dialog box, in which you can define your preferences. After clicking the button with the desired number, you can assign each soil layer a new number or reorganise using the "**Soil colours/Reorganise**" command button. You can save your colour preferences to a file with "**Soil colours/Save**" and use them for different systems by means of the "**Soil colours/Load**" command button. In the lower group box you can also transfer the colour preferences to the Windows colour management dialog box, or vice versa, as user-defined colour preferences for example. You can read a further description by pressing the "**Info**" button.
- "**Hatching**"
Opens a dialog box in which you can define different hatching for each soil.
- "**Legend hatching factor**"
Input here allows tighter hatching in the soil legend. Input < 1.00 can be useful if the hatching spacing is so large that the differences in the hatching of individual soils can no longer be properly discerned in the relatively small boxes used in the legend.

5.6.8 "General legend" menu item

A legend with general properties will be displayed on your output sheet, if the "Show legend" check box is activated in the dialog box of this menu item.

General legend

☒ Show legend

x [mm]: 30.00

y [mm]: 282.50

Font size [mm]: 2.5

Max. no. of lines 13

☐ Background colour

☐ Show program name and version

☐ Show standard

☒ Marked red if not verified

☐ Show buckling analysis

☒ Show sum V analysis

☐ Show subgrade analysis

☒ Req. section length

☒ Req. embedment depth

☒ Show abbreviations for 'General load cases'

☒ Working capacity calculation

Do not enter file name

Without date and time

OK Cancel

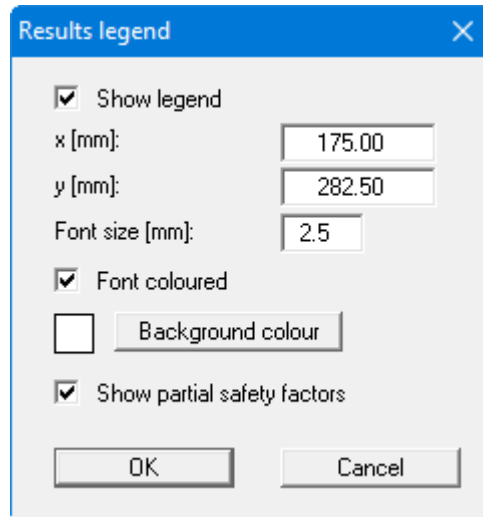
You can define and edit the position of the legend using the values "x" and "y". You control the size of the legend using "Font size" and "Max. no. of lines"; where necessary, several columns are used. The fastest way to modify the position of the legend is to press the [F11] function key and then to pull the legend to the new position with the left mouse button pressed.

By activating the appropriate check boxes you decide which information and descriptions (e.g. verification of sum V, description of load case abbreviations, etc.) are also included in the *General legend*.

Furthermore, in the *General legend* you can, if wished, display information on the program (name and version), on the adopted standard and on the current file (name, path, time info). Any project identification entered in the "File/New" or "Editor 1/Analysis options" dialog box will be shown automatically in the *General legend*.

5.6.9 "Results legend" menu item

Following analysis and design using "**General load cases**" a legend containing the principal system analysis results is displayed on the screen, if the "**Show legend**" check box is activated. You can alter the type of visualisation using the dialog box of this menu item.



You can define and edit the position of the legend using the values "**x**" and "**y**". You control the size of the legend using "**Font size**". A background colour for the legend also can be defined. The fastest way to modify the position of the legend is to press the [F11] function key and then to pull the legend to the new position with the left mouse button pressed.

If the "**Font coloured**" check box is activated, the text for the respective load case is shown in the colours defined in the "**Graphics preferences/Pen colour and width**" menu item (see Section 5.6.4). You can also have the partial safety factors shown in the legend.

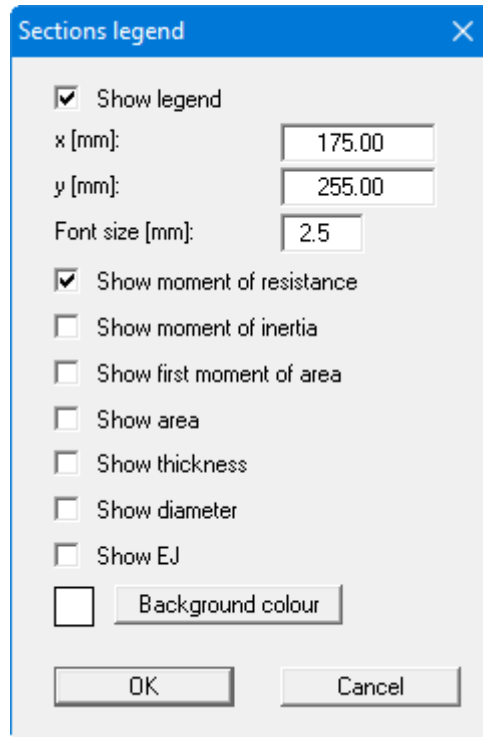
5.6.10 "Design legend" menu item

After successful analysis and design of selected load cases, a legend will be displayed on the screen with the most important results of the system design, if the "**Show legend**" check box is activated in this menu item's dialog box.

You can define and edit the position of the legend using the values "**x**" and "**y**". You control the size of the legend using "**Font size**" and "**Max. no. of lines**"; where necessary, several columns are used. The fastest way to modify the position of the legend is to press the [F11] function key and then to pull the legend to the new position with the left mouse button pressed.

5.6.11 "Sections legend" menu item

A legend containing the principal analysis parameters of the used single section or several sections is displayed on the screen. In the dialog box for this menu item, you can alter the legend's display format or completely hide it by deactivating the "**Show legend**" check box.



You can define and edit the position of the legend using the values "**x**" and "**y**". The size of the legend is controlled by the values for "**Font size**". You can define a background colour. Additional parameters can be displayed by activating the different check boxes.

5.6.12 "Section visualisation" menu item

A legend containing a small sketch of the pile section employed is displayed on the screen. Using this menu item you can alter the type of presentation or turn off the legend completely.

Section visualisation

☒ Show legend

x [mm]: 180.66 Height [mm]: 30.00

y [mm]: 256.10 Width = 1.5 · height

Font size [mm]: 2.0

☒ With soil fill

Background Soil fill

Show which section: R0 1420/20

OK Cancel

You can define and edit the position of the legend using the values "**x**" and "**y**". The size of the legend is controlled by the height-width ratio. The size of the legend is controlled using a height to width ratio based on the height you have entered. The fastest way to modify the position of the legend is to press the [**F11**] function key and then to pull the legend to the new position while holding the left mouse button.

If the dolphin tube has been backfilled, you can display this by activating the "**With soil fill**" check box and specifying the required colour using the "**Soil fill**" check box in the section drawing.

Because only one section can be displayed at a time, the dialog box also displays the query below asking which of the sections used should be displayed when analysing using different sections.

5.6.13 "p-y curves legend" menu item

If you work with the p-y method, a legend of the p-y curves can be displayed. Using this menu item you can alter the type of presentation or turn off the legend completely.

Function p = f(y)

☒ Show function p = f(y)

Heading:

x value [mm]: Width [mm]:

y value [mm]: Height [mm]:

Font size (heading) [mm]:

Font size (axes) [mm]:

☐ Automatic axes max. y [m]:

Pen width [mm]:

Show which soil:

☐ Use soil colours

p-y curves on:

☐ Background colour

OK Cancel

You can define and edit the position of the legend using the values "x" and "y". The size of the legend is controlled by the height and width you have entered. The fastest way to modify the position of the legend is to press the [F11] function key and then to pull the legend to the new position while holding the left mouse button.

You can adapt the display of the function $p = f(y)$ to meet your requirements based on the selected soil, alignment of the p-y curves or line colours.

5.6.14 "Move objects" menu item

Select this menu item in order to position legends, diagrams and other graphical elements at the desired position on the output sheet. You can also move objects by pressing [F11] and then positioning the legend box with the left mouse button pressed. In that case an info-box appears no more.

If "**Manual graph positioning**" has been selected in the "**System/Graph positioning preferences**" menu item (see Section 5.4.7), the result graphs can also be repositioned using this function.

5.6.15 "Save graphics preferences" menu item

Some of the preferences you made with the menu items of the "**Graphics preferences**" menu can be saved to a file. If you select "**GGU-DOLPHIN.alg**" as file name, and save the file on the same level as the program, the data will be automatically loaded the next time the program is started and need not be entered again.

If you do not go to "**File/New**" upon starting the program, but open a previously saved file instead, the preferences used at the time of saving are shown. If subsequent changes in the general preferences are to be used for existing files, these preferences must be imported using the menu item "**Graphics preferences/Load graphics preferences**".

5.6.16 "Load graphics preferences" menu item

You can reload a graphics preferences file into the program, which was saved using the "**Graphics preferences/Save graphics preferences**" menu item. Only the corresponding data will be re-freshed.

5.7 Page size + margins menu

5.7.1 "Auto-resize" menu item

This menu item provides a to-scale visualisation, in both x and y coordinates, of the system and result graphics. If you have previously altered the image coordinates graphically or via editor, you can quickly achieve a complete view using this menu item. This function can also be accessed using the [F9] function key.

5.7.2 "Manual resize (mouse)" menu item

You can use the coordinates of a section of the visualisation as the new image coordinates by marking the desired area with the mouse, pressing the left mouse button and holding the [Ctrl] and [Shift] keys. The scales of the x- and y-axes are adjusted accordingly. If the previous proportions (scale x-direction/scale y-direction) need to be retained, the "**Proportional section**" check box must be activated.

Alternatively, you can simply "**Redefine origin**" of the visualisation. The previous scale preferences are not affected by this.

5.7.3 "Manual resize (editor)" menu item

You can alter the image coordinates by direct numerical input in a dialog box. This allows precise scale input. The coordinates refer to the *drawing area*. This can be defined in the "**Page size + margins/Page size and margins**" menu item by means of the plot margins (see Section 5.7.5).

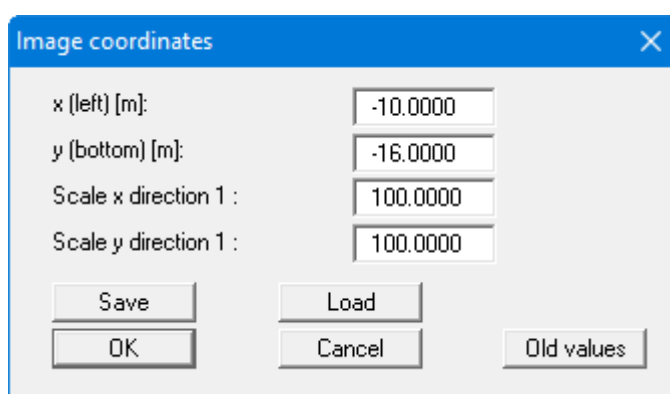


Image coordinates	
x (left) [m]:	-10.0000
y (bottom) [m]:	-16.0000
Scale x direction 1 :	100.0000
Scale y direction 1 :	100.0000
Save Load	
OK Cancel Old values	

The image coordinates entered here can be saved in a file with the extension ".bxy" and be reloaded later for the same file or for different files.

If you want to recover the previous values during input or use the menu item again after editing the coordinates, you can do this by pressing the "**Old values**" button.

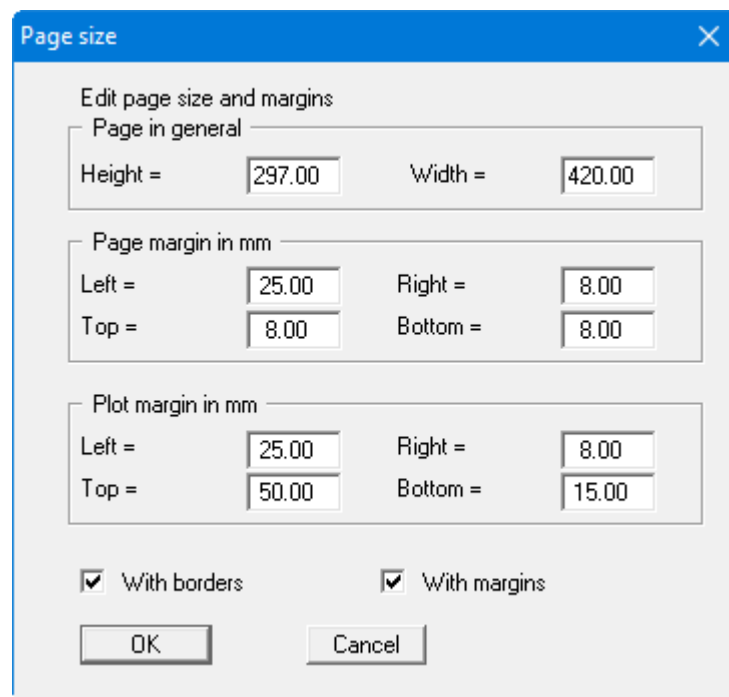
5.7.4 "Font size selection" menu item

You can edit font sizes for labelling the various drawing elements.

The font sizes of legend texts are edited in the respective legend editor. Just double-click in a legend to do this.

5.7.5 "Page size and margins" menu item

The default page set-up is A3 when the program is started. You can edit the page format in the following dialog box.



The screenshot shows a 'Page size' dialog box with the following settings:

Page in general	
Height =	297.00
Width =	420.00

Page margin in mm	
Left =	25.00
Right =	8.00
Top =	8.00
Bottom =	8.00

Plot margin in mm	
Left =	25.00
Right =	8.00
Top =	50.00
Bottom =	15.00

At the bottom, the 'With borders' and 'With margins' checkboxes are checked. The 'OK' and 'Cancel' buttons are at the bottom.

- **"Page in general"** defines the size of the output sheet. The A3 format is set as default. The program automatically draws thin cutting borders around the page, which are required when using a plotter on paper rolls. The borders can be switched off using the **"With borders"** check box.
- **"Page margin"** defines the position of a frame as a distance to the margins. This frame encloses the subsequent diagram. You can switch off the frame deactivating the **"With margins"** check box.
- The **"Plot margin"** define a set distance between the page margin and the actual *drawing area* in which the graphical evaluation of your input is presented.

5.7.6 "Undo" menu item

If you have carried out any changes to dialog boxes or moved objects to a different position on the screen after selecting the **"Graphics preferences/Move objects"** menu item or using the [F11] function key, this menu item will allow you to undo the movements. This function can also be reached by using the key combination [Alt] + [Back] or the appropriate tool in the toolbar (see Section 5.6.6).

5.7.7 "Restore" menu item

When this menu item is selected the last change made in a dialog box or the last change in the position of objects, which you undid using the menu item **"Page size + margins/Undo"** will be restored. This function can also be reached by using the key combination [Ctrl] + [Back] or the appropriate tool in the toolbar (see Section 5.6.6).

5.7.8 "Preferences" menu item

You can activate or deactivate the undo functions.

5.8 Info menu

5.8.1 "Copyright" menu item

You will see a copyright message and information on the program version number.

The "**System**" button shows information on your computer configuration and the folders used by **GGU-DOLPHIN**.

5.8.2 "GGU on the web" menu item

Using this menu item, you can access the GGU Software website: www.ggu-software.com.

Get information on updates and modifications on a regular basis from your program module page. On the "Changelogs" subpage, you can also subscribe to an e-mail notification that informs you of all changes monthly.

5.8.3 "GGU support" menu item

This menu item takes to the GGU-Software Contact area at www.ggu-software.com.

5.8.4 "Compare earth pressure coefficients" menu item

Here you can calculate the earth pressure coefficients for given values of phi, delta and beta.

5.8.5 "Help" menu item

The **GGU-DOLPHIN** manual is opened as a PDF document. The help function can also be accessed using the [F1] function key.

5.8.6 "What's new?" menu item

You will see information on program improvements in comparison to older versions.

5.8.7 "Language preferences" menu item


This menu item allows you to switch the menus and the graphics from German to English and vice versa. To work in German, deactivate the two check boxes **Dialoge + Menüs übersetzen (translate dialogs, menus)** und **Graphiktexte übersetzen (translate graphics)**.

Alternatively, you can work bilingually, e.g. with German dialog boxes but with graphic output in English. The program always starts with the language setting applicable when it was last ended.

6 Tips and tricks

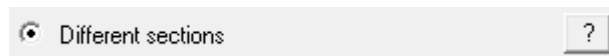
6.1 "?" buttons

Reading of the manual can mostly be dispensed with, because

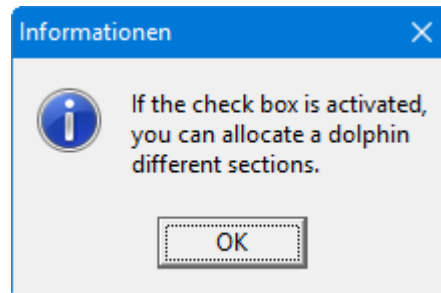
"?" buttons 

dealing with almost all geotechnical and program-specific problems are available in the dialog boxes. You are presented with the necessary information by clicking the "?" button.

For example, the following check box can be found in the "**Editor 1/Analysis options**" dialog box:

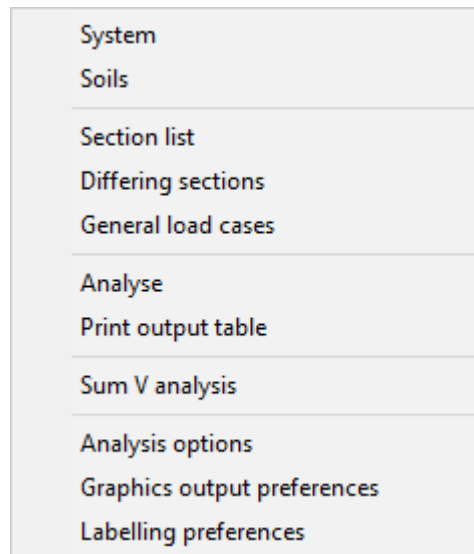


If you click on the question mark, you will see the following message box:



6.2 Keyboard and mouse

If you click the right mouse button anywhere on the screen a context menu containing the principal menu items opens.



By double-clicking the left mouse button on legends or **Mini-CAD** objects, the editor for the selected element immediately opens, allowing it to be edited.

If you double-click in the system graphics with the left mouse button you will see a message box with the results at the selected depth. This gives you a quick overview of the results for any desired depth.

You can scroll the screen with the keyboard using the cursor keys and the [**Page up**] and [**Page down**] keys. By clicking and pulling with the mouse, with [**Ctrl**] pressed, you activate the zoom function, i.e. the selected section will fill the screen. Use the mouse wheel to zoom in or out of the screen view or to pan.

In addition, scale and coordinates of the system graphics (drawing area within the plotting margins) can be altered directly using the mouse wheel. The following mouse wheel functions are available:

Change system graphics (new values can be checked in "Page size + margins/Manual resize (editor)"):

- [Ctrl] + mouse wheel up = enlarge system graphics (change of scale)
- [Ctrl] + mouse wheel down = shrink system graphics (change of scale)
- [Shift] + mouse wheel up = move system graphics up
(change in system coordinates)
- [Shift] + mouse wheel down = move system graphics down
(change in system coordinates)
- [Shift] + [Ctrl] + mouse wheel up = move system graphics right
(change in system coordinates)
- [Shift] + [Ctrl] + mouse wheel down = move system graphics left
(change in system coordinates)

Change screen coordinates:


- Mouse wheel up = move screen image up
- Mouse wheel down = move screen image down
- [Alt] + [Ctrl] + mouse wheel up = enlarge screen image (zoom in)
- [Alt] + [Ctrl] + mouse wheel down = shrink screen image (zoom out)
- [Alt] + [Shift] + mouse wheel up = move screen image right
- [Alt] + [Shift] + mouse wheel down = move screen image left

6.3 *Function keys*

Some of the function keys are assigned program functions. The allocations are noted after the corresponding menu items. The individual function key allocations are:

- [Esc] refreshes the screen contents and sets the screen back to your current zoom, which has the default value 1.0. This is useful if, for example, you have used the zoom function to display parts of the screen and would like to quickly return to a complete overview.
- [F1] opens the manual file.
- [F2] refreshes the screen without altering the current magnification.
- [F5] opens the menu item "**System/Analyse**".
- [F6] opens the menu item "**Evaluation/Main output summary**".
- [F7] opens the menu item "**Evaluation /Results**".
- [F8] opens the menu item "**Evaluation /Move section bases**".
- [F9] opens the menu item "**Page size + margins/Auto-resize**".
- [F11] activates the menu item "**Graphics preferences/Move objects**".

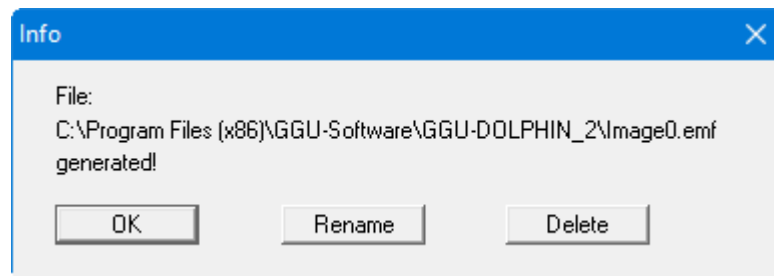
6.4 "Copy/print area" icon

A dialog box opens when the "**Copy/print area**" icon  in the menu toolbar is clicked, describing the options available for this function. For example, using this icon it is possible to either copy areas of the screen graphics and paste them into the report, or send them directly to a printer.

In the dialog box, first select where the copied area should be transferred to: "**Clipboard**", "**File**" or "**Printer**". The cursor is displayed as a cross after leaving the dialog box and, keeping the left mouse button pressed, the required area may be enclosed. If the marked area does not suit your requirements, abort the subsequent boxes and restart the function by clicking the icon again.

If "**Clipboard**" was selected, move to the MS Word document (for example) after marking the area and paste the copied graphics using "*Edit/Paste*".

If "**File**" was selected, the following dialog box opens once the area has been defined:



The default location of the file is the folder from which the program is started and, if several files are created, the file is given the file name "**Image0.emf**" with sequential numbering. If the "**Rename**" button in the dialog box is clicked, a file selector box opens and the copied area can be saved under a different name in a user-defined folder. Saving can be aborted by pressing the "**Delete**" button.

If the "**Printer**" button was pressed in the first dialog box, a dialog box for defining the printer settings opens after marking the area. Following this, a dialog box for defining the image output settings opens. After confirming the settings the defined area is output to the selected printer.

7 Literature

- [1] Recommendations of the Committee for Waterfront Structures, EAU 2012, 11th Edition. Hafenbautechnische Gesellschaft e.V. and German Geotechnical Society. Ernst & Sohn, Berlin 2012.

- [2] Rudolph inter alia: Vergleichsberechnungen zur Dalbenbemessung nach Blum und mit der p-y-Methode (Comparative analyses for dolphin design after Blum and using the p-y method). geotechnik 34 (2011) Issue 4, pp. 237-251.

8 Index

A

Absolute heights, activate use.....	17
Additional length,	
consider in analysis	30
define.....	30
Analysis results,	
display for selected depth	42
display in a legend.....	52
display in a message box	42
save as file.....	8

B

Base inclination, enter on the passive side.....	18
Bed of the water body, enter.....	18
Bending line,	
calculation with Young's modulus.....	28
Buckling analysis,	
select method for analysis	28, 31, 34
show results in legend	51

C

Clipboard	14
Cohesion,	
enter/adopt from soil database	19
Colour,	
activate for load cases in legend.....	52
define for load cases presentation.....	46
define for water presentation	46
Colour/hatching,	
define for soils.....	50
switch on/off	48, 49
Colour/pens, define for graphical elements	46
Company letterhead, add via Mini-CAD	47
Cone resistance,	
enter/adopt from soil database	19
Context menu, open	62
Coordinates,	
alter via editor	57
alter with mouse	57
optimise/reset	57
save/load.....	57
Copy/print area	14, 48, 64
Corrosion, consider for section	27
Cutting borders, switch on/off	58

D

Database,	
for soil properties of common soils	19
Dataset description,	
display	51
enter.....	16
Delete,	
fenders.....	23
sections.....	26
soil layers	20
Design section, select	27
Design,	

display results in legend	52
edit input	36
find optimum section.....	37
Dimension line,	
define.....	41
move with mouse	56
Dolphin,	
define spacing.....	18
define different sections	28
define width for three-dimensional ep.....	17
Drawing area, define.....	58
DXF file,	
export	13
import.....	5

E

Earth pressure coefficients, be analysed	60
Earth quake, consider loads	24
Earth support,	
show verification in a message box	45
Editor window, output table.....	12
EJ, show in sections legend	53
EMF format	14
Equivalent force C, horizontal component.....	30

F

Fenders,	
activate analysis	33
analysis principles	33
define/delete	23
select for analysis	33
File,	
display name in legend.....	51
export to GGU-LATPILE	8
load/save.....	8
First moment of inertia,	
show in sections legend.....	53
Font selection.....	46
Font size,	
define for p-y-curves legend.....	55
define for section visualisation.....	54
define for sections legend.....	53
define for soil properties legend	49
design legend.....	52
dimension line	41
edit for graphical elements	58
general legend	51
Footer, output table.....	10
Friction angle,	
enter/adopt from soil database	19
Function keys.....	63

G

General page information,	
add via Mini-CAD.....	47
GGU-CAD file, export	14
GGUMiniCAD file, export.....	14
Global coordinates,	
use for Mini-CAD output	14

Graph positions,	
alter via editor	39
alter with mouse	56
Graphics, add via Mini-CAD.....	47

H

Hatching,	
define for soils.....	50
switch on/off	49
Header CAD, application explanations.....	47
Header, output table.....	10

L

Labelling, section in graphics	40
Language preferences	6, 60
Layout,	
define for output sheet.....	58
edit for output table	10
Legends, move with mouse	56
Length surcharge,	
consider in analysis	30
define.....	30
show results in a message box.....	45
show results in output table.....	9
Licence protection	6
Load cases,	
activate coloured display in legend	52
define.....	21
define colour/pens	46
define with 2 nd load	21
display analysis results in a legend.....	52
display analysis results in a message box	42
explain abbreviations in legend.....	51
export to GGU-LATPILE	8

M

Manual, open as PDF file	60
Max. steel utilisation,	
show section values in output table	9
Metafile, export	14
Mini-CAD,	
application explanations	47
export file	14
output with global coordinates	14
Moment of inertia, show in sections legend.....	53
Moment of resistance,	
show in sections legend.....	53
Mouse,	
click functions	62
wheel functions	63

N

Navigation, output table.....	47
-------------------------------	----

O

Objects, move with mouse.....	56
Output preferences.....	12, 13
Output table,	
edit output as ASCII.....	12
edit output as graphics.....	10

navigation.....	11
save/load settings for graphical display	10
select output format	9
switch to system graphics.....	11, 47

P

Page,	
copy/print section	48, 64
define format	58
switch margins on/off.....	58
Pagination, automatic	11, 12
Partial safety factors,	
edit.....	21
show in legend.....	52
Passive earth pressure, specify calculation	24
PDF file, import via Mini-CAD.....	5, 47
Pen preferences, edit for graphical elements.....	46
Plausibility checks, view results	29
Plot margins, define.....	58
Print,	
graphics	13
output table.....	13
section	14, 48, 64
several files.....	15
to clipboard.....	14
Program,	
display name in legend	51
save/load preferences	56
show improvements.....	60
show information.....	60
Project data, add via Mini-CAD	47
Project identification,	
display	51
enter.....	16
p-y method,	
display function curves in legend	55
enter soil properties	20
select type of load.....	16

R

Required working capacity,	
enter/determine via EAU equations.....	21, 34
show calculation in output table	9
Result graphics,	
alter positions	39
display	41
edit preferences	40
Results, display for selected depth.....	62
Rods, define for system	29

S

Scale,	
alter with mouse	57
define via editor.....	57
determine automatically	57
Scroll the screen.....	62
Sections,	
activate design with differing sections	17
activate selection from list.....	17
activate/edit legend with parameters	53
consider corrosion	27
define/delete	26

display as sketch in legend	54
edit labelling in graphics	40
edit/enlarge list	26
optimise length graphically	45
select for design	27
select for display in legend	54
Seismic acceleration, consider loads	24
Self-weight dolphin, calculation	28
Shear strength,	
for analysis of vertical capacity	19
Smarticons, for menu items	47
Soil colours/hatching,	
activate display	49
define	50
Soil designations,	
activate presentation in system graphics	49
define	19
enter	19
Soil layers,	
adapt to absolute heights	19
define/delete	20
Soil numbers, activate display	49
Soil properties,	
define	19
display in legend	49
enter/adopt from soil database	19
Specific weight, define for sections	28
Standard, display in legend	51
Status bar main program, activate	47
Steel grade, select for analysis	28, 31, 34
Subgrade analysis, show results in legend	51
Sum V,	
activate analysis/edit preferences	25
activate verification/settings	43
display verification in a message box	43
show analysis results in a message box	44
show analysis results in legend	51
System,	
activate colour/hatching	49
analyse	31
display	41
display properties in legend	51
division into rods	29
edit graphics output preferences	40
show information	29, 60

T

Three-dimensional earth pressure,	
define dolphin width	17
Toolbar, edit for menu items	47
Translation, activate	60
True-type font	46

U

Unit weight,	
enter/adopt from soil database	19

V

Version number,	
display in a message box	60
display in legend	51
Vertical capacity,	
activate analysis	25
edit settings	44
enter soil properties for analysis	19
show results in output table	9

W

Water level, enter	18
What you see is what you get	46
Working capacity,	
activate determination via H,q,k variation	21

Y

Yield strength, user-defined	17
Young's modulus,	
define for sections	28

Z

Zoom factor, define for full-screen display	46
Zoom function, activate	46, 47, 62