

GGU-TRENCH manual

Slurry-trench wall stability (DIN 4126)

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1 GGU-TRENCH: Preface

The **GGU-TRENCH** program allows analysis and representation of the inner and outer stability of diaphragm walls. Analysis can be performed using the **global safety factors** employed by the old DIN 4126 or with the **partial safety factors** used by the new DIN 4126:2013.

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-TRENCH: 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-TRENCH: 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-TRENCH: 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 general preferences for your new system. After leaving the box you then see six menus in the menu bar:

- File
- Edit
- System
- 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 Tips and tricks

5.1 GGU-TRENCH: Keyboard and mouse

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

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

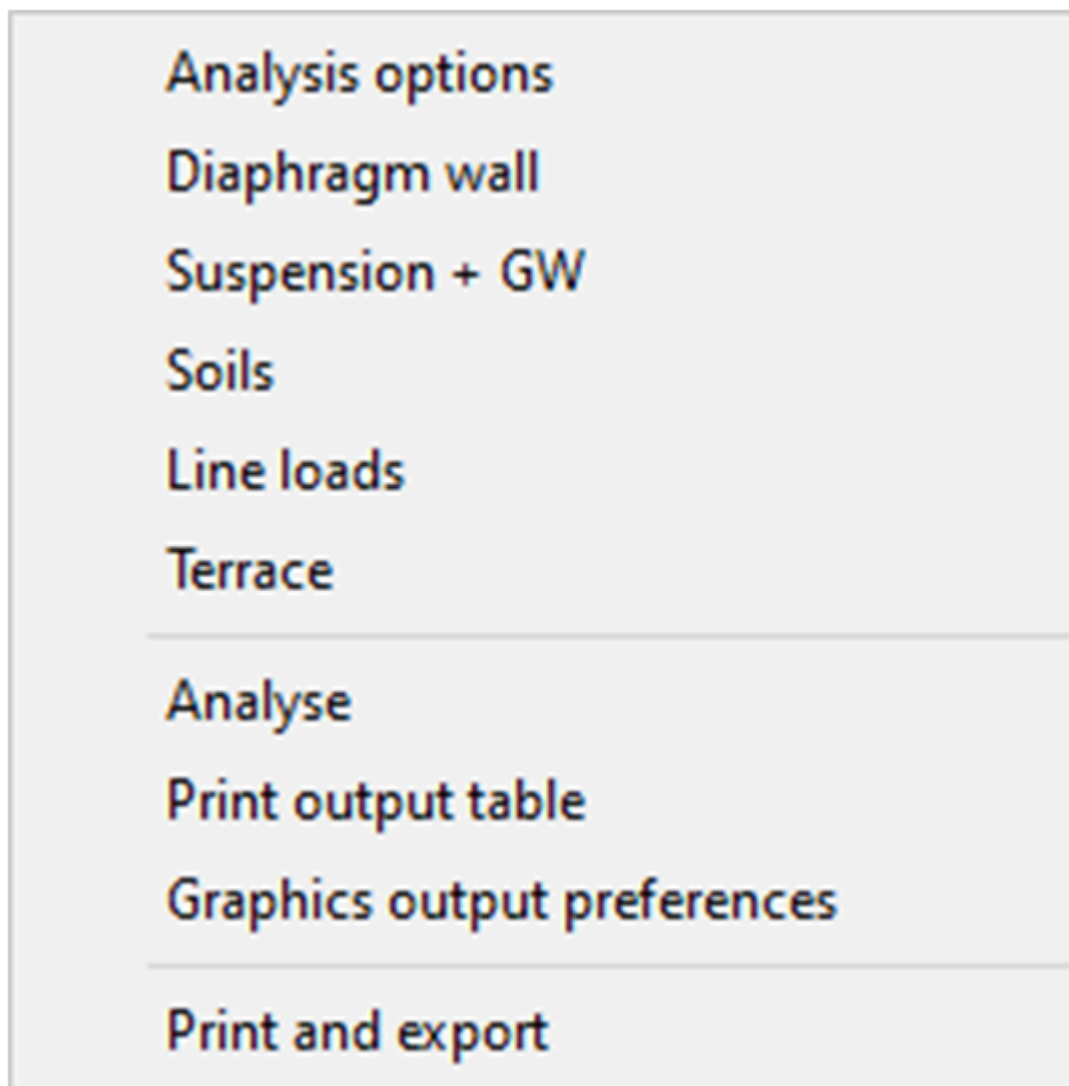
Change system graphics (new values can be checked in "Page size + margins/Manual resize (editor)"):

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

Change screen coordinates:

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

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



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

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

5.2 GGU-TRENCH: 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 from a screen section to your current image zoom, which is usually preset to 1.0 (see “
- **[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:

- [F6] opens the menu item "**System/Minimum safety factors**" when using *partial global safety factor concept*.
- [F9] activates the menu item "**Page size + margins/Auto-resize**".

5.3 GGU-TRENCH: "Copy/print area" icon

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

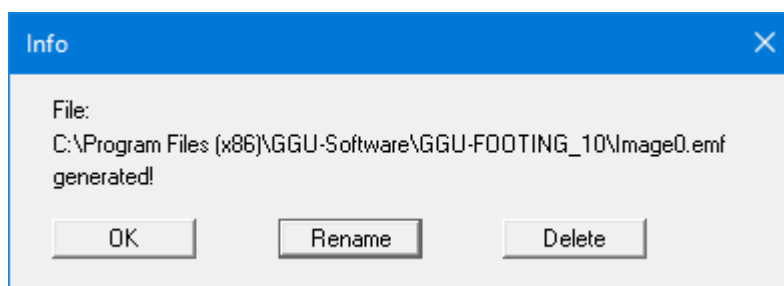


in the menu toolbar is clicked, describing the options available for this function. For example, using this icon it is possible to either copy areas of the screen graphics and paste them into the report, or send them directly to a printer.

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 Analysis principles

6.1 GGU-TRENCH: General notes

Four safety factors must be determined to verify the stability of a diaphragm wall:

1. Safety against groundwater ingress
(DIN 4126 (old); 9.1.1 or DIN 4126:2013; 6.1)
2. Safety against slippage of single grains or grain groups
(DIN 4126 (old); 9.1.2 or DIN 4126:2013; 6.2)
3. Safety against the slurry level falling below the minimum level required for stability
(DIN 4126 (old); 9.1.2 or DIN 4126:2013; 6.3)
4. Safety against slip surfaces endangering the stability of the trench
(DIN 4126 (old); 9.1.2 or DIN 4126:2013; 6.4)

The verifications for 1, 2 and 4 are performed by the program. A verification for 3 must be estimated pursuant to DIN 4126 (old), 9.1.3 or DIN 4126:2013; 6.3.

In comparison to the old safety factor concept, the new DIN 4126:2013 does not bring with it any substantial changes. The old standard requires the following verification for the stability of the trench (see Table 2 in old DIN 4126):

$$\eta = \frac{S - W}{E} \geq 1,1 \text{ or } 1,3$$

The new standard requires the following verification:

$$\gamma_H \cdot (S - W) - \gamma_E \cdot E \geq 0$$

where

$$\gamma$$

$H = 1.0$ and

$$\gamma$$

$E = 1.1$ or 1.3 (see Table 4 in DIN 4126:2013).

Solved for

$$\gamma$$

E we get

$$\gamma_E = \frac{1,0 \cdot (S - W)}{E} \geq 1,1 \text{ or } 1,3 ,$$

which corresponds to the relationship given in DIN 4126 (old).

6.2 GGU-TRENCH: Safety against groundwater ingress into the trench

The program calculates the pressure exerted by the slurry p_s and the pressure exerted by the groundwater p_w at the toe of the diaphragm wall. The FOS, $\eta(\text{gw})$, is then

$$\eta(\text{gw}) = p_s / p_w.$$

The old DIN 4126, (9.1.1) and DIN 4126:2013 (6.1) require a safety factor of 1.05.

6.3 GGU-TRENCH: Safety against slippage of single grains or grain groups

The safety against slippage of single grains or grain groups $\eta(i)$ (also known as inner stability) is calculated pursuant to old DIN 4126 (Section 9.1.2) from

$$\eta(i) = \tau_F / (d_{10} * \gamma'' / \tan(\varphi))$$

The program simplifies " by adopting the buoyant (effective) unit weight of the soil.

The old DIN 4126 (9.1.2) and DIN 4126:2013 (6.2) require a safety factor of 1.0.

6.4 GGU-TRENCH: Safety against slip surfaces endangering the stability of the trench

The safety against slip surfaces endangering the stability of the trench $\eta(a)$ (also known as external stability) is calculated pursuant to the old DIN 4126 from

$$\eta(a) = (S - W) / E$$

S = support force of the suspension [kN]

W = water pressure exerted by groundwater [kN]

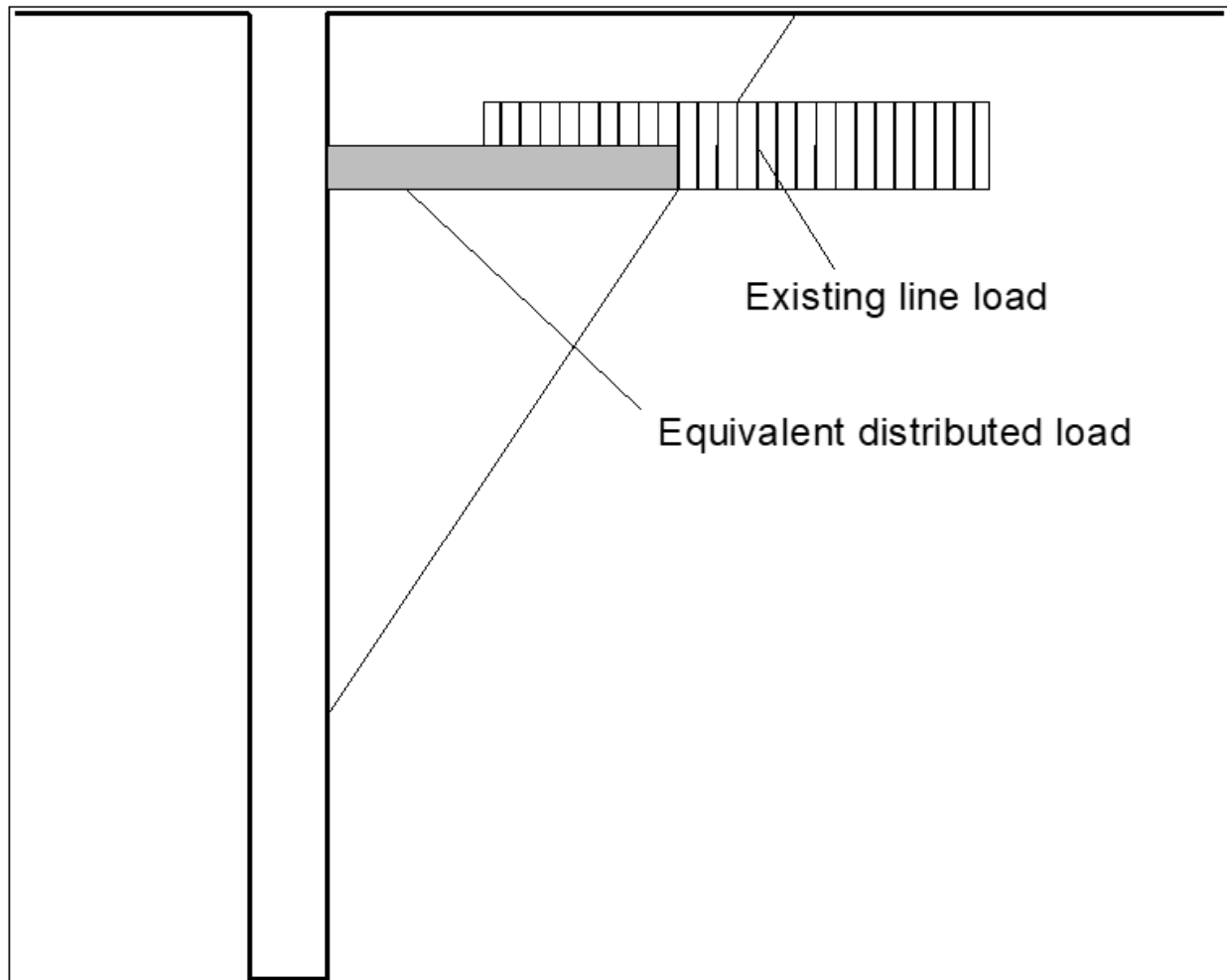
E = earth pressure [kN]

The numerator is obtained from the hydrostatic supporting pressure of the suspension, reduced by the water pressure W from groundwater. Because of the finite length of the trench the current earth pressure problem can no longer be treated as a plane earth pressure case. The default method used in the program is the so-called shoulder theory as shown in Figure 7 of DIN 4126 (old). This employs a finite, triangular earth pressure wedge. The friction forces generated on both flanks of the wedge are utilised for consideration of equilibrium conditions, which gives higher factors of safety as opposed to the plane situation. Friction forces on both flanks ensue from the self-weight of the soil, the distributed load and, if required, any line loads present. A linear increase in the lateral pressure stress consistent with the unit weight of the soil is assumed to a depth equal to the width of the trench. Below this depth the lateral pressure stress is constant. This method is therefore also known as "**bilinear**". DIN 4126 (old) demands a FOS of 1.1 or 1.3 (if loads from structures act in the critical area). With regard to their influence on the lateral pressure stress, any distributed loads present are assumed to decrease linearly from the ground surface (full distributed load) to **0** at a depth corresponding to the trench width.

Alternatively to the bilinear approach, a so-called "**sublinear**" approach after Terzaghi is often used for the depth distribution of the lateral pressure stress. The theoretical principles are described in detail in, for example, "KILCHERT/KARSTEDT, *Standsicherheitsberechnung von Schlitzwänden nach DIN 4126*" (KILCHERT/KARSTEDT, Stability analysis of diaphragm walls to DIN 4126 – no translation published) (Beuth Verlag GmbH). The method after Terzaghi is based on the so-called silo theory. The sublinear approach after Terzaghi can also be selected. According to WALZ and PULSFORT (1983; "*Rechnerische Standsicherheit suspensionsgestützter Erdwände*"; Teil 1 und 2, Tiefbau, Ingenieurbau, Straßenbau, Heft 1 und 2 - "Computed stability of suspension-supported earth walls"; Parts 1 and 2, Tiefbau, Ingenieurbau, Straßenbau, Issues 1 and 2), the sublinear approach after Terzaghi is acceptable if the bilinear approach after DIN 4126 (old) using the bending point defined by the depth z = trench width is not exceeded. This restriction can also be entered in the program.

In contrast to a distributed load, line loads can only act on a limited area beside the guide wall. If you set the check boxes described later in this manual so that line loads act to increase the lateral pressure stress, the program proceeds as follows:

- The proportion of the line load inside the respective slip body is converted to an equivalent distributed load ("smearing") and then treated as a distributed load.



If footings substantially smaller than the trench width exist in the area of a trench, the point load must be converted to an equivalent line load. However, you should then consider whether the point load contributes at all to the lateral pressure stress on the wall. The proportion giving rise to a corresponding equivalent load that increases the favourably acting lateral pressure stress can therefore be individually defined in the program for each line loading by means of a factor (≥ 0.0 and ≤ 1.0).

If the pressure gradient f_{s0}

$$f_{s0} = 2 * \tau_F / d_{10}$$

lies below 200 kN/m² the full membrane effect of the suspension is no longer available, requiring a reduction in the support force. The reduction depends on the penetration depth of the suspension into the respective soil. The program calculates the reduction in the support force. Therefore, instead of the expression

(S – W)

in the above equation, the program calculates the effective support force S' . Even for limit gradients > 200.0 , penetration depths are $> "0.0"$, leading, in principle, to a reduction in the effective support force. In agreement with the DIN 4126 (old), however, the program assumes a penetration depth of $"0.0"$ for limit gradients > 200.0 , giving rise to somewhat higher factors of safety.

When determining the support force S in the region of the guide walls pursuant to old DIN 4126 (9.1.4.2), the earth pressure from soil self-weight and permanent, uniformly distributed surcharge may be adopted up to the value of the at-rest earth pressure, instead of the pressure of the supporting suspension, if the guide walls and their bracing are designed for this. The program has a switch which you can use to select from the options offered in the DIN standard. You can incorporate both distributed loads or line loads into the calculation of the guide wall earth pressure. If line loads contribute to the guide wall earth pressure (can be specified), its component will be taken into consideration completely, independent of the factor described above for the lateral pressure component. In addition, for determination of the at-rest pressure on the guide wall from line loads, the line load, in accordance with Figure 1 is converted to an equivalent line load.

Calculation of the earth pressure to be supported by the slurry fluid is for various user-defined depths, varying the slip surface angle. The variation range of the slip surface angle is user-defined.

In accordance with DIN 4126 (old), a safety factor of 1.5 is to be adopted for any cohesion in the slip surface. The **GGU-TRENCH** program allows a further reduction of the cohesion components in both flanks and in the slip surface, beside the general reduction.

The new standard stipulates that safety is sufficient if the condition

$$\gamma_H \cdot (S_k - W_k) - \gamma_E \cdot E_{ahk} \geq 0$$

is shown.

S_k = characteristic value of support force to 6.4.2 of DIN 4126:2013

W_k = characteristic value of groundwater pressure

E_{ahk} = characteristic value of earth pressure to 6.4.3 of DIN 4126:2013

γ

H = partial factor for the groundwater pressure and the slurry fluid pressure

γ

E = partial factor for earth pressure

The variables in the equation are calculated according to the old DIN 4126. If calculations are consistently performed according to DIN 4126:2013, a safety definition in the sense of the old standard, which provides a guide for the degree of safety, is not obtained. The only statement that can be made is "**Stable**" or "**Instable**".

In order to still arrive at a measure of safety, the utilisation factor μ is defined, obtained from:

$$\mu = \frac{\gamma_E \cdot E_{ahk}}{\gamma_H \cdot (S_k - W_k)}$$

7 File menu

7.1 GGU-TRENCH: "New" menu item

Click on this menu item to create a new wall system.

The 'New' dialog box is shown with a blue title bar and a close button (X) in the top right corner. It contains three main sections: 'Verification concept', 'Project identification', and 'General'. The 'Verification concept' section has three radio buttons: 'Partial safety factors (DIN 4126:2013)' (selected), 'Partial safety factors (DIN 4126-100)', and 'Global safety factors (DIN 4126)'. To the right of these is a checked checkbox 'Add 'EC 7' designation' and a button 'Info EC 7'. The 'Project identification' section has a text input field. The 'General' section has three checkboxes: 'Analysis of slip of individual grains with gam(s) and n' (checked), 'Use absolute heights' (unchecked), and 'Enter d10 in mm' (checked). To the right of the first checkbox is a button with a question mark. To the right of the second checkbox is a label 'Des.' followed by a text input field containing 'm:AD'. At the bottom are 'OK' and 'Cancel' buttons.

You decide whether the necessary verifications are to be performed using the **partial safety factors** to DIN 4126:2013, or using the **global safety factors** to the old DIN 4126. In order to guarantee the compatibility of the older records it is still possible to select DIN 4126-100 here. Eurocode 7 with national annex 'DIN 1054:2010' refers to the DIN 4126:2013. For the sake of formality, the expression 'DIN 4126' can be prefixed by 'EC 7' when printing. Just activate the "**Add 'EC 7' designation**" check box. You can enter a project identification, which will subsequently be entered in the **General legend**.

Analysis compliant with DIN 4126 5.3 requires the characteristic value of the buoyant unit weight of the soil in the slurry. The buoyant unit weight of the soil may be adopted as an approximation. If the check box "**Analysis of slip of individual grains with gam(s) and n**" is deactivated, the buoyant unit weight of the soil is adopted for analysis. Otherwise, a more precise analysis compliant with DIN 4126 5.3 is performed.

If you activate the "**Use absolute heights**" check box, all information with regard to trench depth, guide wall depth, suspension level, groundwater level and depth of soil layers can be given in absolute heights (e.g. in m AD). In the dialog box for diaphragm wall input (see menu item "**Edit/Diaphragm wall**") the height of the ground level must then also be entered in absolute figures. In all relevant dialog boxes, the input value will be shown as [m AD] instead of [m]. This simply provides clarity. You are, of course, free to select a reference level other than [m AD]. If you do not activate the "**Use absolute heights**" check box, ground level is assumed to be 0.0 m and all depth information is positive downwards.

Here, you can predefine the unit for the "**d10**" soil property (see Section "**Edit/Soils**"). If the check box is not activated, this will be in [m].

7.2 GGU-TRENCH: "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.

7.3 GGU-TRENCH: "Save" menu item

You can save data entered or edited during program use to a file, in order to have them available at a later date, or to archive them. The data is saved without prompting with the name of the current file.

7.4 GGU-TRENCH: "Save as" menu item

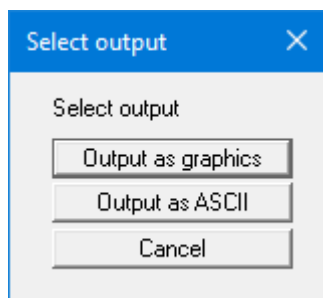
You can save data entered during program use to an existing file or to a new file, i.e. using a new file name. For reasons of clarity, it makes sense to use ".scl" as file suffix, as this is the suffix used in the file requester box for the menu item "**File/Load**". If you choose not to enter an extension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

7.5 "Print output table" menu item

7.5.1 GGU-TRENCH: Selecting the output format

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

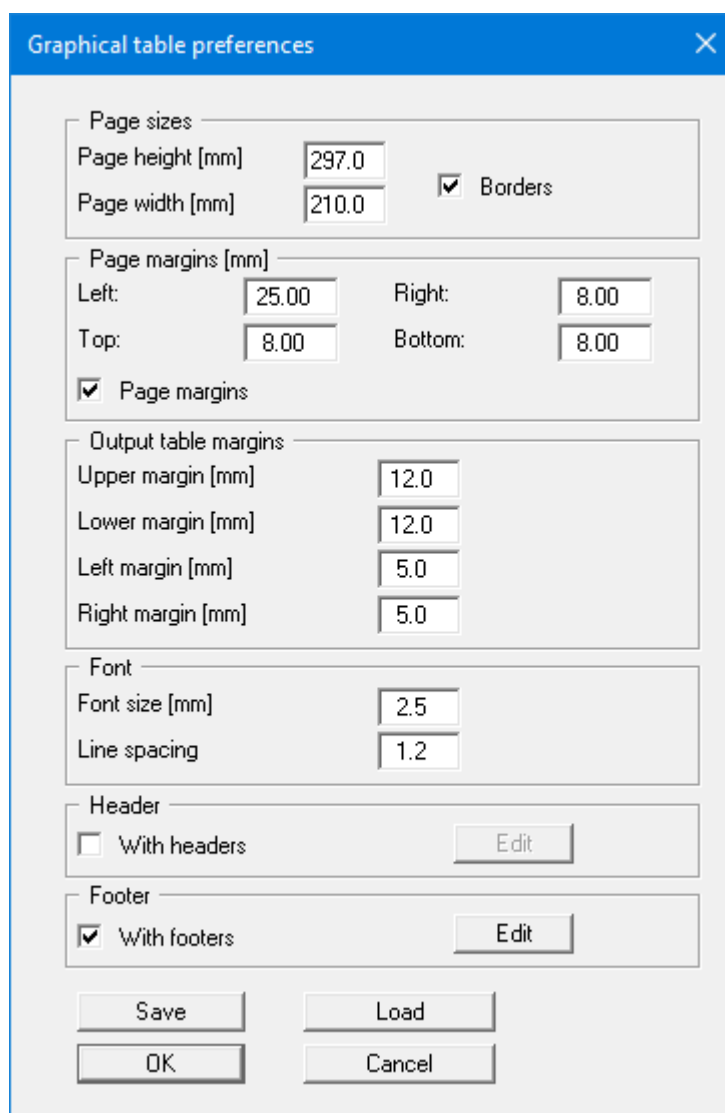
You have the option of designing and printing the output table as an annex to your report within the GGU program. To do this, select "**Output as graphics**" from the following options.



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.

7.5.2 GGU-TRENCH: Button "Output as graphics"

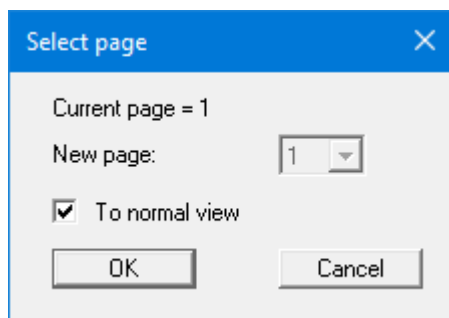
If you selected the **"Output as graphics"** button in the previous dialog box a further dialog box opens, in which you can define further preferences for result visualisation.



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.

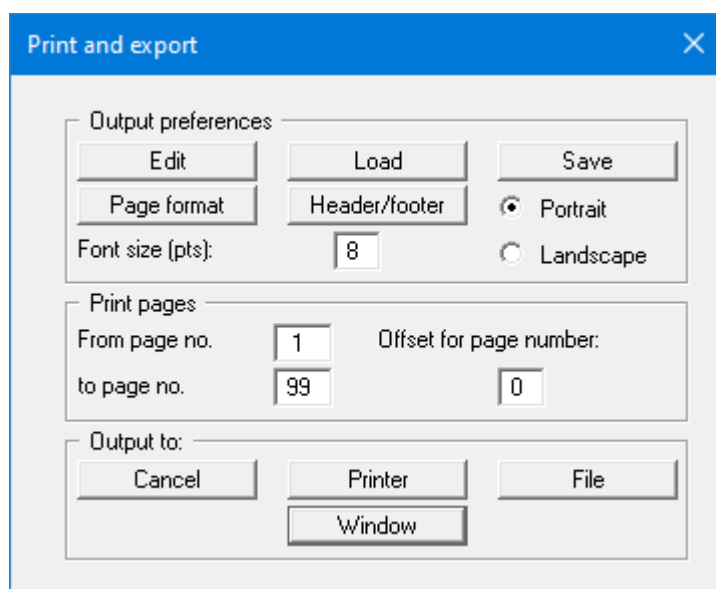
If you need to add a header or footer (e.g. for page numbering), activate the appropriate check boxes **"With headers"** and/or **"With footers"** and click on the **"Edit"** button. You can then edit as required in a further dialog box. You can save your settings for the graphical output table presentation 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.

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:



7.5.3 GGU-TRENCH: Button "Output as ASCII"

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



In the dialog box you can define output preferences.

- **"Output preferences"** group box

Using the **"Edit"** button the current output preferences can be changed or a different printer selected. Using the **"Save"** button, all preferences from this dialog box can be saved to a file in order to have them available for a later session. If you select 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.

7.6 GGU-TRENCH "Output preferences" menu item

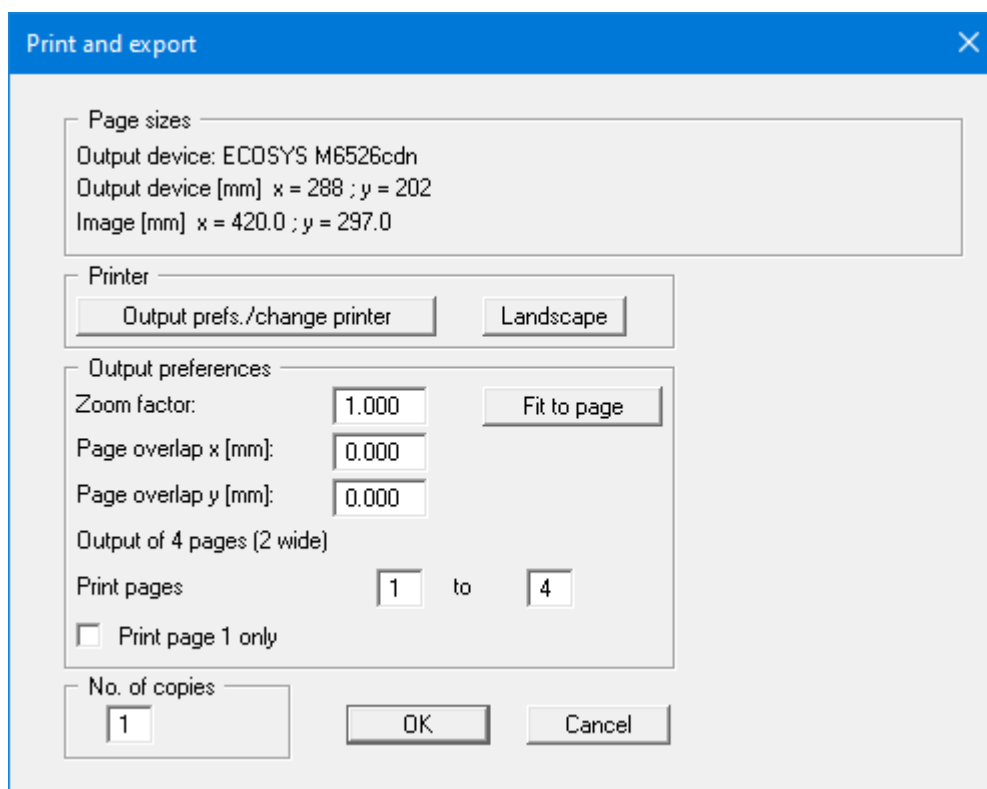
You can edit output preferences (e.g. swap between portrait and landscape) or change the printer in accordance with WINDOWS conventions.

7.7 GGU-TRENCH "Print and export" menu item

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.

I

- **"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



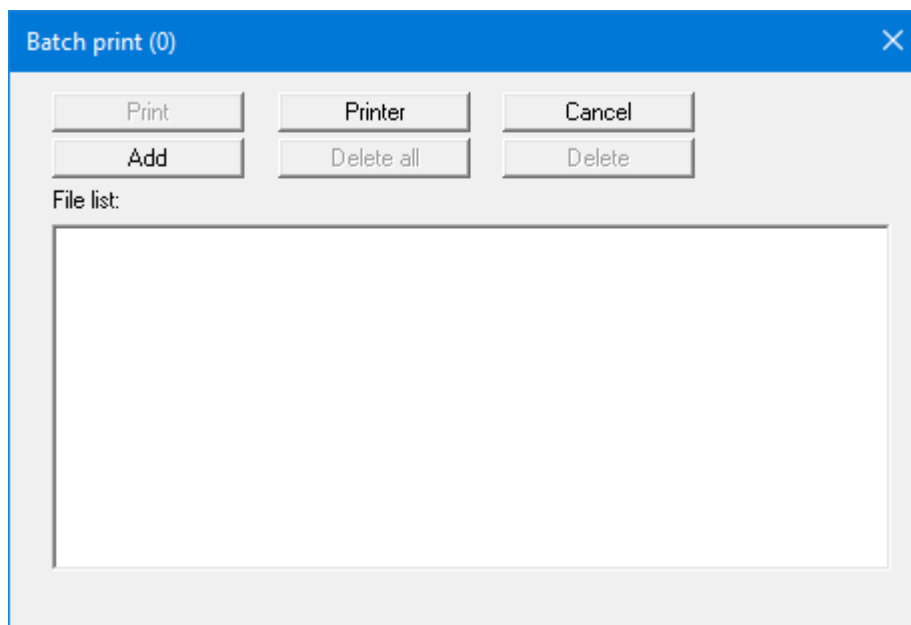
from the toolbar, you can copy parts of the graphics to the clipboard or save them to an EMF file. Alternatively you can send the marked area directly to your printer (see "**Tips and tricks**").

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 in order to enable importing to different GGU applications with the Mini-CAD module.
- **"GGUMiniCAD"**
allows export of the graphics to a file in order to enable processing in the GGUMiniCAD program.
- **"Cancel"**
Printing is cancelled.

7.8 GGU-TRENCH "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.

7.9 GGU-TRENCH "Exit" menu item

After a confirmation prompt, you can quit the program.

7.10 GGU-TRENCH "1, 2, 3, 4" 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 **"1,2,3,4, ..."**, the most recently edited files are displayed with the respective storage path. Selecting one of these files loads the selected file. The next time you call up the menu items **"File / Load"** or **"File / Save"**, the program is automatically located in the directory of the last file loaded.

8 Edit menu

8.1 GGU-TRENCH: "Project identification" menu item

You can enter a description of the current system; this will then be used in the **General legend** (see "Graphics preferences/General legend" menu item).

8.2 GGU-TRENCH: "Analysis options" menu item

You can select the desired verification concept. If a **partial factor concept** is selected, the partial factors for "Slurry fluid" (

γ

H) and "Earth pressure" (

γ

E) can be entered. Further information is available by pressing the "Info" buttons (see also "Analysis principles").



In order to guarantee the compatibility of the older records it is still possible to select DIN 4126-100 here and edit the partial safety factors.

Analysis compliant with DIN 4126 5.3 requires the characteristic value of the buoyant unit weight of the soil in the slurry. The buoyant unit weight of the soil may be adopted as an approximation. If the check box "Analysis of slip of individual grains with $\gamma_{\text{am}}(s)$ and n " is deactivated, the buoyant unit weight of the soil is adopted for analysis. Otherwise, a more precise analysis compliant with DIN 4126 5.3 is performed.

If you activate the "Use absolute heights" check box, all information with regard to trench depth, guide wall depth, suspension level, groundwater level and depth of soil layers can be given in absolute heights (e.g. in m AD). In the dialog box for diaphragm wall input (see menu item "Edit/Diaphragm wall") the height of the ground level must then also be entered in absolute figures. In all relevant dialog boxes, the input value will be shown as [m AD] instead of [m]. This simply provides clarity. You are, of course, free to select a reference level other than [m AD]. If you do not activate the "Use absolute heights" check box, ground level is assumed to be 0.0 m and all depth information is positive downwards.

8.3 GGU-TRENCH: "Diaphragm wall" menu item

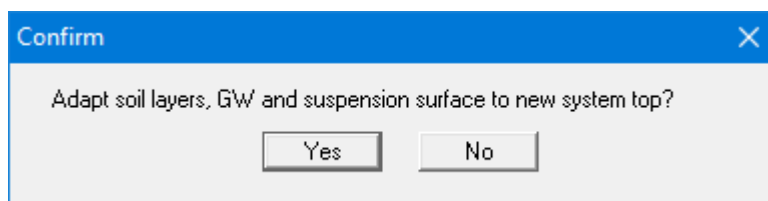
This menu item consists of the central data input for your system and the initial analysis data. You will see a dialog box, in which almost all the basic data necessary for analysis of the diaphragm wall can be entered.



If you do not use absolute heights, ground level is assumed to be 0.0 m and all depth information is positive downwards. If you have activated the "**Use absolute heights**" check box in the "**File/New**" menu item, an additional "**Ground level**" input box will be displayed. All height input is then in [m AD]. To adapt the trench and guide wall depths to the new elevation, you can use the calculate function in the input boxes. Simply enter the new ground level elevation in front of the existing elevation data and let the program calculate and enter the new elevations by clicking "**OK**".

Ground level [m·AD]:	56
Trench base [m·AD]:	56-20.00
Delta depth [m]:	1.00
Trench length [m]:	6.00
Guide wall depth [m·AD]:	56-1.40

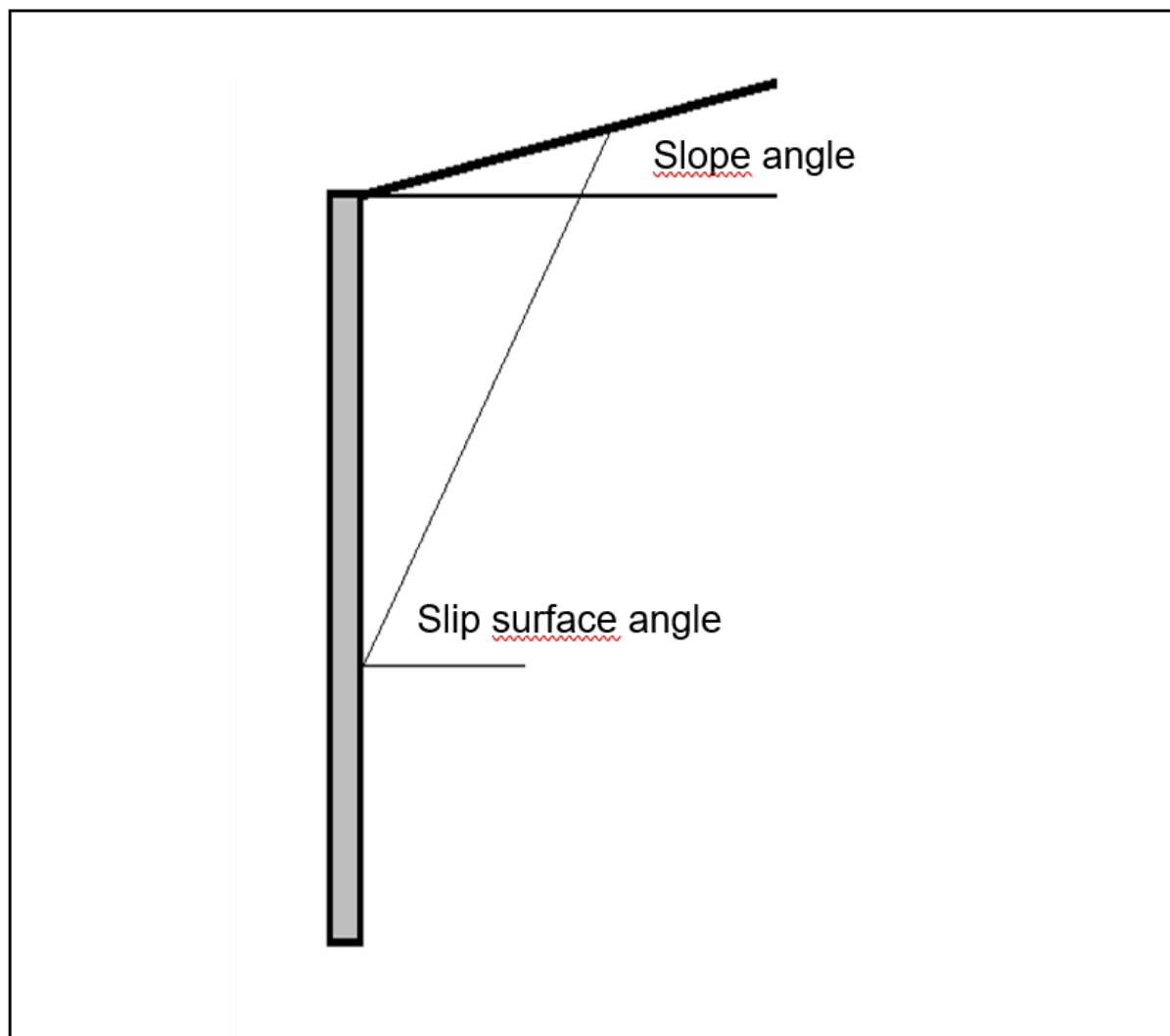
If the program exits the dialog box (see above) after converting and entering the altered elevations, you will first read a query on how to proceed with the remaining elevations.



Normally, the elevations of the soil strata, etc., should be adapted to the new local datum ground level elevation. In the prompt box, then, click the "**No**" button. Adaptation would mean that the depth of a soil layer entered as a positive value would be converted from, for example, 7.5 m to an absolute height of -7.5 m AD. If, then, you only convert your system to [m AD], always select "No".

In the upper group box, you enter the dimensions of the diaphragm wall and the guide wall. The "**Delta depth**" defines the model points at which safety factors are computed. Distinctive points in the system such as the base of the guide wall and layer boundaries are always taken into consideration.

The range of variation of the slip surface angle is then specified.



The number of intermediate angles between the two slip surface angles ("**minimum**" and "**maximum**") is defined by the "**No. of subdivisions**". The program begins the analysis with the first entered minimum slip surface angle. The next **intermediate angle** is then investigated.

In the lower group box, you select the type of lateral pressure increase. There are three possible options:

- bilinear after DIN 4126
- sublinear after Terzaghi
- sublinear after Terzaghi, but with the limitation that the bilinear approach after DIN 4126 using the bending point defined by the depth $z = \text{trench width}$ is not exceeded.

When computing the lateral pressure increase after Terzaghi the lateral pressures increase following an exponential function. In order to model the curve precisely enough in the program, it is possible to control the model points at which the lateral pressures after Terzaghi are computed using the "**Delta depth (Terzaghi)**" value.

In the lower group box, any ground inclination and the value of the distributed load are defined.

In contrast to line loads, the distributed load is always taken into consideration when determining the friction forces acting on the wedge flanks.

8.4 GGU-TRENCH: "Suspension + GW" menu item

Using this menu item, information is entered on the unit weight of the suspension, the suspension surface level, the liquid limit of the slurry fluid (τ_{auf}) and the groundwater level.



8.5 GGU-TRENCH: "Soils" menu item

The layering of the ground is described using this menu item. Any groundwater present does not need to be entered as a layer boundary, the program does this automatically. After clicking on this menu item, the following dialog box opens:



By clicking the "**x soils to edit**" button a further dialog box opens in which you can enter the number of soils. If more than eight soils are present, they can be viewed by navigating through the soil table using the "**Forw.**" and "**Back**" buttons.

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

The properties for each soil are entered into the corresponding input boxes. These are:

- **Base** = base of respective layer [m];
- **gam(f)** = unit weight of wet soil [kN/m³];
- **gam'** = buoyant unit weight of soil [kN/m³];
- **phi** = friction angle of soil [°];

- **c** = cohesion of soil [kN/m²];
- **d10** = grain size of soil for 10 % mass component [mm];
- **gam(s)** = soil grain density [kN/m³];
- **n** = soil pore space [-].

If you have activated the "**Use absolute heights**" check box, the layer depths ("**Base**") are positive upwards, i.e. the layer depths must be entered in mAD.

The soils are sorted according to depth by pressing the "**Sort**" button. This is always done automatically after leaving the dialog box. You can also use this function to eliminate a soil from the table. Simply assign the soil to be eliminated a greater layer depth and then click the "Sort" button. The corresponding soil is now the last soil in the table and can be deleted by reducing the number of soils.

8.6 GGU-TRENCH: "Line loads" menu item

You will see the following dialog box:



By clicking the "**x line loads to edit**" button a further dialog box opens in which you can enter the number of line loads (max. 20). If more than eight line loads are entered they can be viewed by navigating through the line load table using "**Forw.**" and "**Back**".

The values corresponding to the respective line loads are entered into the appropriate fields in the dialog box. These are:

- **Size** = the size of the line load [kN/m²]
- **xleft** = the distance of the left line load boundary from the diaphragm wall [m]
- **xright** = the distance of the right line load boundary from the diaphragm wall [m]
- **Depth** = the depth at which the line load acts [m], from the top of the diaphragm wall
- **Factor Lateral pressure** = the amount by which the line load contributes to an increase in the lateral pressure (0.0 => no contribution)

The line loads are sorted according to acting depth by pressing the "**Sort**" button.

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

Simply assign the line load to be eliminated a greater acting depth and then click the "**Sort**" button. The corresponding line load is now the last line load in the table and is be **deleted** by reducing the number of line loads.

If line loads possess a factor for the lateral pressure > 0.0, the corresponding value will be displayed in brackets in the system graphics, following the value for the line load.

8.7 GGU-TRENCH: "Terrace" menu item

Using this menu item, you can take the influence of a terrace beside the diaphragm wall into consideration.



In the dialog box, define the depth of the terrace below ground level (positive downwards). Below this, enter the distance of the terrace from the guide wall.

The current version of the program only allows for terraces > 0.0 m (= below ground level).

Terraces < 0.0 m (= above ground level) can be taken into consideration approximately by using negative line loads.

Below the terrace, a correspondingly reduced lateral pressure is assumed on both flanks, which leads to a lower friction force on the flanks. In addition, the cohesion component on the slip surface is correspondingly reduced.

8.8 GGU-TRENCH: "User-defined water pressure" menu item

Normally, the water pressure is calculated using the user-defined groundwater level. If you want to take a different water pressure distribution into consideration, you can use a polygon course to define almost any distribution using this menu item.



To enter your water pressure distribution, first activate the corresponding check box. Define the number of polygon model points after clicking the button marked **"x water pressures to edit"**. Then enter your data.

Upwardly or downwardly directed gradients i may result as a consequence of user-defined water pressure distributions, thereby increasing or decreasing the unit weight of the soil. The change in unit weight is equal to $i \cdot w$ and can be taken into consideration by activating the right check box.

8.9 GGU-TRENCH: "Undo" menu item

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

8.10 GGU-TRENCH: "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 "**Edit/Undo**" will be restored. This function can also be reached by using the key combination [**Ctrl**] + [**Back**] or the appropriate tool in the toolbar.

8.11 GGU-TRENCH: "Preferences" menu item

You can activate or deactivate the undo functions.

9 System menu

9.1 GGU-TRENCH: "Analyse" menu item

You see the following dialog box, in which you can define further preferences for the type of analysis:



- **"Analysis with at-rest pressure in front of guide wall"**

If this check box is activated the guide wall is analysed with at-rest pressure. If the check box is not activated the force from the suspension is adopted.

- **"At-rest press. in front of wall with distributed load"**

If this check box is activated any distributed loads are taken into consideration for computation of the at-rest pressure.

- **"At-rest press. in front of wall with line load"**

If this check box is activated any line loads are taken into consideration for computation of the at-rest pressure.

If you activate the line load check box but have entered the line loads with a factor for the lateral pressure of **0.0**, the check box has no affect. A corresponding message will be displayed before analysis commences.

- **"Cohesion safety factor"**

Enter the cohesion safety factor here. In accordance with DIN 4126 (9.1.4.1) and DIN 4126-100 (7.4.3), the cohesion may only be adopted with the reduced value of

$$\text{red } c = \text{cal } c / \text{eta}(c),$$

whereby a value for eta(c) of 1.5 is given.

If higher safety is required, the cohesion in the region of the slip surface and the flanks can be further reduced. You must then enter a value < 1.0 for "Slip surface cohesion factor" and "Flank cohesion factor". The cohesion values reduced by eta(c) are multiplied by this factor.

- **"Slip surface cohesion factor"**

You can enter a factor < 1.0 to further reduce the cohesion values.

- **"Flank cohesion factor"**

You can enter a factor < 1.0 to further reduce the cohesion values.

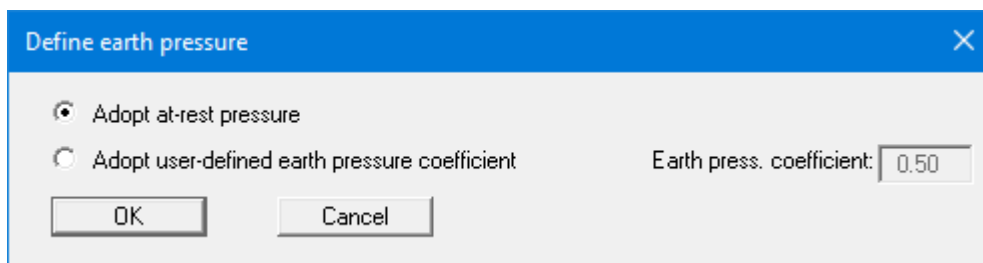
- **"Show failure planes during analysis"**

If you activate this checkbox the failure planes for the current analysis are displayed on the screen. Interesting to look at; however, this does cost more time.

- "OK"

After clicking this button you will see a message box with information on the current preferences. You can deactivate these messages. The system will then be analysed.

Start the analysis by leaving the dialog box with "OK". A further dialog box opens in which you can switch to a calculation with a user-defined earth pressure coefficient.



Once the analysis has been done, you will be presented with information on the principal analysis results in a message box. After closing the message box, detailed analysis results are presented graphically on the screen in a legend (see Section 6.4.7). Even more detailed analysis results can be displayed using the menu item "File/Print output table".

9.2 GGU-TRENCH: "Minimum safety factors" menu item

After an analysis performed using the old **global safety factor concept** you can view the minimum safety factors computed in a message box, without having to reanalyse the system. The same message box opens; the dialog box is the same as that displayed upon completion of analysis.

9.3 GGU-TRENCH: "Maximum utilisation factors" menu item

After an analysis performed using the new **partial safety factor concept** you can view the maximum utilisation factors computed in a message box, without having to reanalyse the system. The same message box opens; the dialog box is the same as that displayed upon completion of analysis.

9.4 GGU-TRENCH: "Allowable FOS preferences" menu item

DIN 4126 demands a FOS of 1.1 or 1.3 (if loads from structures act in the critical area). If you are analysing using the **global safety factor concept**, you can have the user-defined safety factor entered as a horizontal boundary line into the safety factor distribution diagram. Use this menu item to do this.



Just activate the line representation check box and enter the desired safety factor.

9.5 GGU-TRENCH: "Graphics output preferences" menu item

Among other things, the screen graphics consist of several diagrams, presenting depth-oriented results. The represented variables can be specified in the dialog box for this menu item.



Depending on the verification concept selected, the "**Safety factor $\eta(a)$** " or the "**Utilisation factor $\mu(a)$** " is displayed and hatched where specified. Body forces refers to the loads from line loads, soil self-weight, friction forces resulting from both cohesion and the friction angle on both flanks, and the cohesion force on the front of the wall. The reaction force Q is the force resulting from the friction angle on the front of the wall. The lateral pressure is represented without a component from any line loads present with a factor for the lateral pressure of > 0.0 .

If you analysed using a user-defined water pressure, the screen graphics will display a diagram with the water pressure distribution. In the combo box you are given the option of displaying the potential or the gradient, instead of the water pressure.

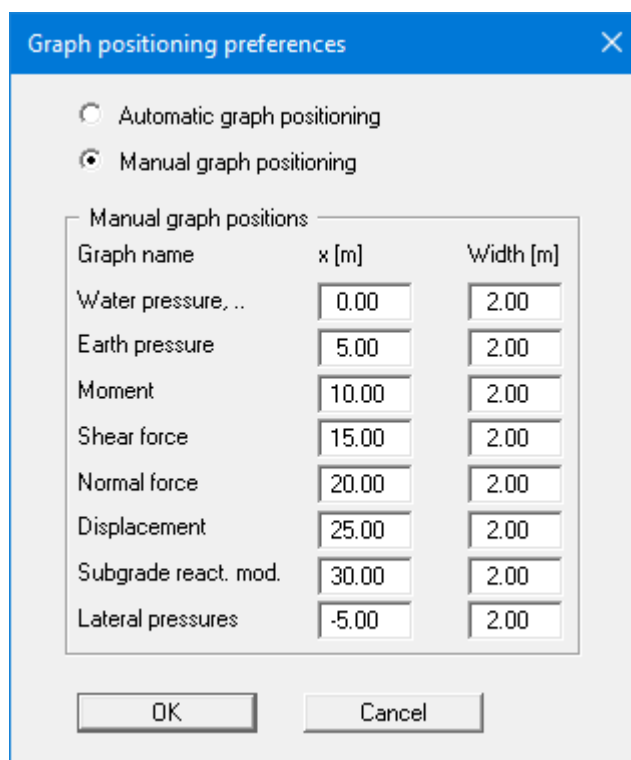
Line loads and distributed loads are shown in the graphics at the height specified in the "**Presentation height (loads)**" field. If you deactivate the "**Same height for all**" check box, the largest load is displayed with the specified value and the remaining smaller loads displayed in proportion to this. The unit can also be displayed by activating the "**Show unit**" check box.

The program automatically scales the graph width to fit.

If the system coordinates are modified, e.g. using "**Page size + margins/Manual resize (editor)**", or by adding further graphics, all graphs are rearranged uniformly within the available space.

9.6 GGU-TRENCH: "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.



The "Graph positioning preferences" dialog box has a blue title bar with a close button. It contains two radio buttons: "Automatic graph positioning" (unselected) and "Manual graph positioning" (selected). Below is a section titled "Manual graph positions" containing a table with three columns: "Graph name", "x [m]", and "Width [m]". The table lists eight graph types with their corresponding x and width values. At the bottom are "OK" and "Cancel" buttons.

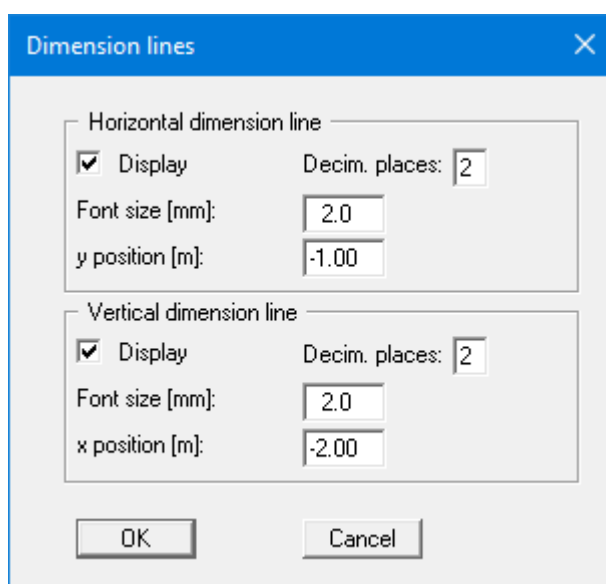
Graph name	x [m]	Width [m]
Water pressure, ..	0.00	2.00
Earth pressure	5.00	2.00
Moment	10.00	2.00
Shear force	15.00	2.00
Normal force	20.00	2.00
Displacement	25.00	2.00
Subgrade react. mod.	30.00	2.00
Lateral pressures	-5.00	2.00

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.

9.7 GGU-TRENCH: "Dimension lines" menu item

You can include a vertical and/or horizontal dimension line in the graphic to illustrate the system dimensions. If the dimension lines are displayed on the screen, you can also open the following dialog box directly by double-clicking the left mouse button over a dimension line.



The "Dimension lines" dialog box has a blue title bar with a close button. It contains two sections: "Horizontal dimension line" and "Vertical dimension line". Each section has a "Display" checkbox (checked), a "Decim. places" spinner (set to 2), a "Font size [mm]" spinner (set to 2.0), and a position spinner. For the horizontal line, the "y position [m]" is set to -1.00. For the vertical line, the "x position [m]" is set to -2.00. At the bottom are "OK" and "Cancel" buttons.

The distance to the wall or pile is defined by means of the "**y position**" for the horizontal dimension line and "**x position**" for the vertical dimension line. Negative values define a position above or to the left of the wall or pile. All values are in metres in the scale selected (see the menu item "**Page size + margins/Manual resize (editor)**").

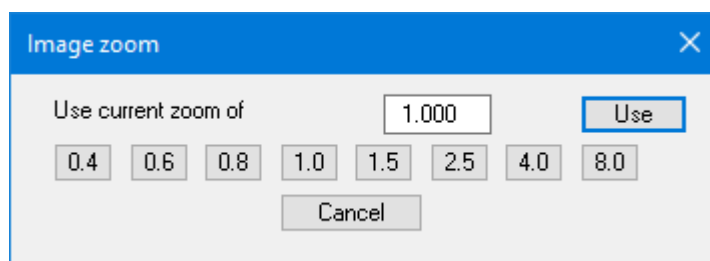
The fastest way to modify the position of the dimension lines is to press the [**F11**] function key and then to pull the legend to the new position with the left mouse button pressed.

10 Graphics preferences menu

10.1 GGU-TRENCH: "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.

10.2 GGU-TRENCH: "Zoom info" menu item

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

10.3 GGU-TRENCH: "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.

10.4 GGU-TRENCH: "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.

10.5 GGU-TRENCH: "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 saved in the "**C:\Program Files (x86)\GGU-Software\Manuals**" folder during installation. The differences between the Mini-CAD and Header CAD are as follows:

- 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.

10.6 GGU-TRENCH: "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-3D-SSFLOW.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.

10.7 GGU-TRENCH: "General legend" menu item

A legend with general properties will be displayed on your output sheet if you have activated the **"Show legend"** check box. Using this menu item you can alter the type of presentation.

General legend [X]

☒ Show legend

Heading:
Initial analysis data

x value: 180.00

y value: 278.00

Font size [mm]: 2.5

Max. no. of rows 12

☒ Marked red if not verified

☐ Show program name and version

☒ Show groundwater equation

☒ Show slip equation

☐ Explain equation

☒ Show standard

Display file name

☒ None ☐ Short ☐ Long

OK Cancel

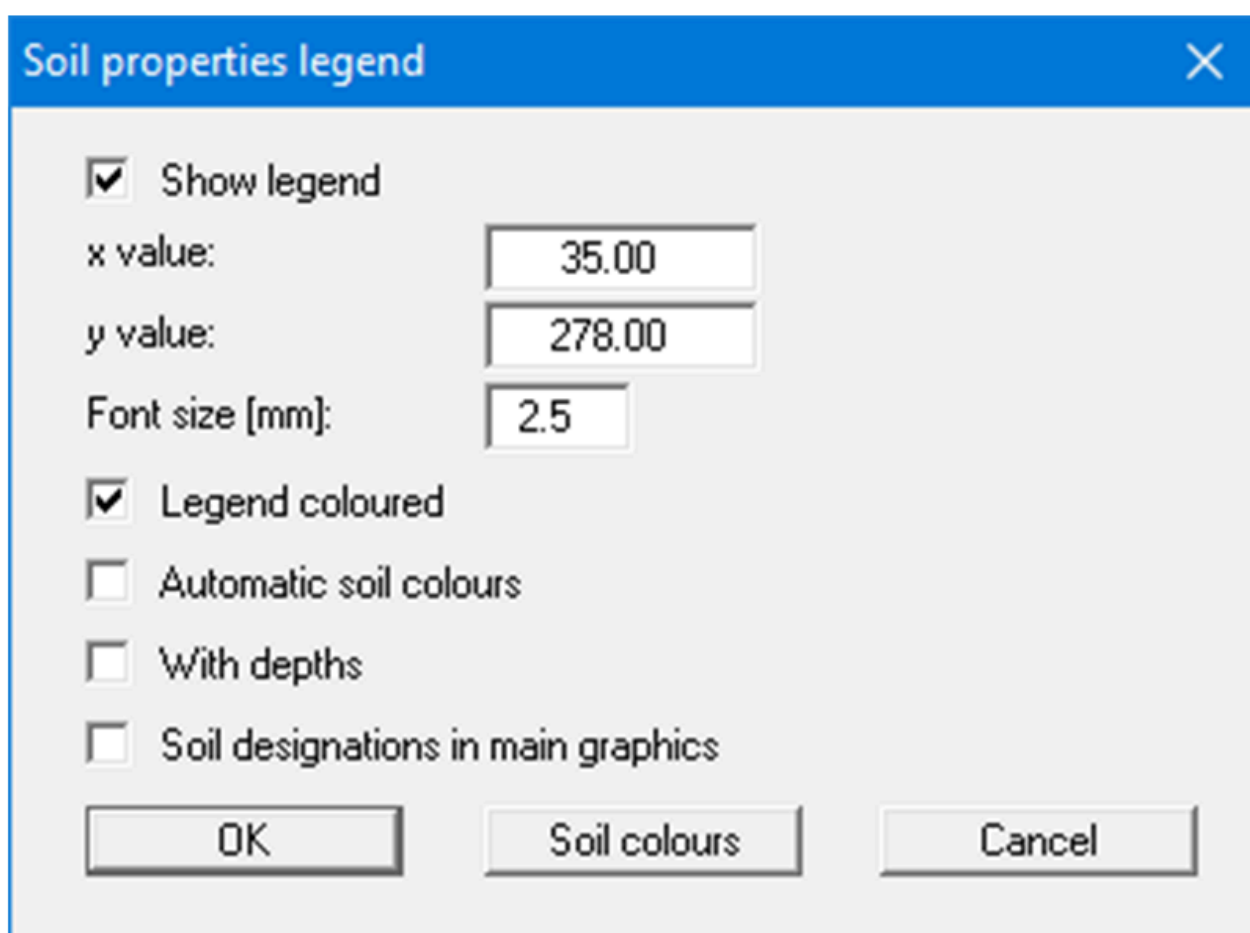
If wanted a given heading can be used. You can define and edit the position of the legend using the values "x" and "y". You control the size of the legend using "Font size" and "Max. no. of lines"; where necessary, several columns are used.

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

In the **General legend** you can, if wished, display further information on different equations and the adopted standard or on the program (name and version). Any project identification entered using the menu items **"File/New"** or **"Edit/Project identification"** will be shown in the general legend. The file name can be switched off (**"None"** option button) or be displayed automatically with or without the path by selecting the appropriate **"Short"** or **"Long"** option button.

10.8 GGU-TRENCH: "Soil properties legend" menu item

A legend with the soil properties will be displayed on your output sheet if you have clicked the **"Show legend"** check box. 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 **"Font size"**.

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.

- **"Legend coloured "**

The soil colours are displayed in the legend. Otherwise, they will be numbered.

- **"Automatic soil colours"**

The soils are assigned soils colours automatically by the program. If the check box is not selected, the soil colours individually defined using the **"Soil colours"** button will be adopted.

- **"With depths"**

The depths of the individual soil layers will be shown in the soil properties legend.

- **"Soil designations in main graphics"**

The designations entered for the individual ground layers are displayed in the system graphics adjacent to the layer depths.

- **"Soil colours"**

You will see a dialog box, in which you can define your preferences. After clicking the button with the desired number you can assign each soil layer a new number or reorganise using the **"Soil colours/Reorganise"** command button. You can save your colour preferences to a file with **"Soil colours/Save"** and use them for different systems by means of the **"Soil colours/Load"** command button. In the lower group box you can also transfer the colour preferences to the Windows colour management dialog box, or vice versa, as user-defined colour preferences for example. You can read a further description by pressing the **"Info"** button.

10.9 GGU-TRENCH: "Move objects" menu item

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

10.10 GGU-TRENCH: "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-TRENCH.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.

10.11 GGU-TRENCH: "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.

11 Page menu

11.1 GGU-TRENCH: "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.

11.2 GGU-TRENCH: "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.

11.3 GGU-TRENCH: "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.

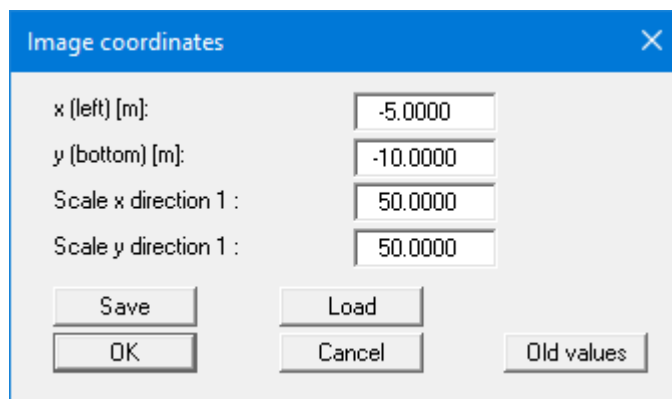


Image coordinates	
x (left) [m]:	-5.0000
y (bottom) [m]:	-10.0000
Scale x direction 1 :	50.0000
Scale y direction 1 :	50.0000
Save Load OK Cancel Old values	

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.

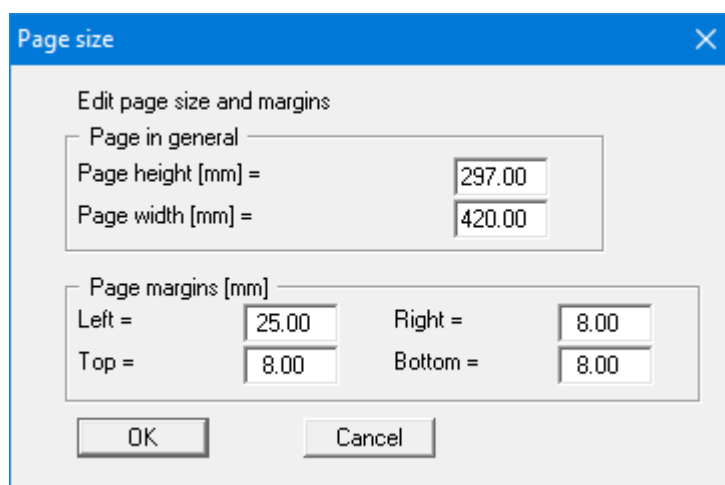
11.4 GGU-TRENCH: "Font size selection" menu item

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.

11.5 GGU-TRENCH: "Page size and margins" menu item

The program uses A3 format as default. You can edit the page format in the following dialog box.



- "Page in general" defines the size of the output sheet. The program automatically draws thin cutting borders around the page, which are required when using a plotter on paper rolls. The borders can be switched off using the menu item "Graphics preferences/Margins and borders".
- "Page margin" defines the position of a frame as a distance to the margins. This frame encloses the subsequent diagram. The margins can be switched off using the menu item "Graphics preferences/Margins and borders".
- The "Plot margin" defines a set distance between the page margin and the actual **drawing area** in which the graphical evaluation of your input is presented.

12 Info menu

12.1 GGU-TRENCH: "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.

12.2 GGU-TRENCH: "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.

12.3 GGU-TRENCH: "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.

12.4 GGU-TRENCH: "Maxima" menu item

A box opens showing the maximum values allowed by the program for the nodes and elements of the FEM mesh (3D and 2D) .

12.5 GGU-TRENCH: "Help" menu item

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

12.6 GGU-TRENCH: "What's new?" menu item

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

12.7 GGU-TRENCH: "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.