

GGU-DOLPHIN manual

Analysis and design of dolphins (Blum, p-y)

Exported on 1.9.2026

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Theorie. Und Praxis.

Geotechnische Softwarelösungen können so einfach sein. Denn Theorie und Praxis lassen sich mit **GGU-Software** und den neuen Angeboten der **civilserve Academy** prima kombinieren: Knackige theoretische Aufgaben lösen und als Sahnehäubchen Ihr

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Praxisseminare
vertiefen!**

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1 GGU-DOLPHIN: 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 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.

If you are already working with **GGU-CONNECT**, you can also import soil properties from your subsoil layer model that you have created in **GGU-CONNECT** (see menu item "**Editor 1 / Soils**").

There are "?" buttons and "Info" buttons in the dialogue boxes for many technical and program-specific questions. Click on the "?" or "Info" buttons to obtain the necessary information.

The program includes convenient data input. The system is permanently displayed on the screen. Every change to the data is displayed on the screen, so that optimum control of the input data is guaranteed.

There are "?" and "Info" buttons in the dialog boxes for many technical and program-specific questions. Click on the "?" buttons or "Info" buttons to obtain the necessary information.

The graphic output supports the true type fonts provided by WINDOWS, so that an excellent layout is guaranteed. Colour output and numerous graphic formats (BMP, TIF, JPG etc.) are supported. PDF and DXF files can also be imported via the integrated **Mini-CAD** system (see "**Mini-CAD**" manual).

The program has been extensively tested. No errors 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 GGU-DOLPHIN: 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 program is bound to a so-called **CmContainer** via a licence with the corresponding product code.

To be able to use the GGU licences in a CmContainer, a runtime environment, the **CodeMeter Runtime Kit**, must be installed on your computer via driver software. You can obtain the current version from [Software for Users - Wibu-Systems](#) (CodeMeter User Runtime for Windows).

You can work with the following CmContainer types on your PC with the CodeMeter Runtime Kit installed (= **CodeMeter licence server**):

- **CmStick**
The licence for your GGU program is stored in a USB dongle.
- **CmActLicense** (soft licence, not for virtual PC/servers)
The licence for your GGU program is stored in a licence file that is linked 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. The advantages of this type of licence binding are described on the following website: [Licence binding | GGU Software](#).

The GGU programs check at start-up and during runtime whether a corresponding license is available in a CmContainer.

3 GGU-DOLPHIN: Language selection

The GGU programs can be used in German and English. The program always starts with the language in which it was terminated.

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).

4 GGU-DOLPHIN: 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 screen is not refreshed after every alteration.

If you would like to refresh the screen contents, press either **[F2]** or **[Esc]**. The **[Esc]** key also resets the screen display to your current image zoom, which is usually preset to 1.0, which corresponds to an A3 or A4 sheet in most GGU programs (see menu item "**Graphics preferences/Refresh and zoom**").

5 Tipps and tricks

5.1 GGU-DOLPHIN: "?"- and "Info" buttons

Reading of the manual can mostly be dispensed with, because

"?" buttons or "Info" 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 buttons.

5.2 GGU-DOLPHIN: 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 content and resets the screen section to your current image zoom, which is preset to 1.0. This is useful, for example, if you have used the magnifying glass function to display sections of the drawing on the screen and want to quickly return to the overall view.
- **[F1]** opens the manual file.
- **[F2]** refreshes the screen without altering the current magnification.
- **[F11]** activates the menu item "**Move objects**", which appears in the GGU programs under various menu titles, e.g. "**Page size + margins**", "**Graphics preferences**" or "**Output preferences**".

In this GGU program, the following function keys are also assigned to program functions:

- **[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**".

5.3 GGU-DOLPHIN: Keyboard and mouse

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

System
Soils
Section list
Differing sections
General load cases
Analyse
Print output table
Sum V analysis
Analysis options
Graphics output preferences
Labelling preferences

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.

In most dialog boxes, the buttons for leaving the box or buttons for decisive functions are marked thickly and can be reached by clicking the **[Enter]/[Return]** key.

In dialog boxes in which you have to make entries, e.g. change soil properties, the quickest way to jump to the next input box is to use the **[Tab]** key. The previous value is marked and can be overwritten directly with the new entry. You do not have to move to the box with the mouse and delete the old entry in advance.

In input boxes with numerical values, you can use the calculation operations listed in “**Tips and tricks: Mathematical functions in input boxes with numbers**” to change them.

You can scroll the screen with the keyboard using the cursor keys and the **[Page up]** and **[Page down]** keys. After activating the zoom functions, click on an area of the screen to enlarge or reduce the display by a factor of 2. Alternatively, by clicking and dragging the mouse while holding down the **[Ctrl]** key, you define a window section which is then displayed in full screen. By clicking and dragging the mouse while holding down the **[Shift]** and **[Ctrl]** keys, you zoom into your system graphic, i.e. you change the scale of your system representation.

You can also use the mouse wheel to zoom in or out or to move the screen display. When the program is started for the first time, the default setting for mouse wheel operation is activated according to Windows conventions:

- Mouse wheel up = move screen image up
- Mouse wheel down = move screen image down
- **[Shift]** + mouse wheel up = move screen image right
- **[Shift]** + mouse wheel down = move screen image left
- **[Strg]** + mouse wheel up = enlarge screen image (zoom in)

[Strg] + mouse wheel down = reduce screen image (zoom out)

If you want to change the system coordinates and the scale of your system using the mouse wheel, activate the "**Mouse wheel operation with global coordinates**" check box in the dialog box of the "**Graphics preferences/Zoom info**" menu item. If you close the program with this setting, the setting is still activated the next time you start it. You can now use the following mouse wheel functions to change the system:

- **[Shift]** + mouse wheel up = move system graphics up
- **[Shift]** + mouse wheel down = move system graphics down
- **[Shift]** + **[Strg]** + mouse wheel up = move system graphics right
- **[Shift]** + **[Strg]** + mouse wheel down = move system graphics left
- **[Strg]** + mouse wheel up = enlarge system graphics (change of scale)
- **[Strg]** + mouse wheel down = reduce system graphics (change of scale)

From a zoomed representation you return to the full screen with **[Esc]**. You can undo a change in scale or system coordinates with **[F9]** (= menu item "**Page size + margins/Auto-resize**").

You can view the changed system coordinates in the menu item "**Page size + margins/Manual resize (editor)**" and, if necessary, adjust them manually by entering more precise numbers.

5.4 GGU-DOLPHIN: Mathematical functions in input boxes with numbers

In input boxes for numerical values, you can use the following arithmetic operations (also in combinations) to determine the desired value or to adjust the existing value. After pressing the **[Return]** or **[Enter]** key, the calculated value is inserted.

Function	Input
Add:	
5 + 12,18	5 + 12,18
Subtract:	
25,74 - 12,18	25,74 - 12,18
Multiply:	
5,23 · 4,18	5,23*4,18

$\pi \cdot 2,5^3$	$\text{PI} * 2,5^3$
Divide:	
$5,23 / 4,18$	$5,23/4,18$ or $5,23:4,18$
Exponentiate:	
2^5	2^5
Radify:	
Root of 27	$w(27)$ or $27^{(1/2)}$
5th root of 81,5	$81,5^{(1/5)}$
Sine, cosine, tangent etc.	
$\sin(32^\circ)$	$\sin(32)$
$\cos(5,23^\circ)$	$\cos(5,23)$
$\tan(45^\circ)$	$\tan(45)$
$\arctan(1,0)$	$\text{atan}(1,0) = 45^\circ$
Natural logarithm:	
$\ln(4,53)$	$\ln(4,53) = 1,5107$
Exponential function:	
$e^{1,5107}$	$\text{ep}(1,5107) = 4,53$

5.5 GGU-DOLPHIN: "Copy/print area" icon

A dialog box opens when the **"Copy/print area"** icon

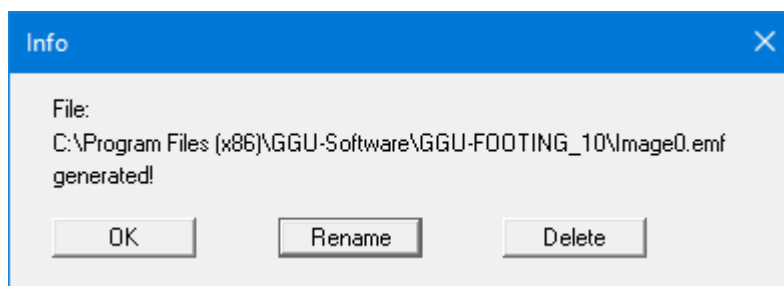


in the menu toolbar is clicked, describing the options available for this function. For example, using this icon it is possible to either copy areas of the screen graphics and paste them into the report, or send them directly to a printer.

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 appears after defining the area, shown here as an example for the **GGU-FOOTING** program:



The default location of the file is the folder from which the program is started (here: GGU-FOOTING_10) 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.

6 File menu

6.1 GGU-DOLPHIN: "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 there).

6.2 GGu-DOLPHIN: "Load" menu item

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

6.3 GGU-DOLPHIN: "Save" menu item

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

6.4 GGU-DOLPHIN: "Save as" menu item

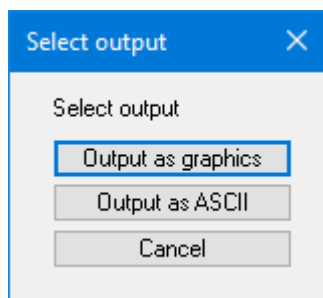
You can save data entered during program use to an existing file or to a new file, i.e. using a new file name. For reasons of clarity, it makes sense to use **".ggu_dlb"** as file suffix, as this is the suffix used in the file requester box for the menu item **"File/Load"**. If you choose not to enter 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.

6.5 "Print output table" menu item

6.5.1 GGU-DOLPHIN: Selecting the output format (Print output table)

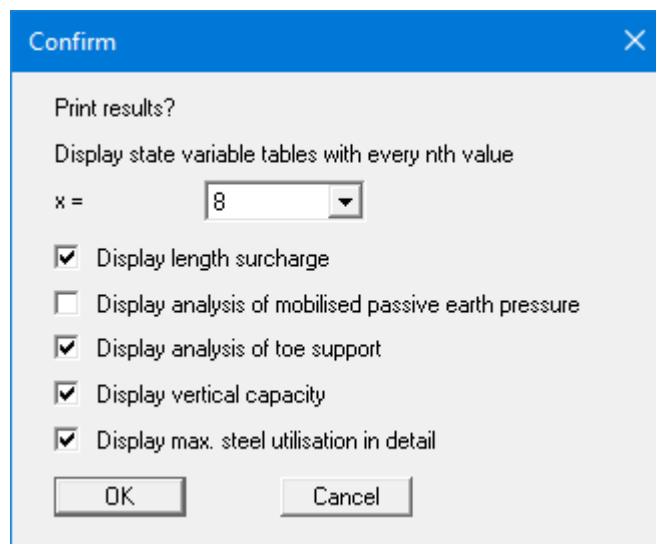
You can have a table printed containing the current analysis results. The results can be sent to the printer or to a file (e.g. for further editing in a word processor). The output contains all information on the current state of analysis, including the system data.

You have the option of designing and printing the output table as an annex to your report within the GGU 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 (as graphics or ASCII), 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. Confirm your input with "**OK**".

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.

6.5.2 GGU-DOLPHIN: "Output as graphics" button (Print output table)

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.

Graphical table preferences

Page sizes

Page height [mm] 297.0

Page width [mm] 210.0

☒ Borders

Page margins [mm]

Left: 25.00 Right: 8.00

Top: 8.00 Bottom: 8.00

☒ Page margins

Output table margins

Upper margin [mm] 12.0

Lower margin [mm] 12.0

Left margin [mm] 5.0

Right margin [mm] 5.0

Font

Font size [mm] 2.5

Line spacing 1.2

Header

☒ With headers Edit

Footer

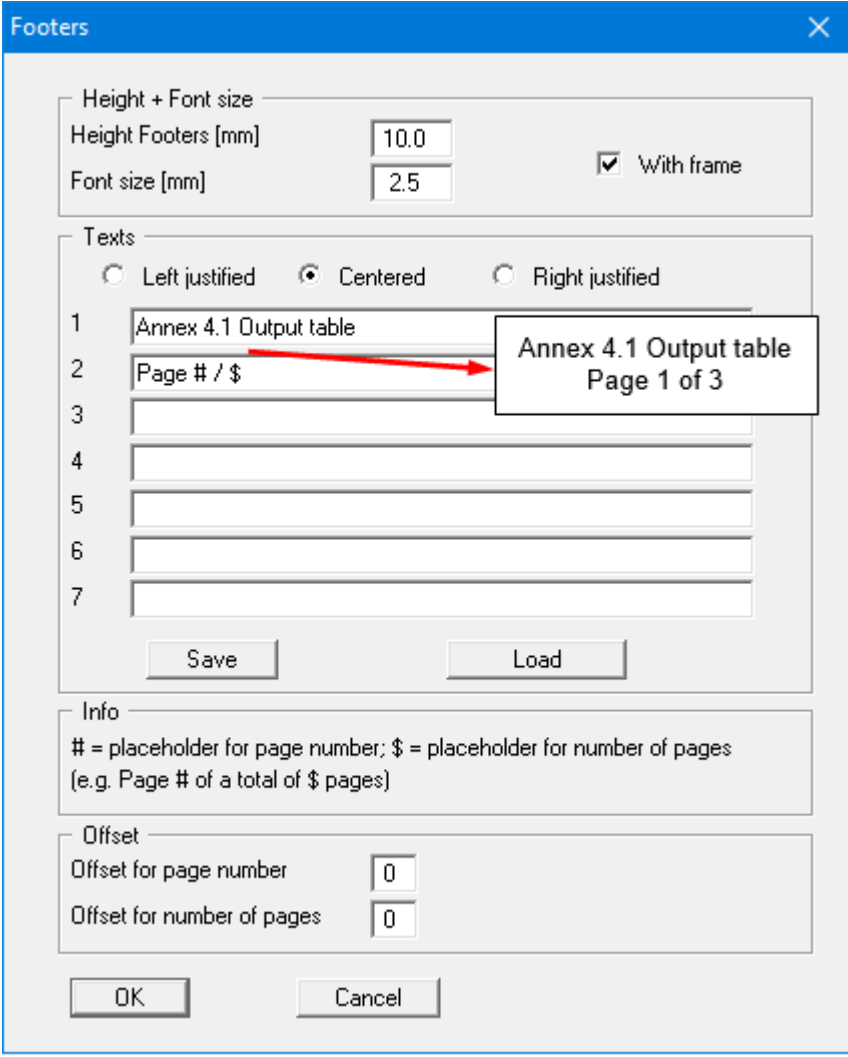
☒ With footers Edit

Save Load

OK Cancel

In the various group boxes of the dialog box, you can define preferences for the table output and layout. In some GGU programs a sketch of the system is integrated in the output table by activating an additional **"Incorporate graphics"** button.

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.



The 'Footers' dialog box is used to configure the footer information. It includes sections for 'Height + Font size', 'Texts', 'Info', and 'Offset'. The 'Texts' section allows for multiple lines of footer text, with options for justification (Left, Center, Right). A red arrow points from the 'Page # / \$' text in line 2 to a preview box showing 'Annex 4.1 Output table' and 'Page 1 of 3'. The 'Info' section explains the placeholders: '#' for page number and '\$' for total pages. The 'Offset' section allows for offsets for page number and total pages. Buttons for 'Save', 'Load', 'OK', and 'Cancel' are present.

Footers

Height + Font size
Height Footers [mm]
Font size [mm] ☒ With frame

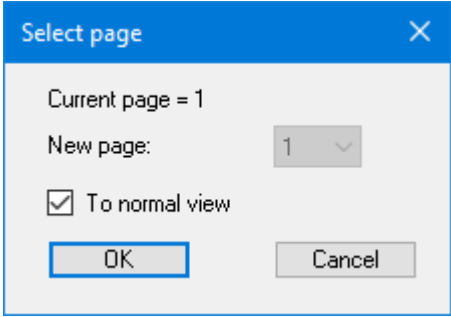
Texts
☐ Left justified ☒ Centered ☐ Right justified

1
2 Annex 4.1 Output table
Page 1 of 3
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 exiting the dialog boxes using "OK" you will see a further dialog box in which you can select the parameters to be used in the output table. After confirmation, the dialog box the output table is presented on the screen page by page. To navigate between the pages, use the arrow tools in the toolbar. If you need to jump to a certain page or back to the graphical visualisation, click on the tool. You will then see the following box:



The 'Select page' dialog box is used to select the page to be displayed. It includes a 'Current page' label, a 'New page' dropdown menu, a 'To normal view' checkbox, and 'OK' and 'Cancel' buttons.

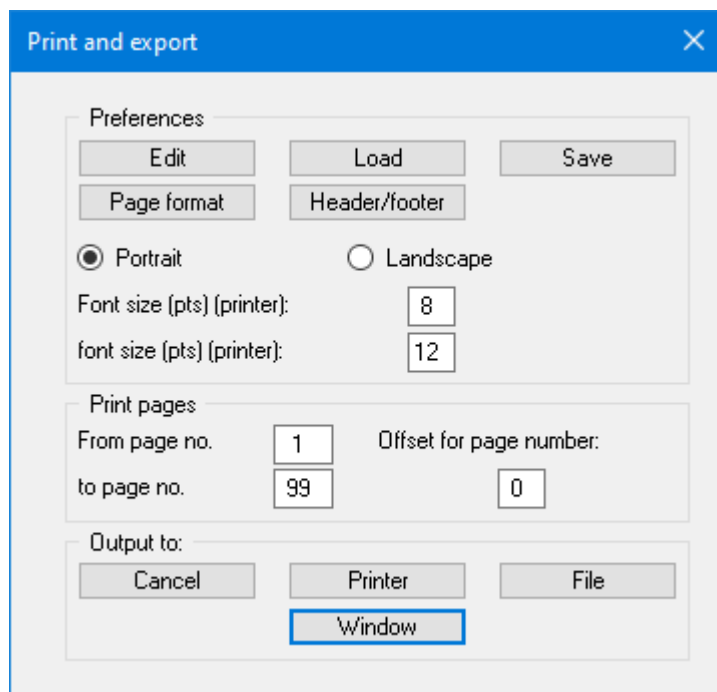
Select page

Current page = 1
New page:
☒ To normal view

aus

6.5.3 GGU-DOLPHIN: "Output as ASCII" button (Print output table)

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 the program name with the extension **".drk"** as the file name and save this file at program level (default setting), this file will be loaded automatically the next time the program is started.

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.

6.6 GGU-DOLPHIN: "Output preferences" menu item

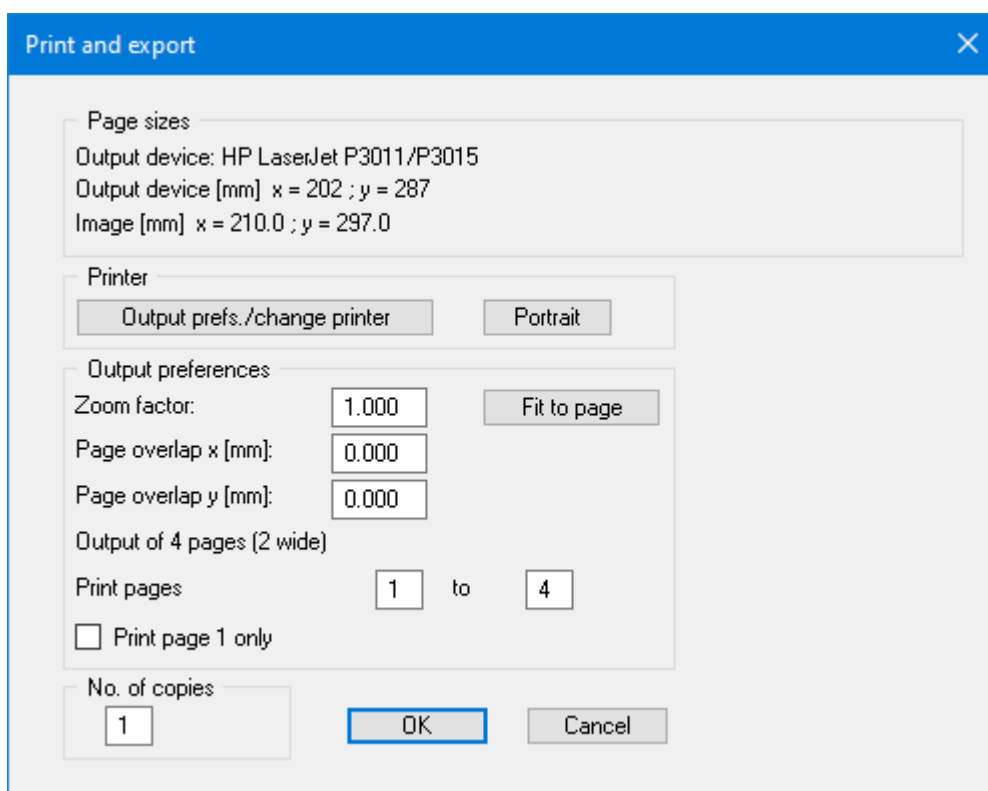
You can edit output preferences (e.g. swap between portrait and landscape) or change the printer in accordance with WINDOWS conventions.

6.7 GGU-DOLPHIN: Print and export

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

- "Printer"

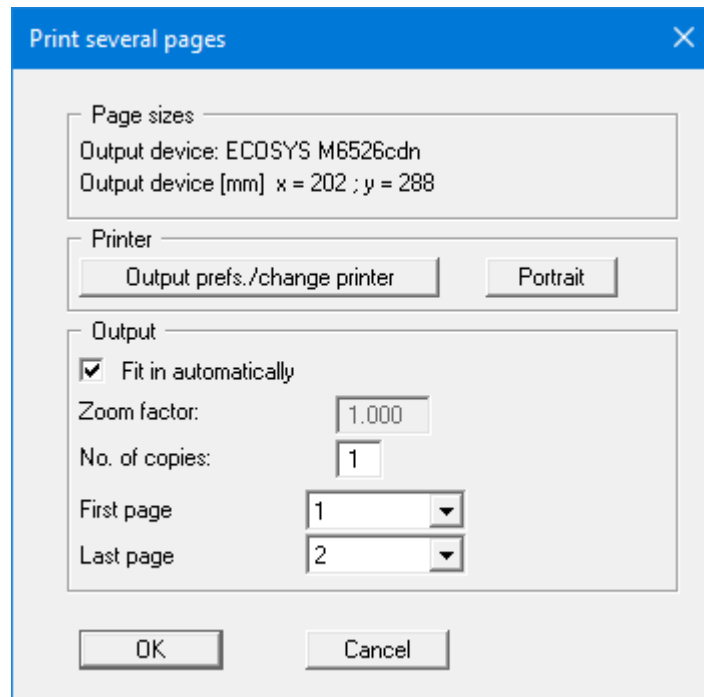
allows graphic output of the current screen contents (**graphical representation**) to the WINDOWS standard printer or to any other printer selected using the menu item "File/Output preferences". But you may also select a different printer in the following dialog box by pressing the "Output prefs./change 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). 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. You can also print only the 1st page with zoom factor = 1.0, in which case the bottom left-hand area is printed. 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**".



You can select the pages of the report to be printed here. To obtain an output with a zoom factor of 1 (button "**Fit in automatically**" is deactivated), you must reduce the page format of your report page so that it lies within the printable area of the output device. To do this, use the dialog box in "**File/Print output table**" button "**Output as graphics**".

In some programs, you can transfer a representation of the system graphic to the output table if you activate the "**Print main graphic**" check box available there.

- "**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 in order 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

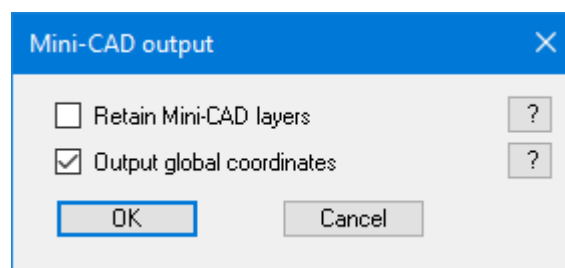


from the toolbar, you can copy parts of the graphics to the clipboard or save them to an EMF file. Alternatively you can send the marked area directly to your printer (see **"Tips and tricks"**).

Using the **"Mini-CAD"** program module you can also import EMF files generated using other GGU applications into your graphics (see menu item **"Graphics preferences/Mini-CAD"**).

- **"Mini-CAD"**

allows export of the graphics to a file 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. After importing the file and pressing the [F9] function key (menu item **"Page size + margins/Auto-resize"**) the system coordinates and the scale are corrected according to the transferred world coordinates. -

"GGUMiniCAD"

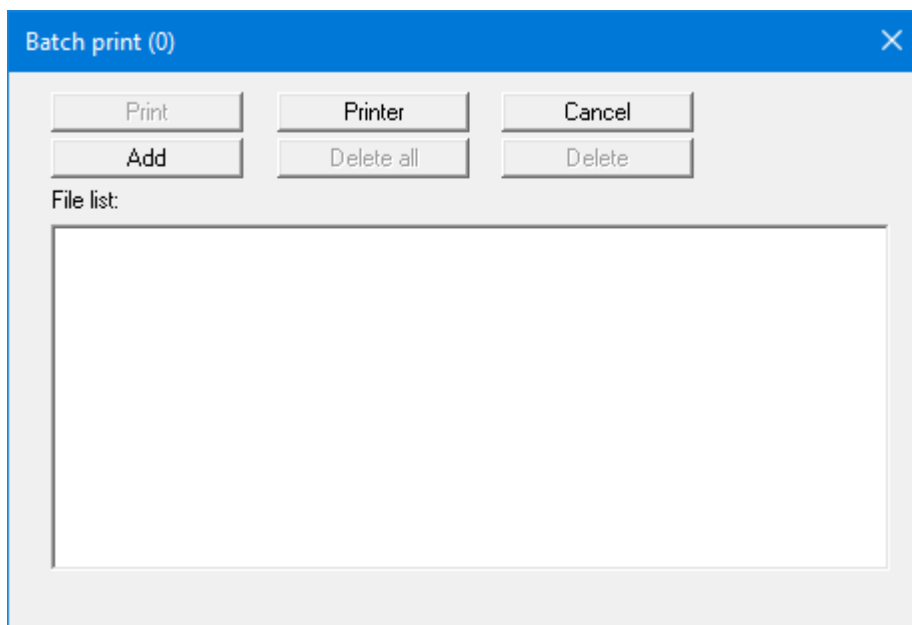
allows export of the graphics to a file in order to enable processing in the **GGUMiniCAD** program. -

"Cancel"

Printing is cancelled.

6.8 GGU-DOLPHIN: "Batch print" menu item

If you would like to print several appendices 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 printer 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.

6.9 GGU-DOLPHIN: "Exit" menu item

After a confirmation prompt, you can quit the program.

6.10 GGU-DOLPHIN: "1, 2, 3, ..." menu items

If you have not stored a working directory for the program icon, the program jumps to the program directory after starting to load or save a file.

Under the menu items of the File menu, the most recently edited files are listed with the respective storage path ("**1, 2, 3, ...**"). Selecting one of these files loads the selected file. The next time the **"File/Load"** or **"File/Save"** menu items are called up in the same program session, the program automatically jumps to the directory of the last file loaded.

7 Editor 1 menu

7.1 GGU-DOLPHIN: "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 contains the following settings:

- Project identification:** Example
- Type of analysis:** Blum's method (selected), p-y method, Passive earth pressure compliant with GEO-3 (unchecked, with a '?' button)
- Type of load:** Static (selected), Cyclic
- General:** Use absolute heights (unchecked), Designation for abs. height: mNHN, Show passive side on right (unchecked), Label passive and active sides in graphics (unchecked)
- Steel design:** With section list (selected, with a '?' button), Differing sections (unchecked, with a '?' button), Numerical dolphin width: Minimum diameter (dropdown), User-defined yield stress $f_{y,k}$ (steel) (unchecked)
- Recalculate image coordinates after each analysis:** checked

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

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.

7.2 GGU-DOLPHIN: "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).

System

System

Bed of body of water [m] 4.00

☐ Always water level = bed of the body of water

Water level [m] 2.00 ?

Base inclination [°] 0.00 ?

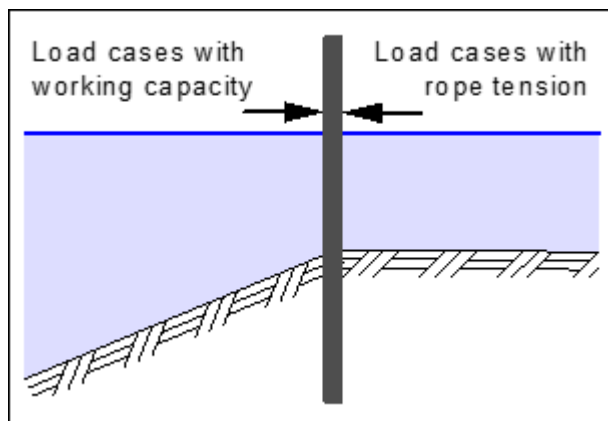
☒ Different force-action directions ?

Dolphin

Dolphin spacing [m] 100.00

OK Cancel

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.

7.3 GGU-DOLPHIN: "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.

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

If you would like to edit the number of soils, select the "**Edit number of soils**" or "**x soils to edit**" button and then enter the new number of soils. Using the "**Sort**" button, you can have the soils sorted according to depth. This sorting will be carried out automatically when leaving the dialog box, without the function being explicitly called-up. Erroneous input is thus impossible from the outset.

If several soils have been entered, and you would like to delete a soil which is not at the end of the list, you can assign this soil a large depth (e.g. 99.0). Then select the "**Sort**" button. The soil will now be at the end of the table and can be **deleted** by reducing the number of soils.

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 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. You can also use your adapted file in other GGU programs by means of the "**Common soils**" function if you copy the file into the appropriate GGU program folder.

All project data can be entered and managed in the **GGU-CONNECT** program. If you have already stored your drilling data as a soil strata model in your project, you can load the soil strata and properties as an xml file using the "**GGU-CONNECT**" button in the above dialog box. A brief overview of the procedure in **GGU-CONNECT** for exporting the data to the GGU analysis programs can be found here:

[GGU-CONNECT - Export contents for GGU analysis programs](#)

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.

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

No.	Depth [m]	gamma [kN/m³]	gamma' [kN/m³]	phi [°]	cu [kN/m²]	d(pas)/phi [-]	qc MN/m²	c _{u,k} kN/m²	eps 50% [-]	Type [-]	Designation
1	30.000	19.00	10.000	32.50	0.00	0.000	10.00	0.00	0.0050	non-cohesive	Sand

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.

7.4 GGU-DOLPHIN: "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 menu item **"System/Analyse"** Section **"Analysing several load cases in a single computation"**).

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]	M,q,k (2) [kN-m]	2nd load present
Joint at top	JoT	0.010	200.00	1.000	1.000	1.000	70.00	☒	1.000	0.00	0.00	0.00	☐
Joint at bottom	JoB	1.000	200.00	1.000	1.000	1.000	70.00	☒	1.000	0.00	0.00	0.00	☐
Rope tension	RoT	0.500	200.00	1.200	1.150	1.100	70.00	☐	1.000	0.00	0.00	0.00	☐

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:

Calculate working capacity Ed

$Ed = \eta \cdot 0.5 \cdot G \cdot v^2 \cdot C_m \cdot C_s \cdot C_c \cdot C_e$
(EAU 2012 6.15.4)

Additional factor η [-] =	1.000	?
Mass of ship G [t] =	8000.0	
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	?
Eccentricity factor C_e [-] =	0.700	?

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

$Ed = \eta \cdot (G \cdot C_m \cdot C_s \cdot C_c) / (2 \cdot (k^2 + r^2)) \cdot [v^2 \cdot (k^2 + r^2 \cdot \cos^2(\alpha)) + 2 \cdot v \cdot \omega \cdot r \cdot k^2 \cdot \sin(\alpha) + \omega^2 \cdot k^2 \cdot r^2]$
(EAU 2012 6.15.4)

Additional factor η [-] =	1.000	?
Mass of ship G [t] =	8000.0	
Length of ship L [m] =	100.0	
Mass radius of inertia of ship k [m] =	25.00	?
Mooring speed of ship v [m/s] =	0.13	?
Distance to centre of mass r [m] =	0.00	?
Rotating speed ω [rad/s] =	0.00	
Angle α between v and r [°] =	84.00	?
Virtual mass factor C_m [-] =	1.650	?
Factor for ship flexibility C_s [-] =	0.950	?
Waterfront structure attenuation factor C_c [-] =	0.950	?

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**").

7.5 GGU-DOLPHIN: "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.

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
21	SPC 300	G 2.9	15.3	107.0
22	SPC 300	G 3.0	15.3	110.0
23	SPC 300	G 3.1	16.2	112.0
24	SPC 350	G 0.9	11.7	76.0

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**"

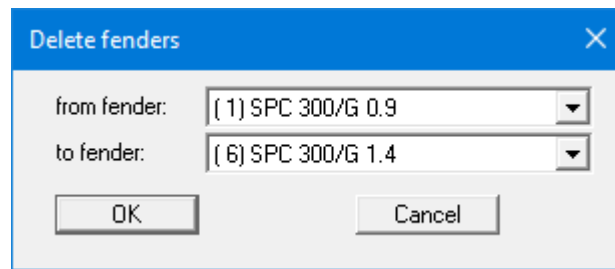
Using the first button you may expand or reduce the list of fenders. New fenders are added to the end of the list. A description of the abbreviations used to enter the fender data is available via the "**Info**" button.

- "**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.

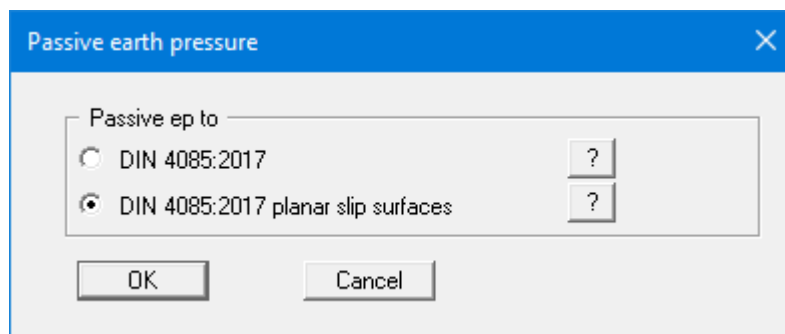


- **"Manipulate values"**

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.

7.6 GGU-DOLPHIN: "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 " $|\delta| \leq \frac{2}{3} \phi$ ".

7.7 GGU-DOLPHIN: "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).

Seismic acceleration

Consideration of seismics

☒ Modify earth pressure coefficients (EC 8)

☐ Modify earth pressure coefficients (EAU 1990)

Input

kh = ah/g (horizontal) [-]: ?

kv = av/g (vertikal) [-]: ?

Partial safety factor gam,phi' [-]: ?

(ah = horizontal seismic acceleration in m/s²)

(av = vertical seismic acceleration in m/s²)

(g = gravitational acceleration = 9.81 m/s²)

Info

kh = 0,1 ==> Building damage

kh = 0,2 ==> Serious building damage

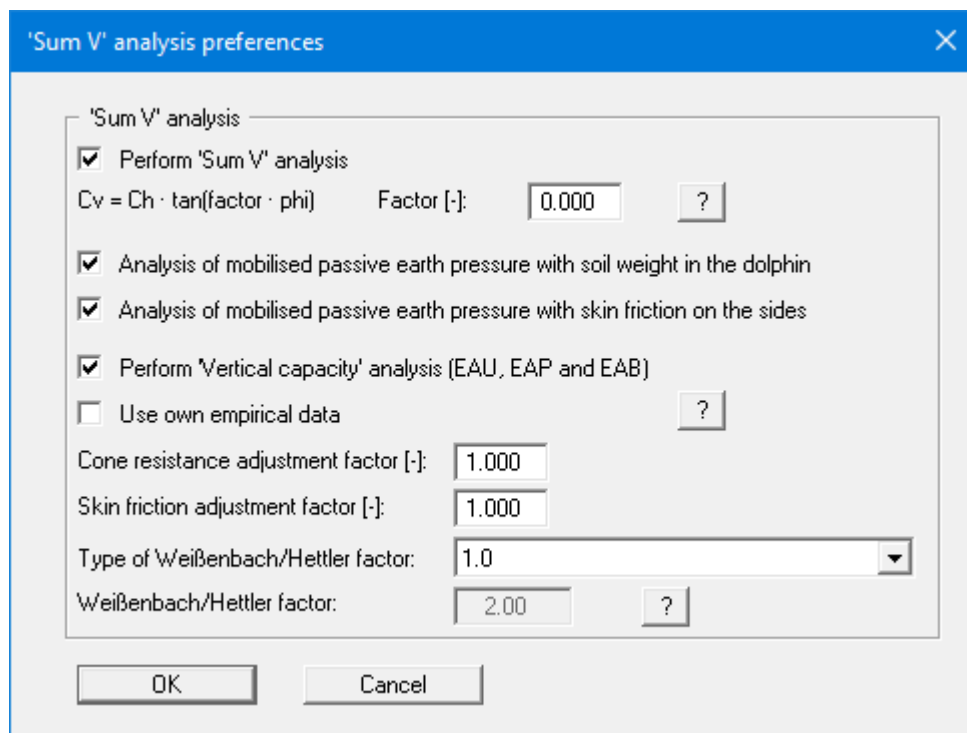
kh = 0,8 ==> Devastating

kh = 1,0 ==> Complete devastation

OK Cancel

7.8 GGU-DOLPHIN: "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 software dialog box titled "'Sum V' analysis preferences". It contains several settings for analysis:

- ☒ Perform 'Sum V' analysis
Cv = $Ch \cdot \tan(\text{factor} \cdot \phi)$ 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 are "OK" and "Cancel" buttons.

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

8 Editor 2 menu

8.1 GGU-DOLPHIN: "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.

Sections

Forw.

Back

Cancel

Done

Load

Save

Sort

Delete

Delete doubles

Go to no.:

1

47 Sections to edit

Info

Select section

Generate tubular section

No.	Designation	D [mm]	t [mm]	W _{el} [cm ²]	W _{pl} [cm ²]	A [cm ²]	I [cm ⁴]	Available steel grades										
								235	275	355	420	460	240	270	320	390	430	690
1	Arcelor 1016/12	1016.0	12.0	9389.5	12096.8	378.5	476984.5	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
2	Arcelor 1016/14	1016.0	14.0	10889.6	14057.0	440.7	553192.0	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
3	Arcelor 1016/16	1016.0	16.0	12371.6	16001.4	502.7	628479.4	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
4	Arcelor 1219/14	1219.0	14.0	15784.6	20329.3	530.0	962072.2	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
5	Arcelor 1219/16	1219.0	16.0	17950.6	23156.7	604.7	1094091.3	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
6	Arcelor 1219/18	1219.0	18.0	20094.9	25965.2	679.1	1224782.5	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
7	Arcelor 1422/16	1422.0	16.0	24565.3	31630.7	706.7	1746594.4	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
8	Arcelor 1422/18	1422.0	18.0	27519.2	35483.8	793.9	1956613.7	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
9	Arcelor 1422/20	1422.0	20.0	30447.6	39314.7	880.9	2164822.5	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
10	Arcelor 1524/16	1524.0	16.0	28279.9	36386.4	758.0	2154928.1	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
11	Arcelor 1524/18	1524.0	18.0	31689.4	40826.6	851.6	2414734.3	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
12	Arcelor 1524/20	1524.0	20.0	35071.6	45243.0	945.0	2672453.6	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
13	Arcelor 1626/18	1626.0	18.0	36153.8	46543.9	909.3	2939306.9	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
14	Arcelor 1626/20	1626.0	20.0	40022.4	51587.4	1009.1	3253822.5	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
15	Arcelor 1626/22	1626.0	22.0	43861.8	56605.5	1108.6	3565967.3	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
16	Arcelor 1829/18	1829.0	18.0	45914.2	59036.9	1024.1	4198852.7	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
17	Arcelor 1829/20	1829.0	20.0	50848.1	65452.3	1136.6	4650061.1	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
18	Arcelor 1829/22	1829.0	22.0	55749.1	71839.0	1248.9	5098253.1	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
19	Arcelor 2032/20	2032.0	20.0	62968.5	80965.5	1264.2	6397594.7	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐
20	Arcelor 2032/22	2032.0	22.0	69060.4	88885.7	1389.2	7016536.1	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐	☐

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"**

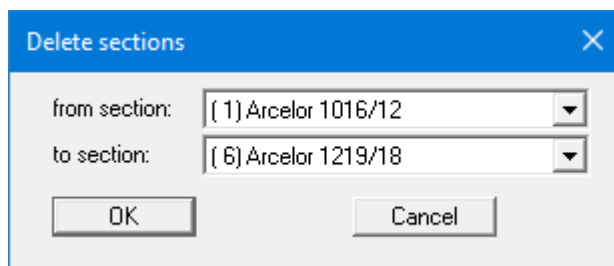
Using the first button you may expand or reduce the list of sections. New sections are added to the end of the list. A description of the abbreviations used to enter the section data is available via the **"Info"** button.

- **"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.

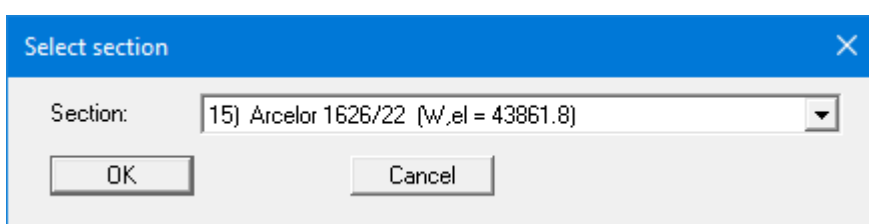
- **"Delete"**

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



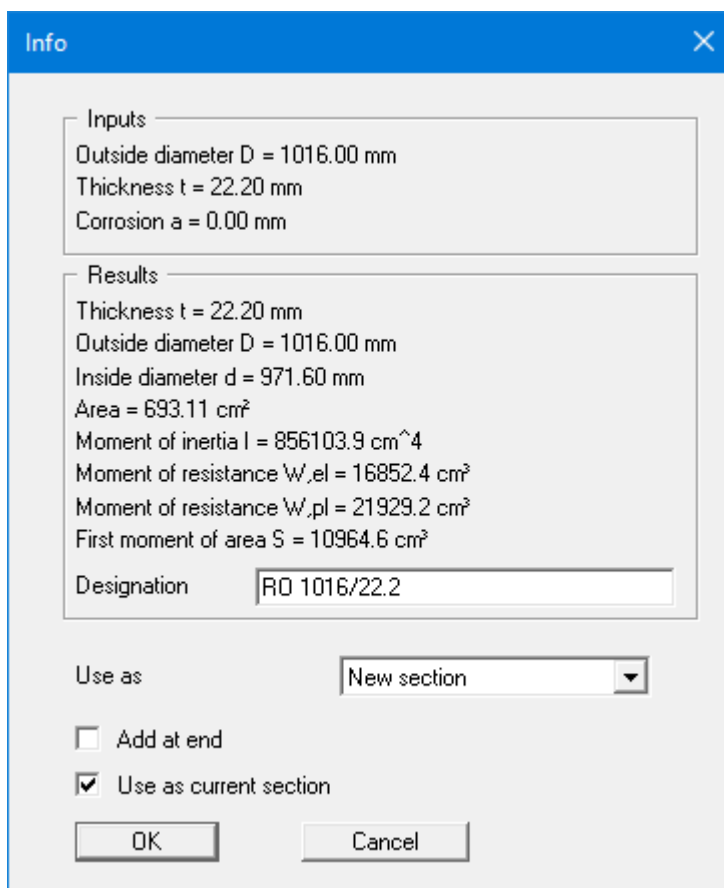
- **"Select section"**

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:



8.2 GGU-DOLPHIN: "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	Buckling analysis
1	4.000	Arcelor 1524/16	S 355	Buckling analysis with $f_{y,k}$ reduction
2	13.805	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**".

8.3 GGU-DOLPHIN: "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.

9 System menu

9.1 GGU-DOLPHIN: "Info" menu item

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

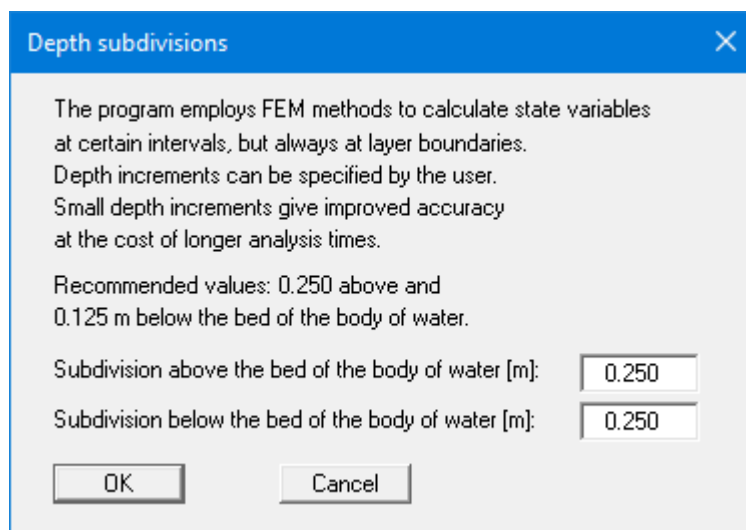
9.2 GGU-DOLPHIN: "Special preferences" menu item

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.

9.3 GGU-DOLPHIN: "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.



9.4 GGU-DOLPHIN: "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:

$$\Delta x \geq Ch / ephC$$

Ch = equivalent force after Blum (horizontal component)

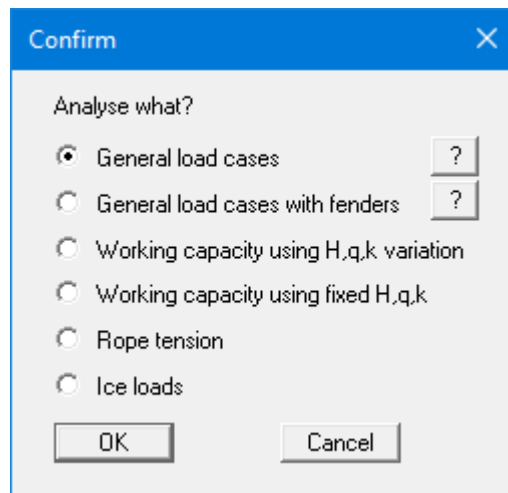
ephC = passive earth pressure stress at the theoretical toe TF

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.

9.5 "Analyse" menu item

9.5.1 GGU-DOLPHIN: Select load case for analysis

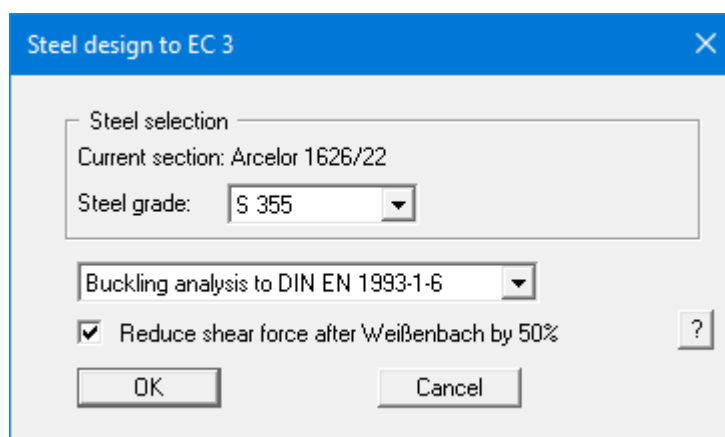
Once you have entered all data required to fully describe the system it can be analysed. You can also initiate the analysis using the [F5] function key. You will see the following dialog box, in which you now select the required load case or cases.



9.5.2 GGU-DOLPHIN: 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:

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]	M,q,k (2) [kN·m]	2nd load present
Joint at top	JoT	0.010	200.00	1.000	1.000	1.000	70.00	☒	1.000	0.00	0.00	0.00	☐
Joint at bottom	JoB	1.000	200.00	1.000	1.000	1.000	70.00	☒	1.000	0.00	0.00	0.00	☐
Rope tension	RoT	0.500	200.00	1.200	1.150	1.100	70.00	☐	1.000	0.00	0.00	0.00	☐

OK Cancel Save Load Sort LC 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 [-]	H,q,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.

9.5.3 GGU-DOLPHIN: 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 start dialog box you will initially also see the dialog box for the steel design settings compliant with EC3 (see menu item "System/Analyse" Section "Analysing several load cases in a single computation"). 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.

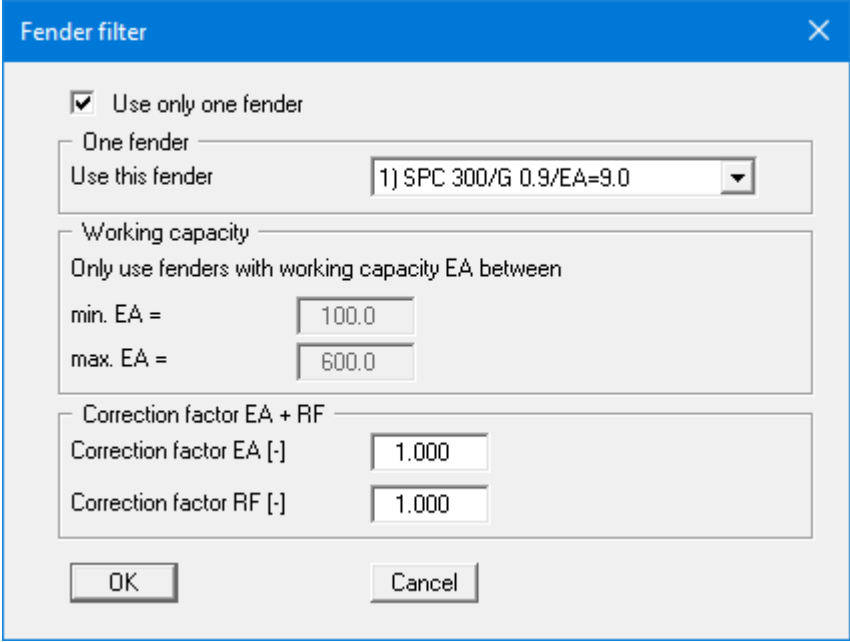
General load cases

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]	Fenders analysis	Depth (2) [m]	H,q,k (2) [kN]	V,q,k (2) [kN]	M,q,k (2) [kN·m]	2nd load present
Joint at top	JoT	0.010	200.00	1.000	1.000	1.000	70.00	☒	1.000	0.00	0.00	0.00	☐
Joint at bottom	JoB	1.000	200.00	1.000	1.000	1.000	70.00	☒	1.000	0.00	0.00	0.00	☐
Rope tension	RoT	0.500	200.00	1.200	1.150	1.100	70.00	☐	1.000	0.00	0.00	0.00	☐

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

For fender analysis, the **Req. working capacity** must first be entered or determined by pressing the **"Calculate working capacity"** button (also see menu item **"Editor 1/General load cases"**). 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:



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.

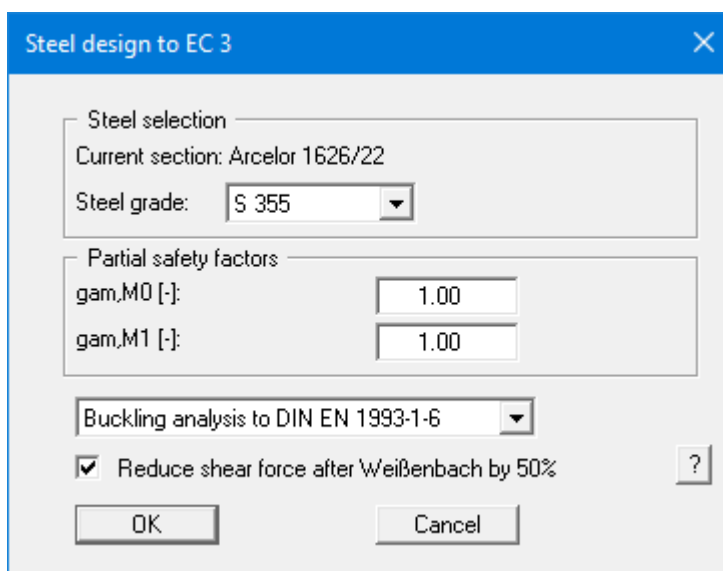
You can find another example with fender analysis in the **"Example General load cases_Fenders.ggu_dlb"** file in the program's examples folder.

9.5.4 GGU-DOLPHIN: 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.

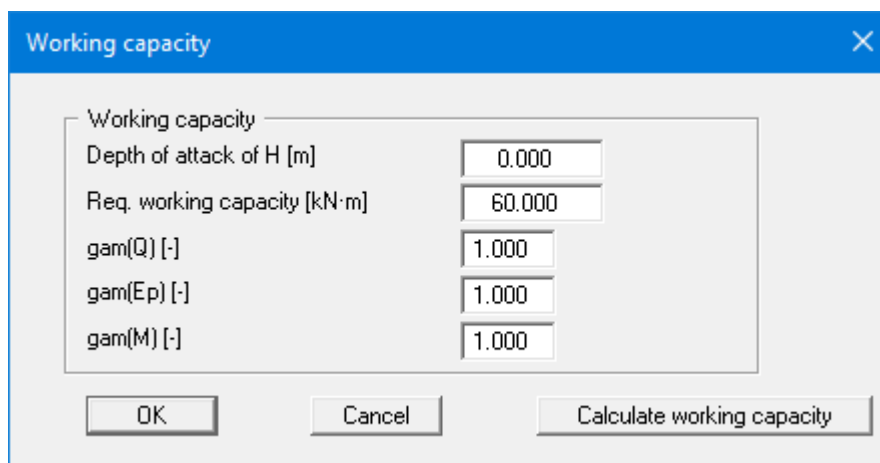
In the **"Working capacity...."** load cases, a dialog box for steel design compliant with EC3 opens first, shown below as an example for the **"Working capacity using H,q,k variation"** load case:



The "Steel design to EC 3" dialog box contains the following elements:

- 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% (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 elements:

- Working capacity**
 - Depth of attack of H [m]: 0.000
 - Req. working capacity [kN·m]: 60.000
 - gam(Q) [-]: 1.000
 - gam(Ep) [-]: 1.000
 - gam(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 menu item **"Editor 1/General load cases"**). 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!

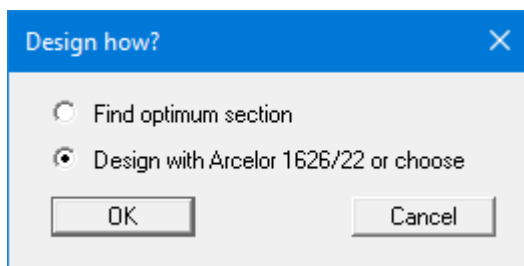
OK

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.

9.6 GGU-DOLPHIN: "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 showing "Buckling analysis to DIN EN 1993-1-6".
- Select steel:** A dropdown menu showing "S 355".
- Actions:** A table with columns for "Design situation", "max M,qg", "Max. Q,qg", and "Max. N,qg".

Design situation	max M,qg	Max. Q,qg	Max. N,qg
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".
- Checkboxes:** A checked checkbox labeled "Reduce shear force after Weißenbach by 50%".
- Buttons:** "Info", "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, 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:

Info

47 sections investigated.

Best results for the first 18 Sections (sorted by A)

Arcelor 1524/18 ($\mu = 0.953$) ($A = 851.6 \text{ cm}^2$)
Arcelor 1422/20 ($\mu = 0.991$) ($A = 880.9 \text{ cm}^2$)
Arcelor 1626/18 ($\mu = 0.836$) ($A = 909.3 \text{ cm}^2$)
Arcelor 1524/20 ($\mu = 0.861$) ($A = 945.0 \text{ cm}^2$)
Arcelor 1626/20 ($\mu = 0.754$) ($A = 1009.1 \text{ cm}^2$)
Arcelor 1829/18 ($\mu = 0.660$) ($A = 1024.1 \text{ cm}^2$)
Arcelor 1626/22 ($\mu = 0.688$) ($A = 1108.6 \text{ cm}^2$)

Optimum section:
 Arcelor 1524/18
 Utilisation factor $\mu = 0.953$
 Area $A = 851.6 \text{ cm}^2$
 Governing design situation max M,gq

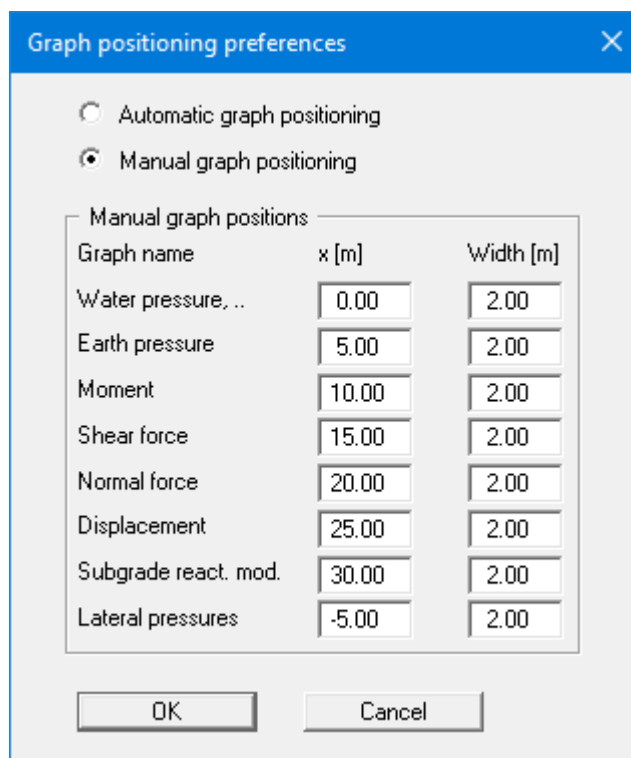
Section "Arcelor 1524/18" accept?

OK Cancel

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.

9.7 GGU-DOLPHIN: "Graph positioning preferences" menu item

If you are not happy with the automatic graph arrangement, you can use this menu item to create an arbitrary arrangement. The dialog box of the **GGU-RETAIN** program is shown here as an example. Other graphs may be listed in other GGU programs.

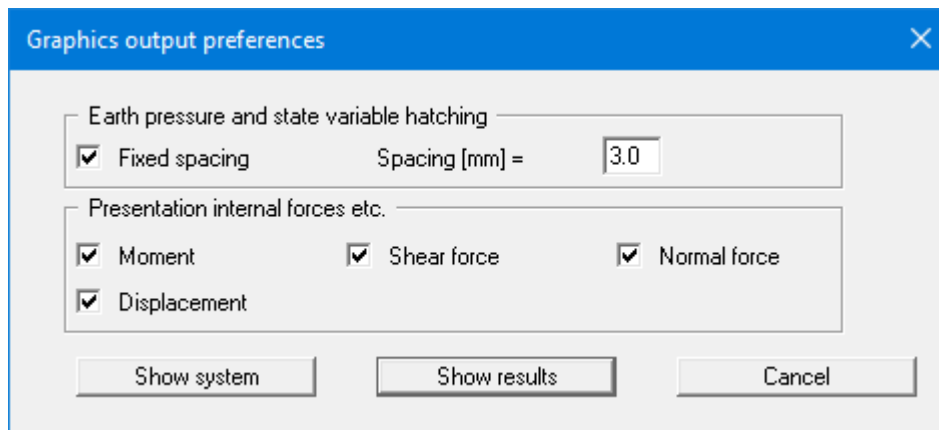


For a customised graph arrangement, activate the "**Manual graph positioning**" check box. The graphs are then displayed centred at the sheet position "**x**" with the specified "**Width**".

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

9.8 GGU-DOLPHIN: "Graphics output preferences" menu item

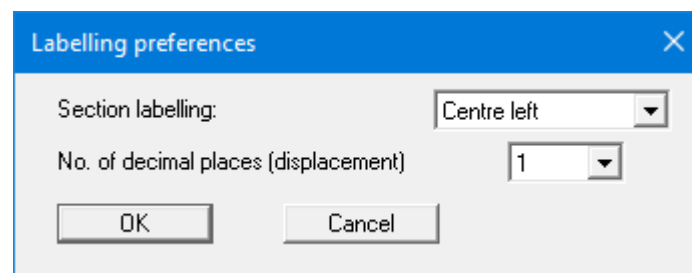
Among other things, the screen graphics consist of several graphs, presenting depth-oriented results. This menu item opens a dialog box which allows you to visualise the selected state variables on the screen by activating the corresponding check boxes. On the whole, the dialog box is self-explanatory.



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.

9.9 GGU-DOLPHIN: "Labelling preferences" menu item

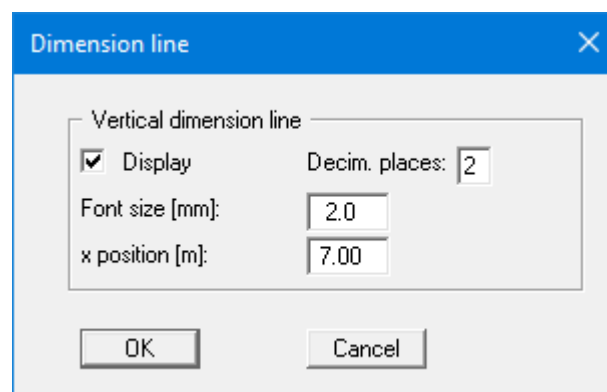
This menu item allows you to specify labelling preferences for the result graphics.



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.

9.10 GGU-DOLPHIN: "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)**"). 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.

9.11 GGU-DOLPHIN: "Display system" menu item

Once a system has been analysed, all the state variables are automatically shown on screen. So as not to overburden the screen, certain elements of the system (for example, surcharges) are no longer shown. If you want to view all the system data without state variables, clicking this menu item will enable you to do so.

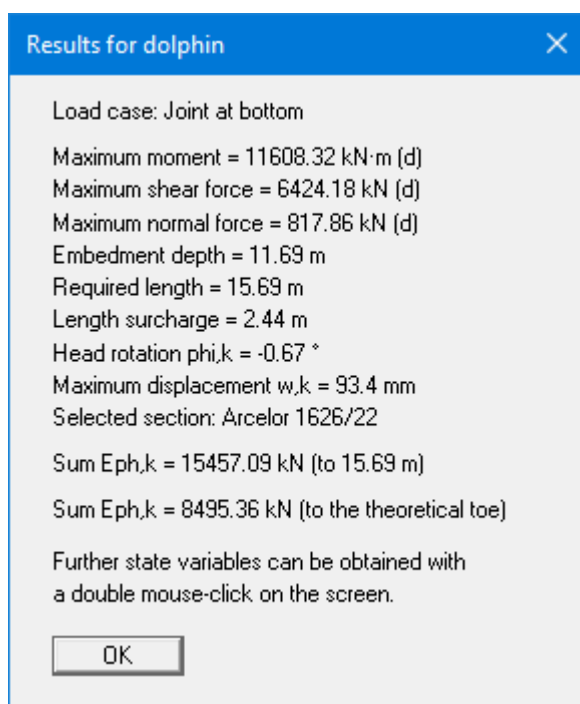
9.12 GGU-DOLPHIN: "Display results" menu item

After a system has been analysed, all state variables are automatically presented 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.

10 Evaluation menu

10.1 GGU-DOLPHIN: "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.

10.2 GGU-DOLPHIN: "Results" menu item

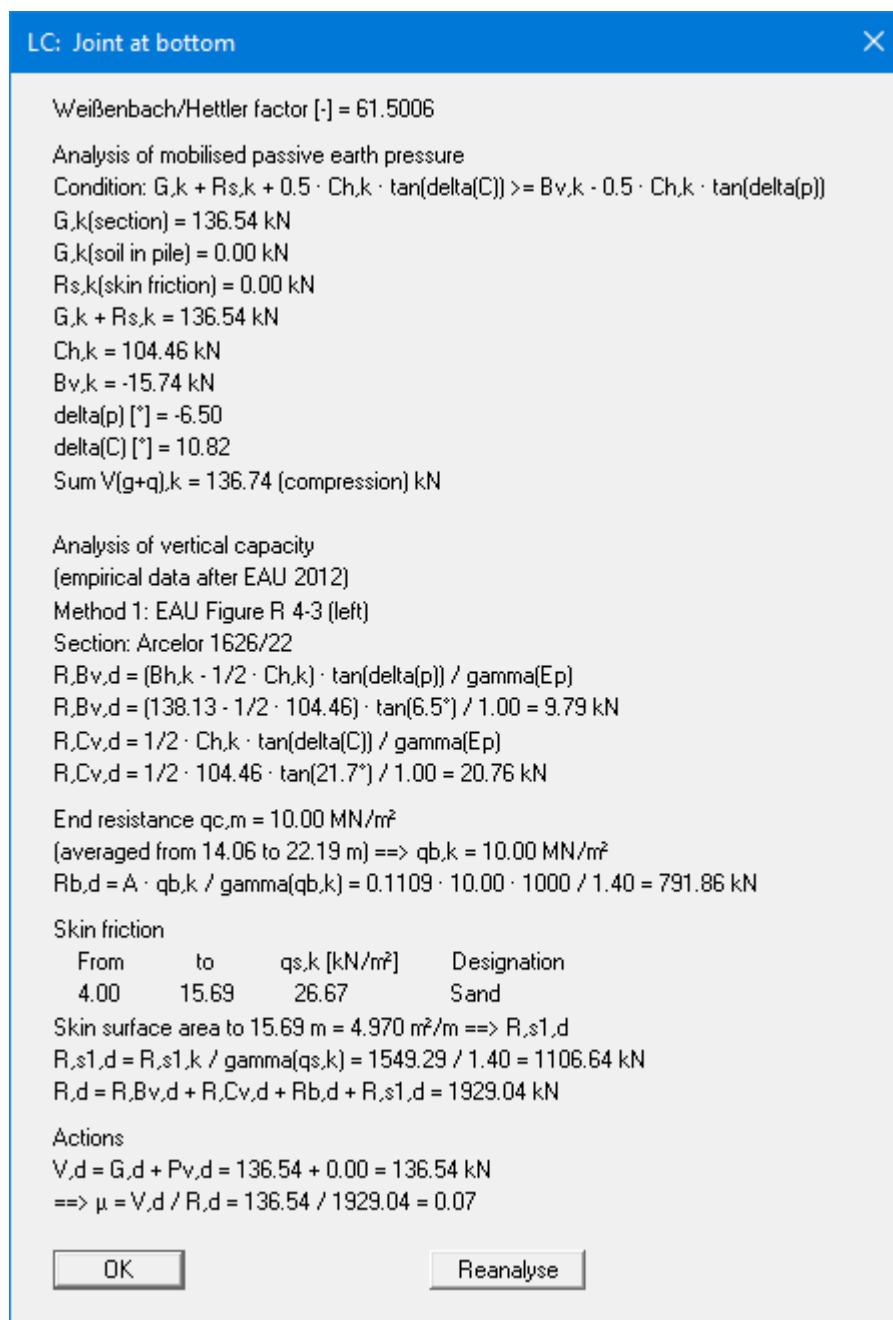
If analysing using "**General load cases**", you will see a message box with the results of all analysed load cases. This function can also be accessed by pressing [F7].

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.

10.3 GGU-DOLPHIN: "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 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 recalculate 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)

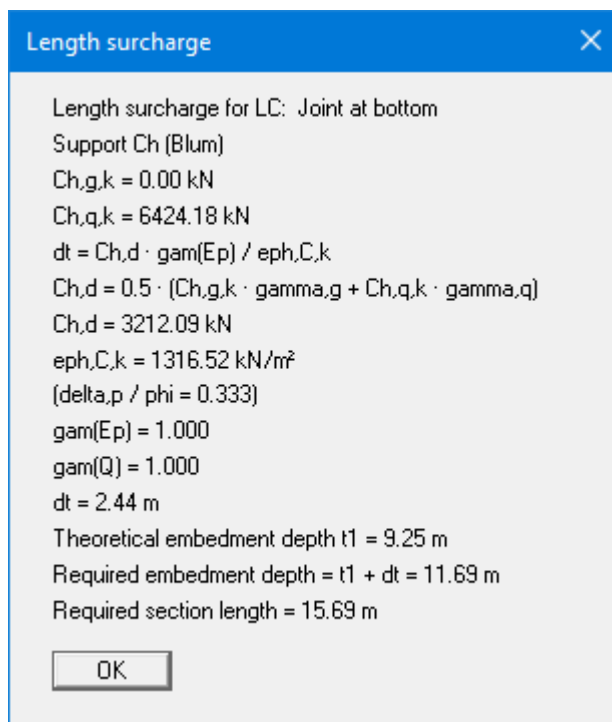
☐ Allow interpolation for $c_{u,k} < 60 \text{ kN/m}^2$ (Skin friction)

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 menu item "Graphics preferences/General legend").

10.4 GGU-DOLPHIN: "Length surcharge" menu item (Evaluation)

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



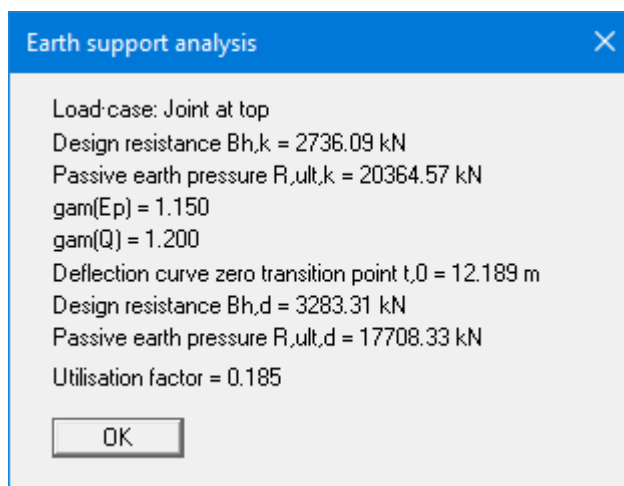
10.5 GGU-DOLPHIN: "Move section bases" menu item

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.

10.6 GGU-DOLPHIN: "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.

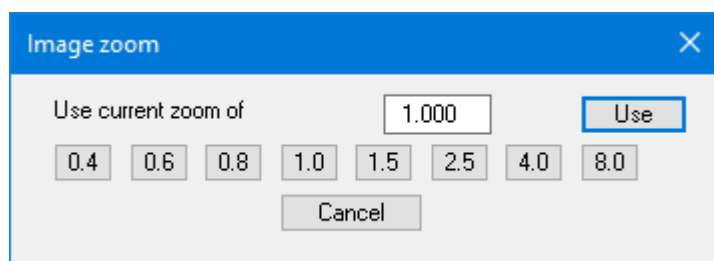


11 Graphics preferences menu

11.1 GGU-DOLPHIN: "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.

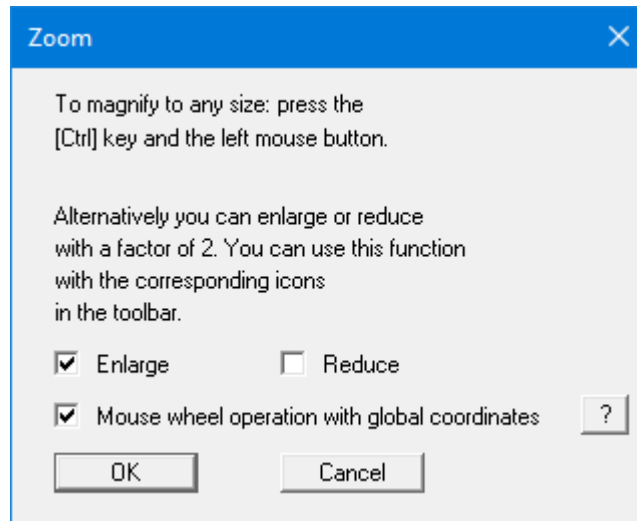


A zoom factor between 0.4 and 8.0 can be entered in the input box. By then clicking on "**Use**" to exit the box the current factor is accepted. By clicking on the "0.4", "0.6", etc. buttons, the selected factor is used directly, and the dialog box closed.

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.

11.2 GGU-DOLPHIN: "Zoom info" menu item

An info box informs you about the activation and possibilities of the zoom functions.



A quick way to enlarge a specific section of the screen is to open a magnifying glass window by holding down the **[Ctrl]** key and the mouse button.

A quicker way to zoom in and out of the system graphics is to use the mouse wheel. When the program is started for the first time, the default setting for mouse wheel operation is activated according to Windows conventions.

If you want to change the system coordinates and the scale of your system using the mouse wheel, activate the **"Mouse wheel operation with global coordinates"** check box. If you close the program with this setting, the setting is still activated the next time you start it.

The functions via the mouse wheel can be found in the chapter **"Tips and Tricks: Keyboard and Mouse"**.

11.3 GGU-DOLPHIN: "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.

11.4 GGU-DOLPHIN: "Pen colour and width" menu item

In order to enhance the clarity of the graphics you can preset the pen settings for various graphic elements in the GGU programs.

You can change the pen widths for the elements listed in the dialog box and adjust the pen and/or fill colours by clicking on the button with the element name. In some GGU programs you can also define a line colour for selected elements.

For the graphic output of colours on **monochrome printers** (e.g. laser printers), colours are replaced by an equivalent shade of grey. In the case of very light colours, the corresponding graphic elements are then barely visible on the printer. In such cases, it makes sense to change the colour setting to darker colours.

11.5 GGU-DOLPHIN: "Mini-CAD toolbar" and "Header toolbar" menu items

Using this menu item you can add free text, lines, circles, polygons and images (e.g. files in formats BMP, JPG, PSP, TIF, etc.) to the main program graphics. PDF files can also be imported as images. A pop-up menu opens, the icons and functions used are described in more detail in the [Mini-CAD manual](#).

The differences between the Mini-CAD and Header CAD are as follows:

- Drawing objects created with **Mini-CAD** refer to the coordinate system (generally in [m]) in which the drawing is created and are displayed accordingly. You should therefore select this menu item if you wish to enter additional information on the system. These objects can be saved in a **".mcd"** file using the



icon in the pop-up menu and loaded as such in other GGU programs using the



icon in the pop-up menu.

- Drawing objects created with the **Header CAD** refer to the sheet format (in [mm]). They therefore always remain at the same sheet position, regardless of the coordinate system of the measuring points. You should select this menu item if you want to enter general information on the drawing (e.g. company logo, report number, system number, stamp). If you save this so-called header data in a **".kpf"** file using the icon



in the pop-up menu, you can reload this header data for a completely different system (with different system coordinates) and also in other GGU programs using the icon



in the pop-up menu. The saved header data can then be found in the same position. This considerably simplifies the creation of general sheet information.

11.6 GGU-DOLPHIN: "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 cannot be called up via normal menu titles and menu entries.

Not all of the icons described below are available in all GGU programs.



"Next page"/"Previous page"

You can use these icons to scroll forwards and backwards between individual pages. In many GGU programs, you can use this in the **output table representation**.



"Select page" or "Diagram/Output table"

If you are in the **output table representation**, you can use this symbol to jump to a specific page or switch back to the normal display, i.e. your graphic display.



"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.



"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**").

**"Colour on/off" or "Colour/hatching"**

If you want to remove the colour from the system display, e.g. to create a black and white printout, you can do this using this on/off switch.

In several GGU programs, 4 colour and hatching settings are possible via this icon, which you can click through in sequence. A colour filled representation is the default setting, the next click shows the hatching, then coloured and hatched. The fourth click shows a representation with neither colour nor hatching. The next click starts again.

**"Move object"**

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

**"Undo move object"**

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

**"Restore move object"**

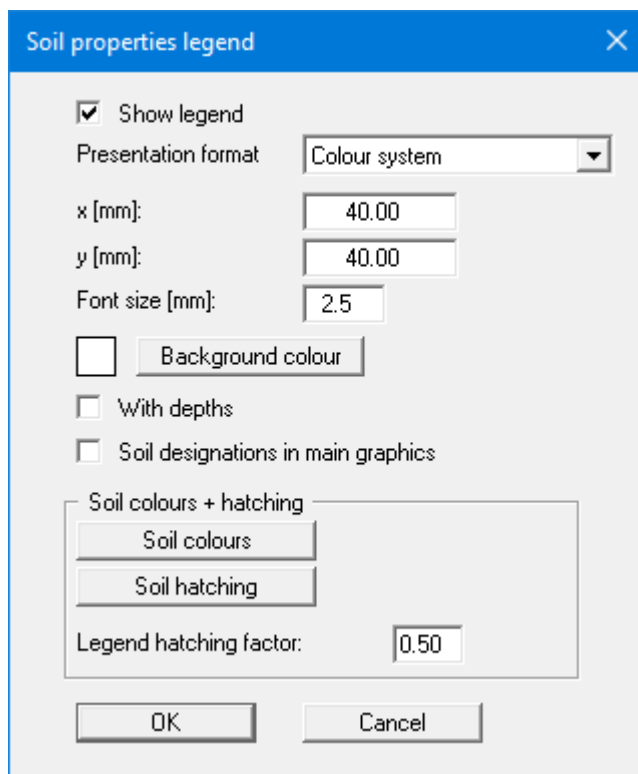
By clicking this symbol, the last object movement undo carried out using "Undo move object" can be restored.

**"Construction phase back"/"Construction phase forward"**

If you are in the display of construction phases, you can use these icons to scroll back and forth between the individual construction phases.

11.7 GGU-DOLPHIN: "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**". You can control the size of the legend via the "**Font size**". You can also define a background colour in some legends.

The fastest way to modify the position or size of the legend is to press the [F11] function key and then to either pull the legend to the new position or to move the sides of the legend to their new size 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.

In the "**Soil colours + soil hatching**" group box, you can make the desired adjustments according to your individual requirements:

- "**Automatic**"

The program automatically assigns soil colours to the soils. If the check box is deactivated, the soil colours that you can set individually under the "**Soil colours**" button are used.

- **"Soil colours"**

You will see a dialog box in which you can make your desired settings. Here you can assign a new colour to each soil layer after clicking on the button with the desired number or reassign the colours via **"Soil colours/Reorganise"** button. You can save your colour settings to a file under **"Soil colours/Save"** and reuse them for other systems using the **"Soil colours/Load"** button. In the lower area, you can transfer the colour settings to the Windows colour box as user-defined colours, for example, or vice versa. Click on the **"Info"** button for further explanations.

- **"Hatching"**

You will see a dialog box in which you can define different hatchings for each soil.

- **"Legend hatching factor"**

A narrower hatching can be achieved in the small boxes of the legend than in the system presentation. To do this, select an entry < 1.00 .

11.8 GGU-DOLPHIN: "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 [X]

☒ Show legend

x [mm]: 30.00

y [mm]: 282.50

Font size [mm]: 2.5

Max. no. of lines: 10

☐ 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 [v]

Without date and time [v]

OK Cancel

You can define and edit the position of the legend using the values "**x**" and "**y**". You can control the size of the legend via the "**Font size**" and "**Max. no. of lines**"; if necessary, the legend is displayed in several columns. You can also define a background colour in some legends.

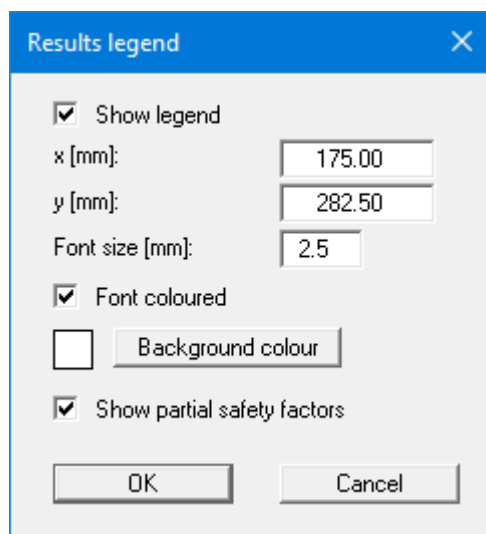
The fastest way to modify the position or size of the legend is to press the [**F11**] function key and then to either pull the legend to the new position or to move the sides of the legend to their new size with the left mouse button pressed.

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.

11.9 GGU-DOLPHIN: "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 can control the size of the legend via the "**Font size**". You can also define a background colour in some legends.

The fastest way to modify the position or size of the legend is to press the [**F11**] function key and then to either pull the legend to the new position or to move the sides of the legend to their new size 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. You can also have the partial safety factors shown in the legend.

11.10 GGU-DOLPHIN: "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 can control the size of the legend via the **"Font size"** and **"Max. no. of lines"**; if necessary, the legend is displayed in several columns. You can also define a background colour in some legends.

The fastest way to modify the position or size of the legend is to press the **[F11]** function key and then to either pull the legend to the new position or to move the sides of the legend to their new size with the left mouse button pressed.

11.11 GGU-DOLPHIN: "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.

Sections legend

☒ Show legend

x [mm]: 175.00

y [mm]: 255.00

Font size [mm]: 2.5

☒ Show moment of resistance

☐ Show moment of inertia

☐ Show first moment of area

☐ Show area

☐ Show thickness

☐ Show diameter

☐ Show EJ

☐ Show class

☐ Background colour

OK Cancel

You can define and edit the position of the legend using the values **"x"** and **"y"**. You can control the size of the legend via the **"Font size"**. You can also define a background colour in some legends.

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

Additional parameters can be displayed by activating the different check boxes.

11.12 GGU-DOLPHIN: "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]: 360.00 Height [mm]: 30.00

y [mm]: 15.00 Width = 1.5 · height

Font size [mm]: 2.0

☐ With soil fill

Background Soil fill

Show which section: Arcelor 1524/16

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. A background colour 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 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.

11.13 GGU-DOLPHIN: "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.

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 "**Width**" and "**Height**". In some legends, you can also adjust the font size of the label and/or specify a background colour.

The fastest way to modify the position or size of the legend is to press the [**F11**] function key and then to either pull the legend to the new position or to move the sides of the legend to their new size with the left mouse button pressed.

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.

11.14 GGU-DOLPHIN: "Move objects" menu item

If you select this entry, you can then use the mouse to move the various objects and legends. Move the mouse over the object of your choice. If you are over a movable object, the mouse pointer will take on the shape of a cross. Now press the left mouse button and drag the object to the desired position while holding down the button.

After going to this menu item **only one object** at a time can be moved using the mouse or its size be altered.

If you want to edit several objects, you can also activate the function more quickly by pressing the [**F11**] key or the symbol



. An info box will then no longer appear.

In many GGU programs you can also alter the size of an object using this menu item or the **[F11]** function key. If you are positioned over the frame of a resizable object after activating the function, the mouse takes on the shape of a double arrow. Hold down the left mouse button and drag the frame until the object has reached the desired size. Drag a corner to maintain the aspect ratio of the sides. If you drag on one side, the object becomes taller or wider.

Using the **[Back]** key or by clicking on the icon



you can undo the last change to the position or size of an object.

In programs in which you can position the diagrams yourself (menu item "**System/Graph positioning preferences**"), the result diagrams can also be moved using this function if you have switched to "**Manual graph positioning**".

11.15 GGU-DOLPHIN: "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**".

11.16 GGU-DOLPHIN: "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 refreshed.

12 Page size + margins menu

12.1 GGU-DOLPHIN: "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.

12.2 GGU-DOLPHIN: "Manual resize (mouse)" menu item

You can transfer the coordinates of a section of your previous graphic display as new image coordinates by holding down the **[Ctrl]** and **[Shift]** keys and marking the desired area with the left mouse button. The scales of the x-direction and y-direction are adjusted accordingly.

In the default setting, the **"Proportional section"** check box is activated. This retains the previous proportions (scale x-direction/scale y-direction).

If you activate the **"Redefine origin"** check box, you can adjust the image coordinates without changing the scale. In this way, you can quickly achieve the desired visualisation without having to try out the x/y coordinates if the scale is set appropriately.

12.3 GGU-DOLPHIN: "Manual resize (editor)" menu item

You can alter the current 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.

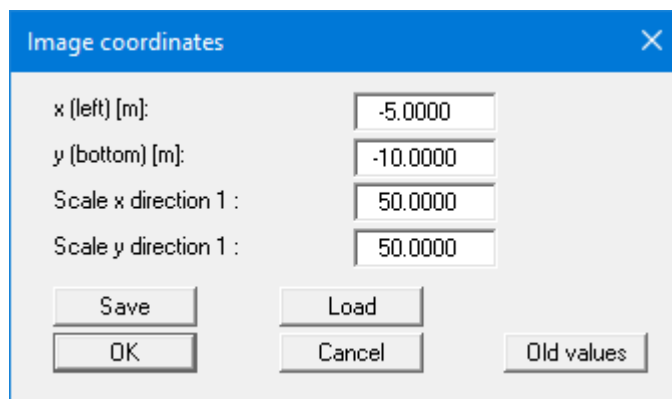


Image coordinates	
x (left) [m]:	-5.0000
y (bottom) [m]:	-10.0000
Scale x direction 1 :	50.0000
Scale y direction 1 :	50.0000
Save Load OK Cancel Old values	

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.

12.4 GGU-DOLPHIN: "Font size selection" menu item

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

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

12.5 GGU-DOLPHIN: "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.

Page size

Edit page size and margins

Page in general

Height = 297.00 Width = 420.00

Page margins in mm

Left = 25.00 Right = 8.00
Top = 8.00 Bottom = 8.00

Plot margins in mm

Left = 25.00 Right = 8.00
Top = 25.00 Bottom = 25.00

☒ With borders ☒ With margins

OK Cancel

- "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 deactivating the "With borders" check box.
- "Page margins" define 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 margins**" define a set distance between the page margin and the actual **drawing area** in which the graphical evaluation of your input is presented.

12.6 GGU-DOLPHIN: "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 icon



in the toolbar.

12.7 GGU-DOLPHIN: "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 icon



in the toolbar.

12.8 GGU-DOLPHIN: "Preferences" menu item

You can activate or deactivate the undo functions.

13 Info menu

13.1 GGU-DOLPHIN: "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 the GGU program.

13.2 GGU-DOLPHIN: "GGU on the web" menu item

Using this menu item, you can access the [GGU Software website](#).

Check the page of your program module at regular intervals for information about updates and changes. On the "**Changelogs**" subpage, you can also subscribe to an e-mail notification that informs you of all changes on a monthly basis.

13.3 GGU-DOLPHIN: "GGU support" menu item

This menu takes you directly to the [GGU Software Support Portal](#).

Here you can enter your support request directly and upload your edited GGU program file.

13.4 GGU-DOLPHIN: "Compare earth pressure coefficients" menu item

Here you can calculate the earth pressure coefficients for given values of ϕ , δ and β .

13.5 GGU-DOLPHIN: "Help" menu item

You will be directed to the homepage of the online manual for the GGU program. The help function can also be accessed using the **[F1]** function key.

13.6 GGU-DOLPHIN: "What's new?" menu item

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

13.7 GGU-DOLPHIN: "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 dialogues, 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.

14 GGU-DOLPHIN: 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.