

## Editing a Template in the Laboratory Program

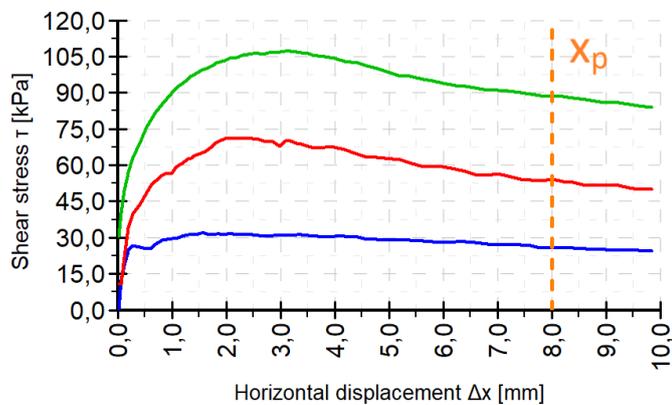
Program: Laboratory  
 File: Demo\_manual\_52.gsg

This manual describes advanced work with formulas and graphs in templates using the example of editing the Shear Box Test. **Basic formula work is explained in Engineering Manual No. 51. This manual requires the knowledge covered in Manual No. 51.**

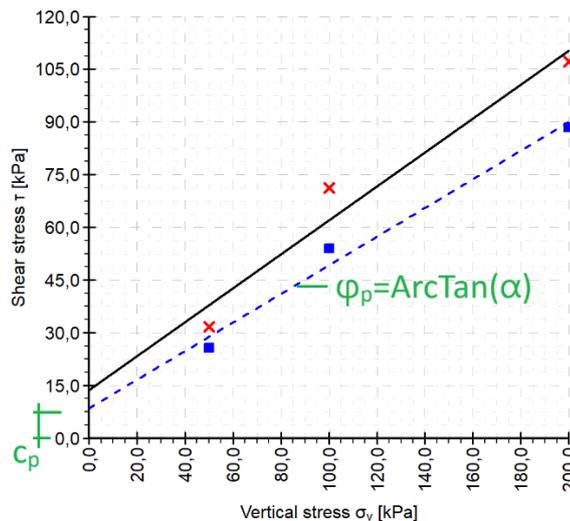
Our goal is to determine the values of the angle of internal friction  $\varphi_p$  and cohesion  $c_p$  at any point during the test (for the displacement specified by us at the test point  $x_p$ ).

In our case, we will consider  $x_p = 8\text{ mm}$ .

The calculation procedure is the same as for the standard peak strength. From the stress graph of individual tests, we read the stress values at point  $x_p$ .



We then fit a straight line through the obtained points and calculate the values  $\varphi_p$  and  $c_p$ .



*Note: We usually look for the stated value of the shear parameters in the part of the test beyond its peak in an attempt to find residual shear strength parameters. However, since the shear box test is not suitable for determining the actual residual parameters, we present the derived shear parameters for the selected deformation.*

Output report of the shear box test of the template set "Laboratory - EN-Standard" has the following form:

<b>Shear Box Test</b>	
Project: Apartment building "Moonlighting" - Survey for building permit	
Test ID: Shear box test	Project ID: 2022/3548
Supplier: GEO5 Laboratory Ltd.	Customer: Survey ABC Ltd.
Date of measurement: 27.03.2023	Performed by: John Young

Sample	
Field test: BH5	Sample type: undisturbed
Sample index: VA1/1254	Geotechnical type: GT2
Depth from: 7,00 m	Description:
Depth to: 7,80 m	Clay with low plasticity, stiff, gray-blue color

Specimen				
Specimen ID: VA1/1254-12		Consolidation time: 24,0 hour		
Depth: 7,35 m		Shear rate: 0,001 mm/min		
	<b>Before test</b>	<b>Specimen Nr. 1</b>	<b>Specimen Nr. 2</b>	<b>Specimen Nr. 3</b>
Dimensions (width/height) [mm]	-	60,00 / 21,00	60,00 / 21,00	60,00 / 21,00
Moisture content [%]	22,45	24,40	24,30	22,10
Consolidation (before test) [mm]	-	0,210	0,550	1,170
Vertical stress [kPa]	-	50	100	200
Max. shear stress [kPa]	-	31,7	71,3	107,2
Wet unit weight [kg/m <sup>3</sup> ]	1802,0	1848,0	1921,0	1967,0
Dry unit mass [kg/m <sup>3</sup> ]	1472,2	1485,5	1545,4	1610,9
Displacement at failure [mm]	-	1,530	2,061	3,080

Measured values and results							
<b>Test results:</b>	<table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 50%;"></th> <th style="width: 25%;">Angle of internal friction <math>\phi_{ef}</math> [°]</th> <th style="width: 25%;">Cohesion <math>c_{ef}</math> [kPa]</th> </tr> </thead> <tbody> <tr> <td style="text-align: right;"><b>Peak values:</b></td> <td style="text-align: center;"><b>25,8</b></td> <td style="text-align: center;"><b>13,8</b></td> </tr> </tbody> </table>		Angle of internal friction $\phi_{ef}$ [°]	Cohesion $c_{ef}$ [kPa]	<b>Peak values:</b>	<b>25,8</b>	<b>13,8</b>
	Angle of internal friction $\phi_{ef}$ [°]	Cohesion $c_{ef}$ [kPa]					
<b>Peak values:</b>	<b>25,8</b>	<b>13,8</b>					
<b>Notes</b> Specimens were flooded with water during the test. Moisture content indicated for the test specimens is after the end of the test (moisture content determined according to EN ISO 17892-01). Specimen supplied by the customer, test results refer to the sample as received. Test equipment: hydraulic shear device. Test performed in accordance with EN ISO 17892-10.							
<b>Verified by:</b> Peter Filmer	<b>Date of issue:</b> 28.03.2023  <div style="text-align: right;">Stamp and signature</div>						

The required form of the protocol is this:

		<b>Shear Box Test</b>		
Test ID: Shear box test		Project: Apartment building "Moonlighting" - Survey for building permit		
Supplier: GEO5 Laboratory Ltd.		Project ID: 2022/3548		
Date of measurement: 27.03.2023		Customer: Survey ABC Ltd.		
Performed by: John Young				
Sample				
Field test: BH5		Sample type: undisturbed		
Sample index: VA1/1254		Geotechnical type: GT2		
Depth from: 7,00 m		Description:		
Depth to: 7,80 m		Clay with low plasticity, stiff, gray-blue color		
Specimen				
Specimen ID: VA1/1254-12		Consolidation time: 24,0 hour		
Depth: 7,35 m		Shear rate: 0,001 mm/min		
	<b>Before test</b>	<b>Specimen Nr. 1</b>	<b>Specimen Nr. 2</b>	<b>Specimen Nr. 3</b>
Dimensions (width/height) [mm]	-	60,00 / 21,00	60,00 / 21,00	60,00 / 21,00
Moisture content [%]	22,45	24,40	24,30	22,10
Consolidation (before test) [mm]	-	0,210	0,550	1,170
Vertical stress [kPa]	-	50	100	200
Max. shear stress [kPa]	-	31,7	71,3	107,2
Wet unit weight [kg/m <sup>3</sup> ]	1802,0	1848,0	1921,0	1967,0
Dry unit mass [kg/m <sup>3</sup> ]	1472,2	1485,5	1545,4	1610,9
Displacement at failure [mm]	-	1,530	2,061	3,080
Measured values and results				
<b>Test results:</b>		<b>Angle of internal friction <math>\phi_{ef}</math> [°]</b>	<b>Cohesion <math>c_{ef}</math> [kPa]</b>	
<b>Peak values:</b>		<b>25,8</b>	<b>13,8</b>	
<b>Post peak values at displacement 8,0 mm:</b>		<b>22,1</b>	<b>8,5</b>	
Notes				
Specimens were flooded with water during the test. Moisture content indicated for the test specimens is after the end of the test (moisture content determined according to EN ISO 17892-01). Specimen supplied by the customer, test results refer to the sample as received. Test equipment: hydraulic shear device. Test performed in accordance with EN ISO 17892-10.				
<b>Verified by:</b> Peter Filmer		<b>Date of issue:</b> 28.03.2023		Stamp and signature

**Solution:**

Edit the template with the demo file - Demo01.gla, which you can find in Fine online examples. Name the newly created template set EM 52 and save it in the Template Administrator for further use. We introduce the term “Post peak parameters” for the required parameters within the solution of this manual.

We will divide the solution of the problem into several parts:

1. Define the data type “Displacement for post peak strength” and fill in its value
2. Define other data types needed for calculation and plotting in the graph
3. Input formulas for automatic calculations
4. Edit the output log and desktop preview to include the new data

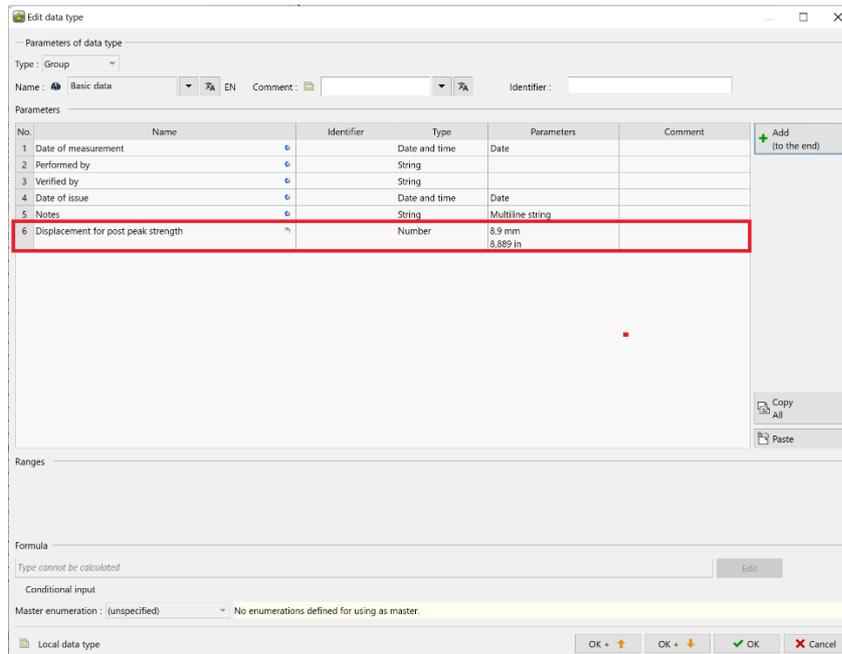
**Part 1**

First, open the Demo01.gla file, which contains the data we will be working from. In the Templates frame, check if we have set the template set we want to edit – “Laboratory - EN-Standard”. Press the “Edit copy of current template set and add it into the Administrator” button to open the template set editing window.

Assign a name to the created set of templates and save it in the administrator as a user template.

Open the template for the shear box test and add a new local data type into the “Basic data” group, name it “**Displacement for post peak strength**” and assign the following parameters:

- Type: Number
- Unit type: length
- Name: Displacement for post peak strength
- Symbol: -
- Empty text: -
- Metric unit: mm, 1 decimal place
- Imperial unit: in, 3 decimal places



*Note: Creating local data types and basic work with templates is described in detail in Engineering Manual 51.*

Save the edited template and proceed into the “shear box test” frame and open the already input test.

In the window, we see a new field for the data type we created, “Displacement for post peak strength”. We will fill in 8 mm according to the specifications. We will then use this value in further calculations.

*Note: by having this value already filled in, we will see previews of specific calculations when creating formulas. This will make our work easier.*

Test ID : Shear box test

Sample index : VA1/1254 Select sample ▼

Basic data | Specimen | Specimen Nr. 1 | Specimen Nr. 2 | Specimen Nr. 3 | Results | Calculations | Attachments

Date of measurement : 27.03.2023

Performed by : John Young

Verified by : Peter Filmer

Date of issue : 28.03.2023

Notes :  
Specimens were flooded with water during the test. Moisture content indicated for the test specimens is after the end of the test (moisture content determined according to EN ISO 17892-01).  
Specimen supplied by the customer, test results refer to the sample as received.

Displacement for post peak strength : 8,0 [mm]

Recalculate OK Cancel

## Part 2

Now return to the template modification and into group “Specimen Nr. 1” add another local data type “Post peak shear stress” with the following parameters:

- Type: Number
- Unit type: pressure
- Name: Post peak shear stress
- Symbol:  $\tau_{pp}$
- Empty text: -
- Metric unit: kPa, 1 decimal place
- Imperial unit: psi, 3 decimal places

This data type will not be entered by the user, but we will assign a formula to it for automatic calculation.

We need the same data type in the group for specimens 2 and 3. To save ourselves the work, we can now copy the created item and press the “OK + down arrow” button to go straight to the “Specimen Nr. 2” group, where we simply paste the item.

Parameters of data type

Type : Group

Name : Specimen Nr. 1 EN Comment : Identifier :

No.	Name	Identifier	Type	Parameters	Comment
4	Dry unit mass		Number	8,9 kg/m <sup>3</sup> 8,89 lb/ft <sup>3</sup>	
5	Moisture content		Number	8,89 % 8,89 %	
6	Vertical stress		Number	9 kPa 8,889 psi	
7	Consolidation (before test)		Number	8,889 mm 8,8889 in	
8	Displacement at failure		Number	8,889 mm 8,8889 in	
9	Shear - measurement		Table	General	
	Horizontal displacement		Number	Number of elements 4	
	Vertical displacement		Number		
	Shear stress		Number		
	Mobilized friction angle		Number		
10	Max. shear stress		Number	Symbol: $\tau_{max}$ 8,9 kPa 8,889 psi	
11	Post peak shear stress		Number	Symbol: $\tau_{pp}$ 8,9 kPa 8,889 psi	

Ranges

Formula

Type cannot be calculated

Conditional input

Master enumeration : (unspecified) No enumerations defined for using as master.

Local data type

Buttons: OK + ↑, OK + ↓, OK, Cancel

Continue by also pasting it into the group “Specimen Nr. 3”.

Next, we continue by creating data types for the calculations and output logs. In the “Results” group we already have two data types for the results in the peak values. We can now copy and then re-paste these two data types into the same group. The program will warn us that the same data types are already in the group, yet we select to paste them again.

Parameters of data type

Type : Group

Name : Results EN Comment : Identifier :

No.	Name	Identifier	Type	Parameters	Comment
1	Angle of internal friction		Number	Symbol: $\phi_{ef}$ 8,9 ° 8,9 °	
2	Cohesion		Number	Symbol: $c_{ef}$ 8,9 kPa 8,889 psi	

Parameters

Formula

Conditional input

Master enumeration : (unspecified) No enumerations defined for using as master.

Local data type

OK + ↑ OK + ↓ OK Cancel

Paste data types

Name	Type	Paste	Replace	Note
Angle of internal friction	Number	<input checked="" type="checkbox"/>		Same as existing data type No. 1 "Angle of internal friction". Will be pasted as a new data type.
Cohesion	Number	<input checked="" type="checkbox"/>		Same as existing data type No. 2 "Cohesion". Will be pasted as a new data type.

Paste Close

Now simply open the newly added items and edit the name and symbol, e.g. by adding "(pp)", referring to post peak strength.

Edit data type

Parameters of data type

Type: Group

Name: Results EN Comment: Identifier:

Parameters

No.	Name	Identifier	Type	Parameters	Comment
1	Angle of internal friction		Number	Symbol: $\varphi_{ef}$ 8,9 ° 8,9 °	
2	Cohesion		Number	Symbol: $c_{ef}$ 8,9 kPa 8,889 psi	
3	Angle of internal friction (pp)		Number	Symbol: $\varphi_{ef(pp)}$ 8,9 ° 8,9 °	
4	Cohesion (pp)		Number	Symbol: $c_{ef(pp)}$ 8,9 kPa 8,889 psi	

Copy All Paste

Ranges

Formula

Type cannot be calculated Edit

Conditional input

Master enumeration: (unspecified) No enumerations defined for using as master.

Local data type

OK + ↑ OK + ↓ **OK** Cancel

In the same way, copy the tables in the “Calculations” group - and name them “Post peak strength”.

Edit data type

Parameters of data type

Type : Group

Name : Calculations EN Comment : Identifier :

Parameters

No.	Name	Identifier	Type	Parameters	Comment
1	Peak strength - points (graph)		Table	General	
	Shear stress		Number	Number of elements 2	
	Vertical stress		Number		
2	Peak strength - Tangent line		Table	General	
	Tangent line slope		Number	Number of elements 4	
	Tangent line shift		Number		
	Vertical stress		Number		
	Shear stress		Number		
3	Post peak strength - points (graph)		Table	General	
	Shear stress		Number	Number of elements 2	
	Vertical stress		Number		
4	Post peak strength - Tangent line		Table	General	
	Tangent line slope		Number	Number of elements 4	
	Tangent line shift		Number		
	Vertical stress		Number		
	Shear stress		Number		

Ranges

Formula

Type cannot be calculated

Conditional input

Master enumeration : (unspecified) No enumerations defined for using as master.

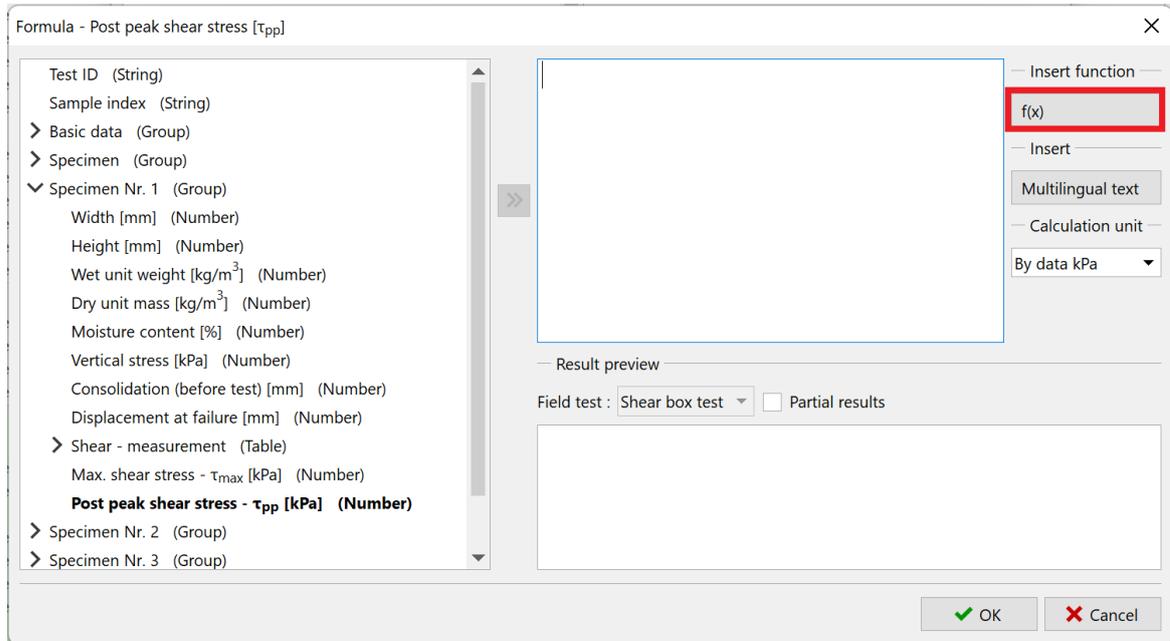
Local data type

## Part 3

Now we will continue by entering the formulas.

*Note: Basic work with formulas is explained in Engineering Manual 51.*

In the tree, find the newly created data "Post peak shear stress" under the group "Specimen Nr. 1" and open the window for adding the formula. Here we press the button to add a function.



The basic version of the shear box test template works with the "Shear - Measurement" table, in which the user enters the Horizontal displacement, vertical displacement and shear stress. For the peak parameters, the maximum entered shear stress is considered. In the task specification, we have defined that we will consider the surface parameters for the specified horizontal displacement - in this task we consider 8 mm. Using the linear interpolation function, we must therefore calculate the given shear stress for the selected horizontal displacement.

The function can be found in the list under "LINEARINTERPOLATION".

The function calculates the stress value (y) for the specified displacement (x) from the "Shear - Measurement" table.

The variables in the function are:

- x – Displacement for post peak strength
- Coordinates x – "Horizontal displacement" in the Shear – measurement table
- Coordinates y – "Shear stress" in the Shear – measurement table

The notation of the function is as follows:

The screenshot shows the 'Formula - Post peak shear stress [τ<sub>pp</sub>]' dialog box. On the left, a list of variables is shown, with 'Horizontal displacement - Δx [mm] (Number)' highlighted in red and 'Shear stress - τ [kPa] (Number)' highlighted in purple. The right side of the dialog features a function editor with the formula: `LINEARINTERPOLATION({Displacement for post peak strength};{Δx0};{τ0})`. Below the function editor, the 'Result preview' section shows the value '25,7'. The dialog also includes buttons for 'OK' and 'Cancel'.

Enter the formulas for the post peak shear stress for specimens 2 and 3 in the same way.

The correctness of the input can be verified at any time in the test input window, where we can see the calculated values of the surface shear stress for our selected displacement of 8 mm.

Edit test: Shear box test

Test ID : Shear box test

Sample index : VA1/1254 Select sample ▾

Basic data | Specimen | Specimen Nr. 1 | Specimen Nr. 2 | Specimen Nr. 3 | Results | Calculations | Attachments

Width : 60,00 [mm]

Height : 21,00 [mm]

Wet unit weight : 1921,0 [kg/m<sup>3</sup>]

Dry unit mass : 1545,4 [kg/m<sup>3</sup>]

Moisture content : 24,30 [%]

Vertical stress : 100 [kPa]

Consolidation (before test) : 0,550 [mm]

Displacement at failure : 2,061 [mm]

Shear - measurement :

No. ↗	Horizontal displacement Δx [mm]	Vertical displacement Δz [mm]	Shear stress τ [kPa]	Mobilized friction angle φ <sub>mob</sub> [°]
1	0,023	0,000	10,746	6,1
2	0,055	-0,005	10,746	6,1
3	0,118	-0,014	21,692	12,2
4	0,172	-0,020	31,542	17,5
5	0,196	-0,025	34,030	18,8
6	0,284	-0,032	39,934	21,8
7	0,408	-0,044	43,980	23,7
8	0,520	-0,053	48,259	25,8

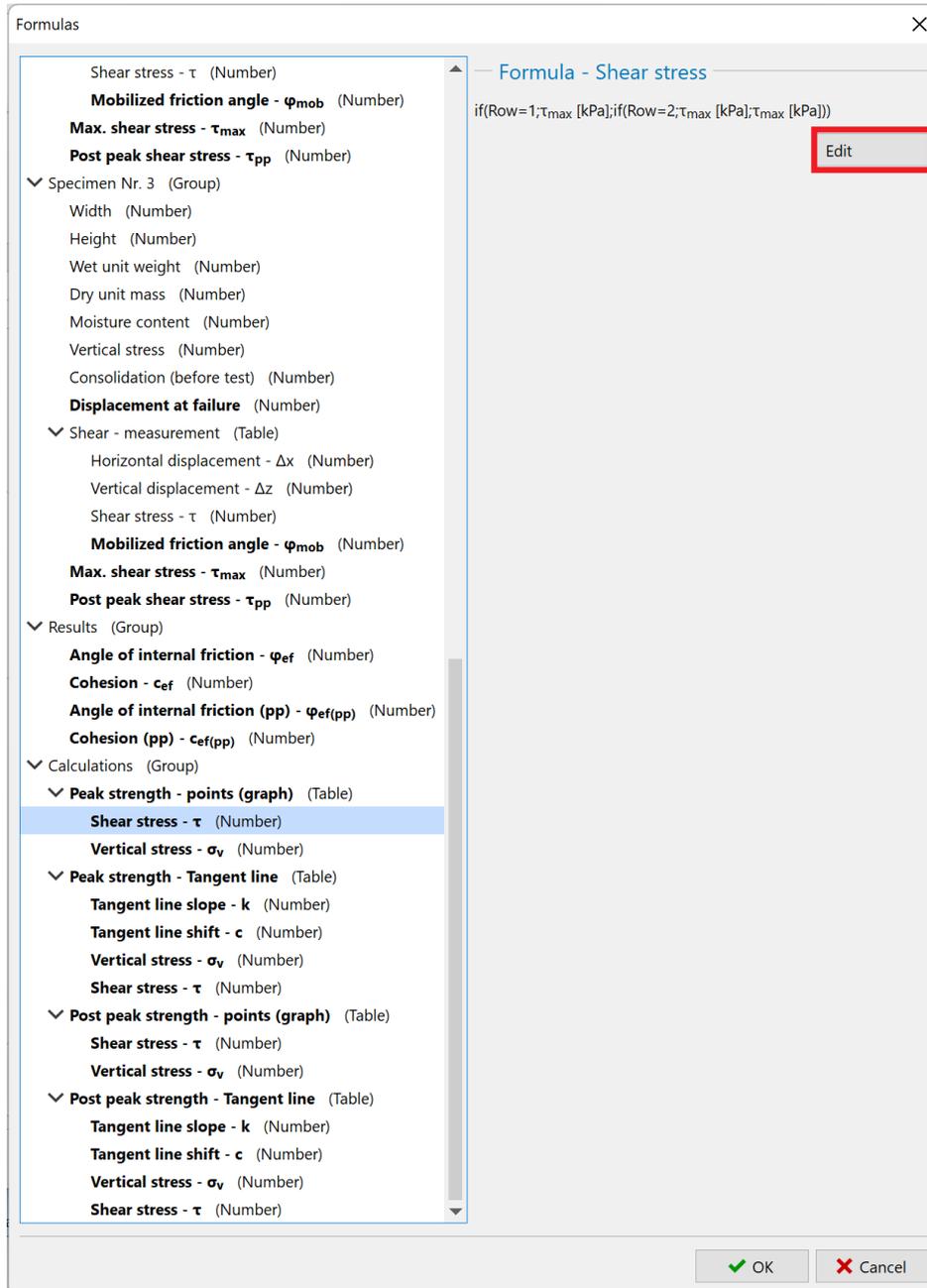
Max. shear stress : τ<sub>max</sub> = 71,3 [kPa]

Post peak shear stress : τ<sub>pp</sub> = 54,0 [kPa]

Recalculate OK Cancel

Next, we continue by entering the formulas for plotting the graph. We have prepared two tables in the data. The first plots the points in the graph, the second plots the line (trend line). As we can see in the tree of the formula editing window, the data we copied was copied including the formulas.

We start by editing the table plotting the points. The "Vertical stress" column is the same as the one in the table for the peak parameters, so we don't need to modify it. Therefore we will modify the formula for the "Shear stress" column.



Here we see that we use the IF formula to fill the table in a way, so that the first row of the table is filled with the data of the first specimen, the second row with the data of the second specimen, and the third row with the data of the third specimen.

In the formula, we just need to replace the references to Max. shear stress with references to Post peak shear stress, always for the respective specimens. We can do this simply by pressing the left mouse button on the red framed item (which corresponds to the red reference in the formula), holding it down, and moving the mouse to the new item. This will change the link to match the newly selected data type.

Formula - Shear stress [τ]

Wet unit weight [kg/m<sup>3</sup>] (Number)  
 Dry unit mass [kg/m<sup>3</sup>] (Number)  
 Moisture content [%] (Number)  
 Vertical stress [kPa] (Number)  
 Consolidation (before test) [mm] (Number)  
 Displacement at failure [mm] (Number)  
 > Shear - measurement (Table)  
 Max. shear stress -  $\tau_{max}$  [kPa] (Number)  
 Post peak shear stress -  $\tau_{pp}$  [kPa] (Number)  
 ✓ Specimen Nr. 2 (Group)  
 Width [mm] (Number)  
 Height [mm] (Number)  
 Wet unit weight [kg/m<sup>3</sup>] (Number)  
 Dry unit mass [kg/m<sup>3</sup>] (Number)  
 Moisture content [%] (Number)  
 Vertical stress [kPa] (Number)  
 Consolidation (before test) [mm] (Number)  
 Displacement at failure [mm] (Number)  
 > Shear - measurement (Table)  
 Max. shear stress -  $\tau_{max}$  [kPa] (Number)  
 Post peak shear stress -  $\tau_{pp}$  [kPa] (Number)  
 ✓ Specimen Nr. 3 (Group)  
 Width [mm] (Number)

if({Row}=1;{τ<sub>pp</sub>[kPa]};if({Row}=2;{τ<sub>max</sub>[kPa]};{τ<sub>max</sub>[kPa]}))

Insert function  
 f(x)  
 Insert  
 Multilingual text  
 Calculation unit  
 kPa

Result preview  
 Field test : Shear box test  Partial results  
 1 : 25,700  
 2 : 71,300  
 3 : 107,200

OK Cancel

The second option is to right-click on the link in the formula and press the "Change" option to select a new data type from the tree.

Formula - Shear stress [τ]

IF( Test ; Then ; Else )  
Specifies a logical test to perform

if((Row)=1;{τ<sub>pp</sub>[kPa]};if((Row)=2;{τ<sub>max</sub>[kPa]};{τ<sub>max</sub>[kPa]}))

Change  
Remove

Result preview

Field test : Shear box test  Partial results

1 : 25,700  
2 : 71,300  
3 : 107,200

OK Cancel

The resulting formula has the following form:

Formula - Shear stress [τ]

if((Row)=1;{τ<sub>pp</sub>[kPa]};if((Row)=2;{τ<sub>pp</sub>[kPa]};{τ<sub>pp</sub>[kPa]}))

Result preview

Field test : Shear box test  Partial results

1 : 25,700  
2 : 54,000  
3 : 88,400

OK Cancel

The formula for the trendline should be adjusted automatically when copying. Nevertheless, we open it and check that the data links match the post peak strength.

Formula - Post peak strength - Tangent line ✕

- Test ID (String)
- Sample index (String)
- > Basic data (Group)
- > Specimen (Group)
- > Specimen Nr. 1 (Group)
- > Specimen Nr. 2 (Group)
- > Specimen Nr. 3 (Group)
- > Results (Group)
- ▼ Calculations (Group)
  - > Peak strength - points (graph) (Table)
  - > Peak strength - Tangent line (Table)
  - ▼ Post peak strength - points (graph) (Table)
    - Number of row
    - Shear stress -  $\tau$  [kPa] (Number)
    - Vertical stress -  $\sigma_v$  [kPa] (Number)
  - ▼ Post peak strength - Tangent line (Table)
    - Number of row
    - Tangent line slope - k [-] (Number)

**LINEARTRENDANDPOINTS**(({ $\sigma_v$  [kPa]};{ $\tau$  [kPa]}))

Result preview

Field test : Shear box test  Partial results

2; 0,407428571428571; 8,500000000000004; 0; 8,500000000000004; NAN; NAN; 200; 89,9857142857143

✓ OK
✕ Cancel

The final formulas we need to modify are in the "Results" group. In them, again, we just replace the references from the peak strength table to the post peak strength table.

The screenshot shows the 'Formulas' dialog box with the following structure:

- Shear stress -  $\tau$  (Number)
  - Mobilized friction angle -  $\varphi_{mob}$**  (Number)
  - Max. shear stress -  $\tau_{max}$**  (Number)
  - Post peak shear stress -  $\tau_{pp}$**  (Number)
- Specimen Nr. 3 (Group)
  - Width (Number)
  - Height (Number)
  - Wet unit weight (Number)
  - Dry unit mass (Number)
  - Moisture content (Number)
  - Vertical stress (Number)
  - Consolidation (before test) (Number)
  - Displacement at failure** (Number)
- Shear - measurement (Table)
  - Horizontal displacement -  $\Delta x$  (Number)
  - Vertical displacement -  $\Delta z$  (Number)
  - Shear stress -  $\tau$  (Number)
  - Mobilized friction angle -  $\varphi_{mob}$**  (Number)
  - Max. shear stress -  $\tau_{max}$**  (Number)
  - Post peak shear stress -  $\tau_{pp}$**  (Number)
- Results (Group)
  - Angle of internal friction -  $\varphi_{ef}$**  (Number)
  - Cohesion -  $c_{ef}$**  (Number)
  - Angle of internal friction (pp) -  $\varphi_{ef(pp)}$**  (Number)
  - Cohesion (pp) -  $c_{ef(pp)}$**  (Number)
- Calculations (Group)
  - Peak strength - points (graph) (Table)
    - Shear stress -  $\tau$  (Number)
    - Vertical stress -  $\sigma_v$  (Number)
  - Peak strength - Tangent line (Table)
    - Tangent line slope -  $k$  (Number)
    - Tangent line shift -  $c$  (Number)
    - Vertical stress -  $\sigma_v$  (Number)
    - Shear stress -  $\tau$  (Number)
  - Post peak strength - points (graph) (Table)
    - Shear stress -  $\tau$  (Number)
    - Vertical stress -  $\sigma_v$  (Number)
  - Post peak strength - Tangent line (Table)
    - Tangent line slope -  $k$  (Number)
    - Tangent line shift -  $c$  (Number)
    - Vertical stress -  $\sigma_v$  (Number)
    - Shear stress -  $\tau$  (Number)

The formula editor on the right shows: **Formula - Angle of internal friction (pp)**  
 $ATAN(k/l)$   
 Edit

Buttons: OK, Cancel

This completes the work with formulas. After returning to the test input window, we can check if the calculated values are correct.

Edit test: Shear box test

Test ID : Shear box test

Sample index : VA1/1254 Select sample ▾

Basic data	Specimen	Specimen Nr. 1	Specimen Nr. 2	Specimen Nr. 3	Results	Calculations	Attachments
Angle of internal friction :	$\varphi_{ef}$ =				25,8	[°]	
Cohesion :	$c_{ef}$ =				13,8	[kPa]	
Angle of internal friction (pp) :	$\varphi_{ef(pp)}$ =				22,1	[°]	
Cohesion (pp) :	$c_{ef(pp)}$ =				8,5	[kPa]	

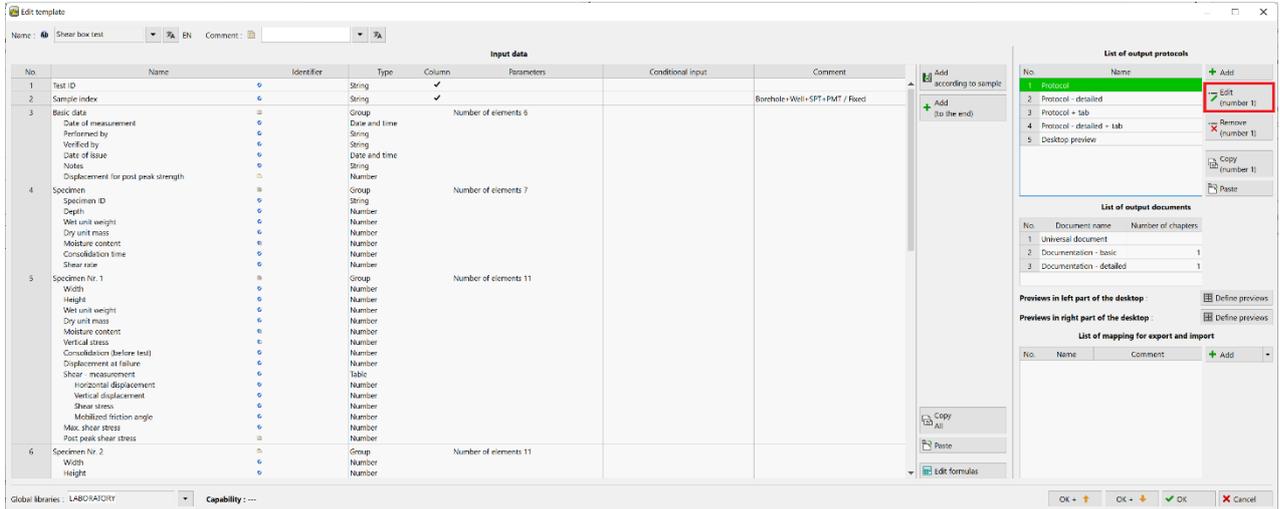
Recalculate ✓ OK ✗ Cancel

## Part 4

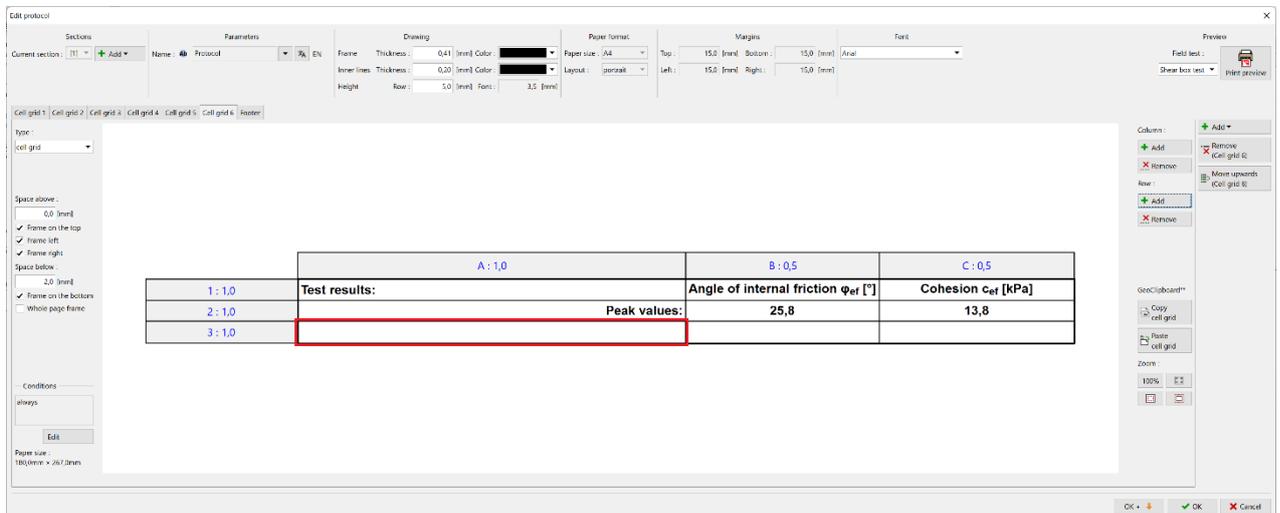
In the next stage, we modify the graph and protocol to include the newly created data.

*Note: Basic log editing work is described in Engineering Manual 51.*

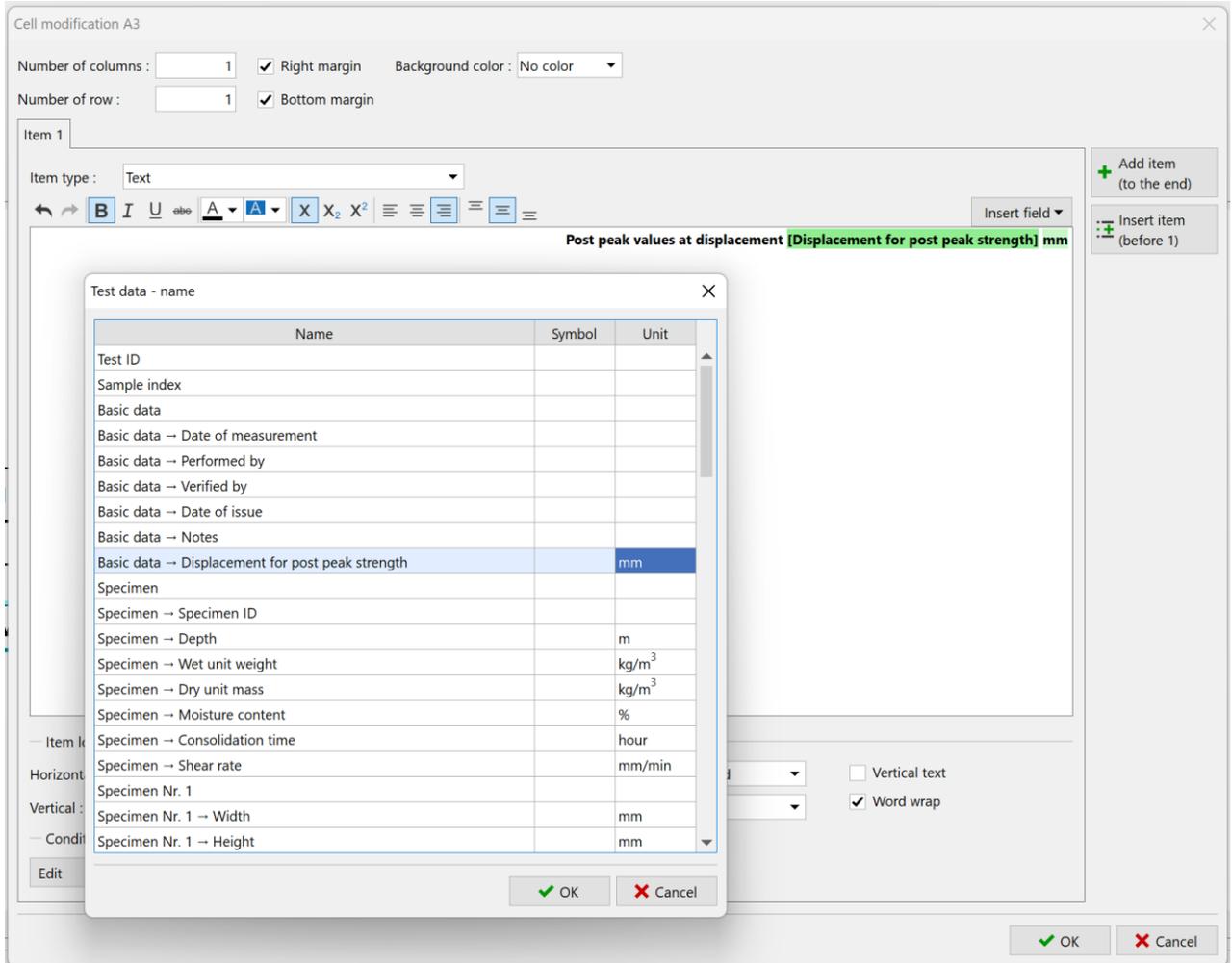
We'll start by modifying the protocol:



In the "Cell grid 6" tab, where the resulting values are shown, add a row.

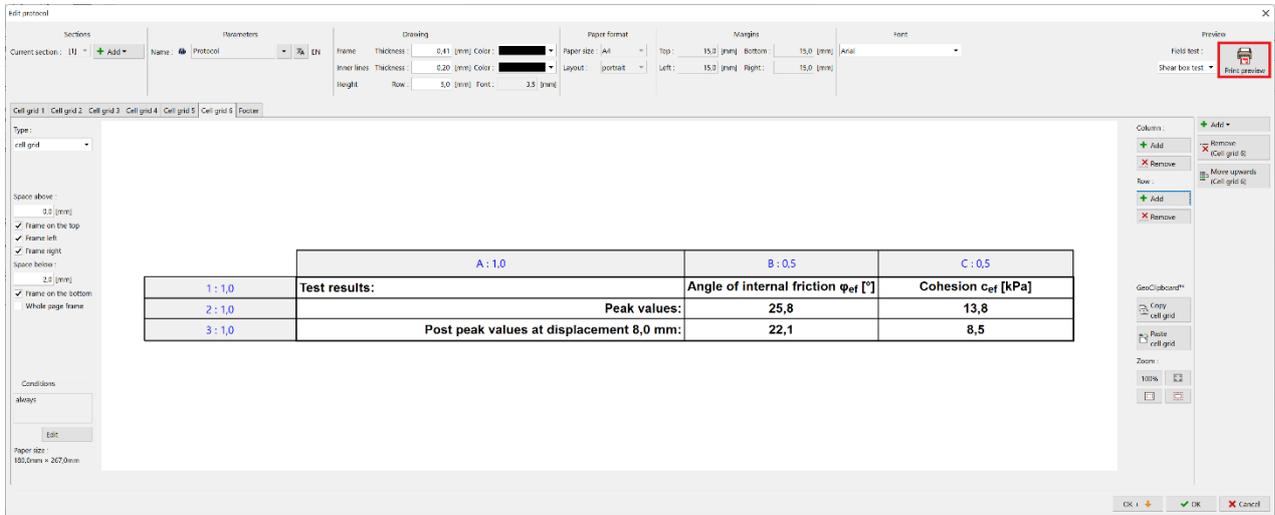


In the newly created cell, type the text "Post peak values at displacement", modify the formatting and add a link to the displacement data type we have chosen. The number itself can be added via the "Test data - data" option, the unit can be added via the "Test data - name" option. This will ensure that if we change the unit in the data to e.g. cm, there will be a change in the output report as well.

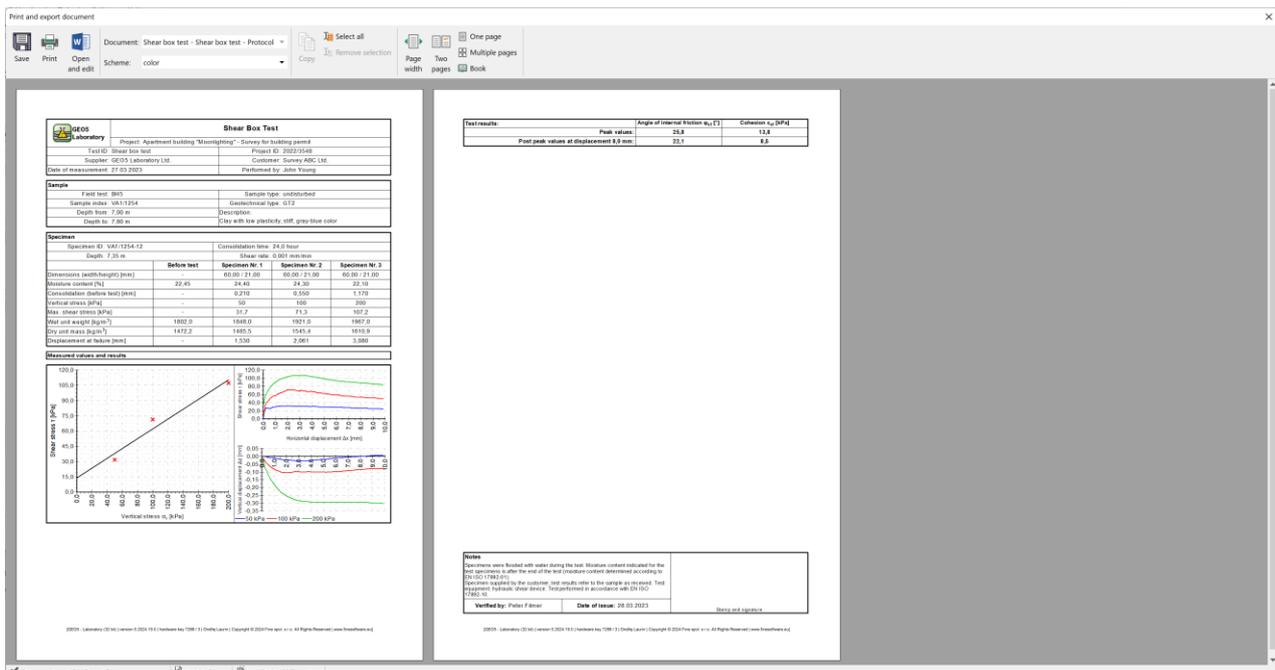


*Note: in case we would like to use the protocol in more languages, it is possible to insert "Multilingual text" via the "Insert field" option, where the text can be translated into other languages.*

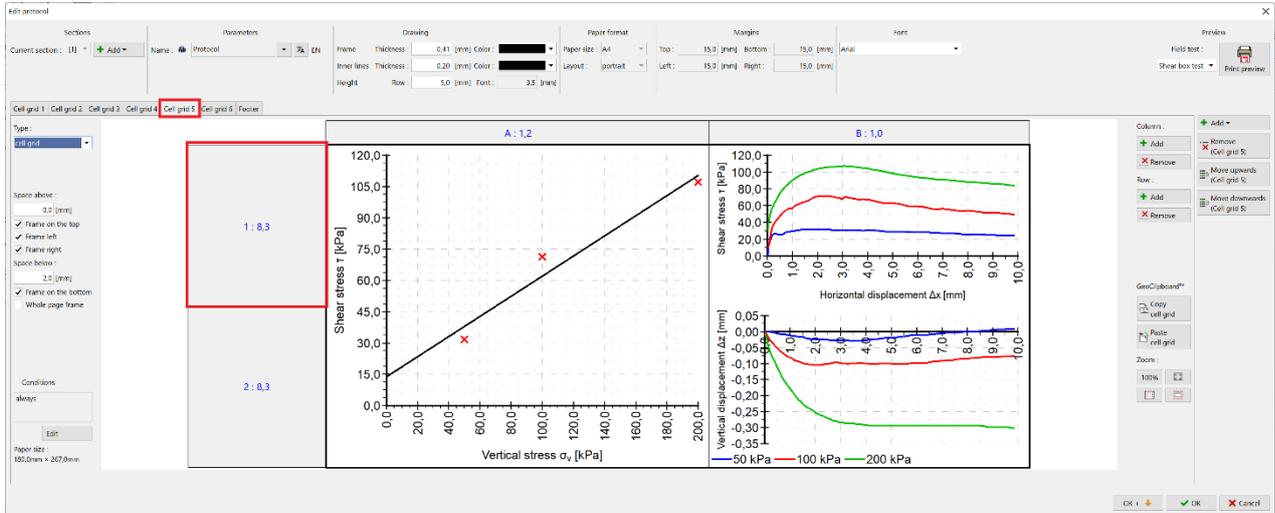
Then insert the corresponding data into the remaining cells. Select "Test data - data" via the "Insert field" option.



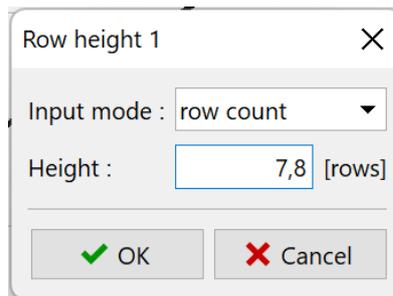
Using the "Print Preview" button, you can view the modified report in print form. Here we can see that since we have added a line, everything no longer fits on one page.



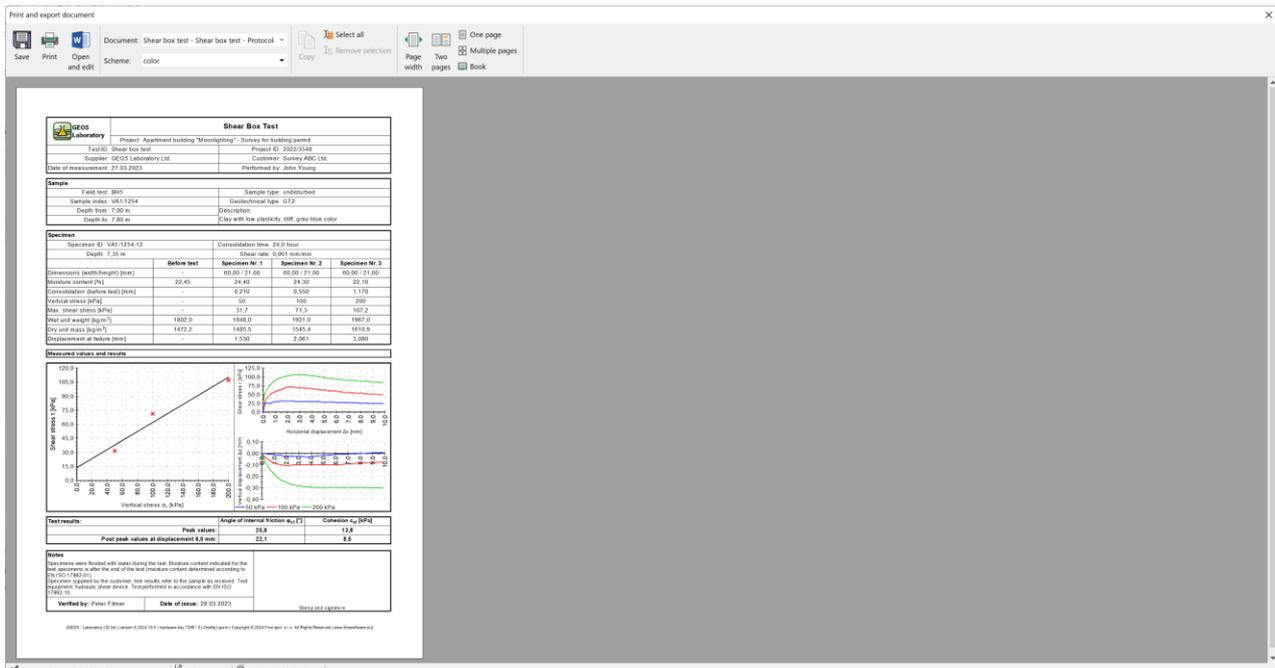
To solve this, for example, reduce the size of the graph in the "Grid cell 5" tab - each row by 0.5.



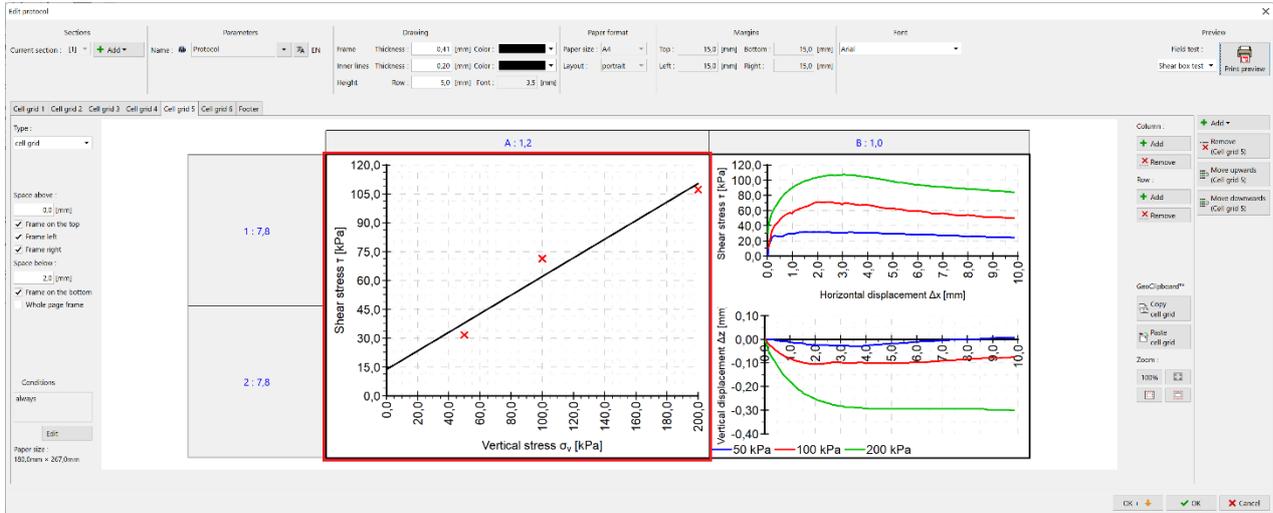
Reduce the size by 0.5 - to 7.8 for both rows.



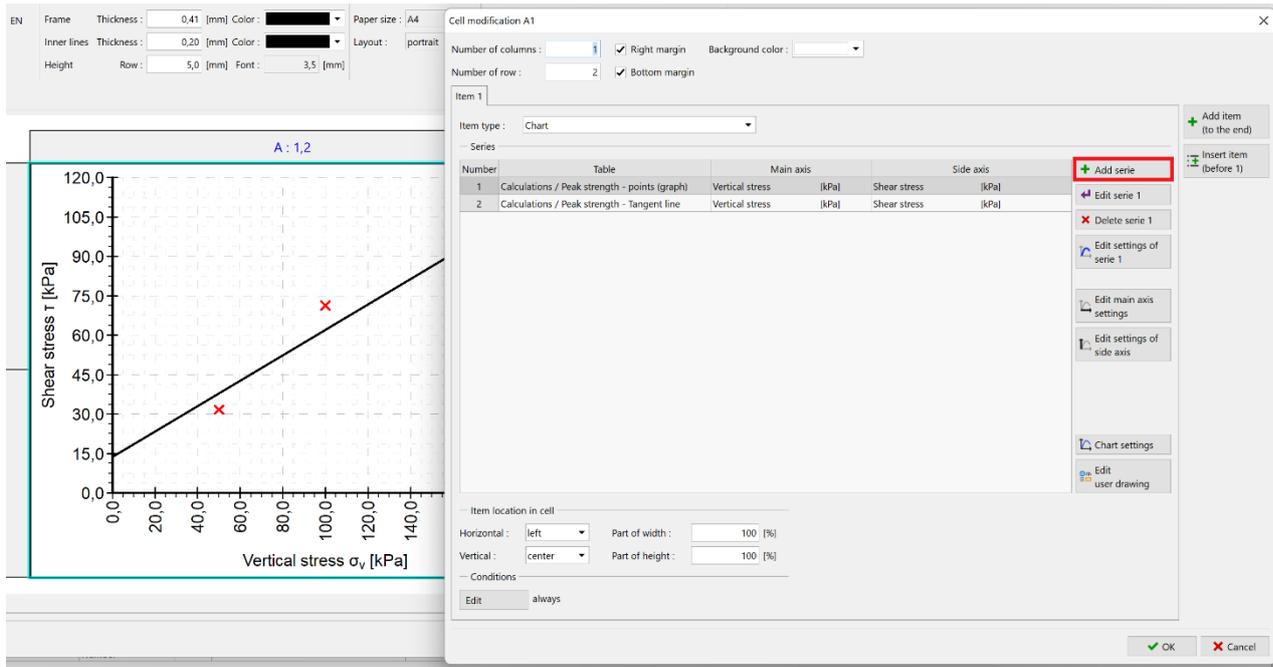
Now we can see that the protocol fits on one page again.



Last remaining task is to add the new data to the graph. Click on the graph and open the editing window.



Press the "Add serie" button.



Select the table "Post peak strength - points", the main axis "Vertical stress" and the secondary axis "Shear stress".

Cell modification A1

Number of columns :   Right margin Background color :

Number of row :   Bottom margin

Item 1

Item type : Chart

Series

Number	Table	Main axis	Side axis
1	Calculations / Peak strength - points (graph)	Vertical stress [kPa]	Shear stress [kPa]
2	Calculations / Peak strength - Tangent line	Vertical stress [kPa]	Shear stress [kPa]

Add series

Data source

Table :

Main axis :

Side axis :

Chart settings

Side axis :

Item location in cell

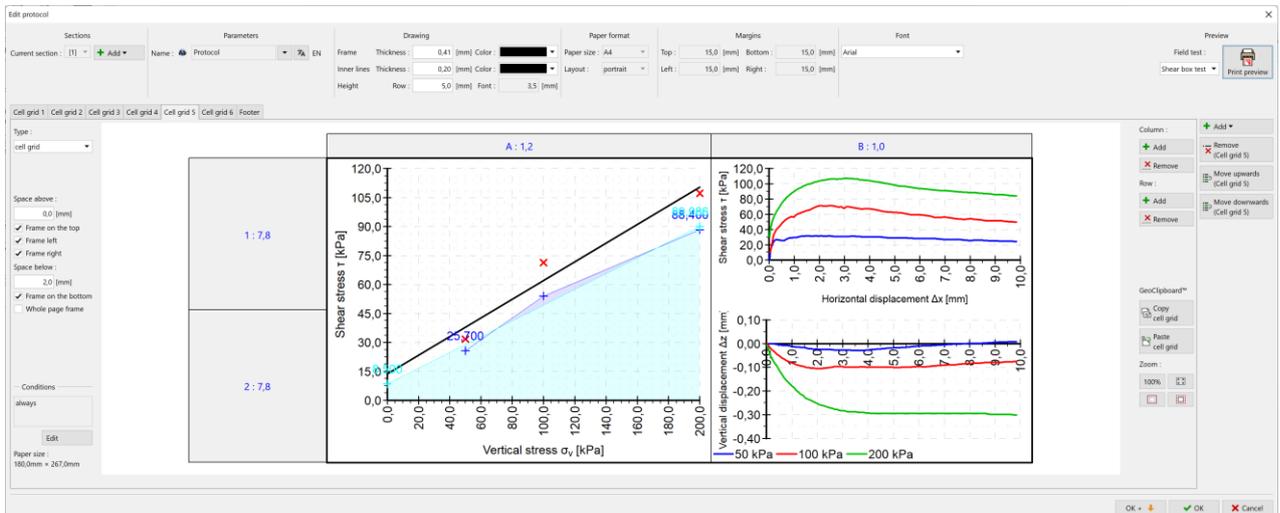
Horizontal :  Part of width :  [%]

Vertical :  Part of height :  [%]

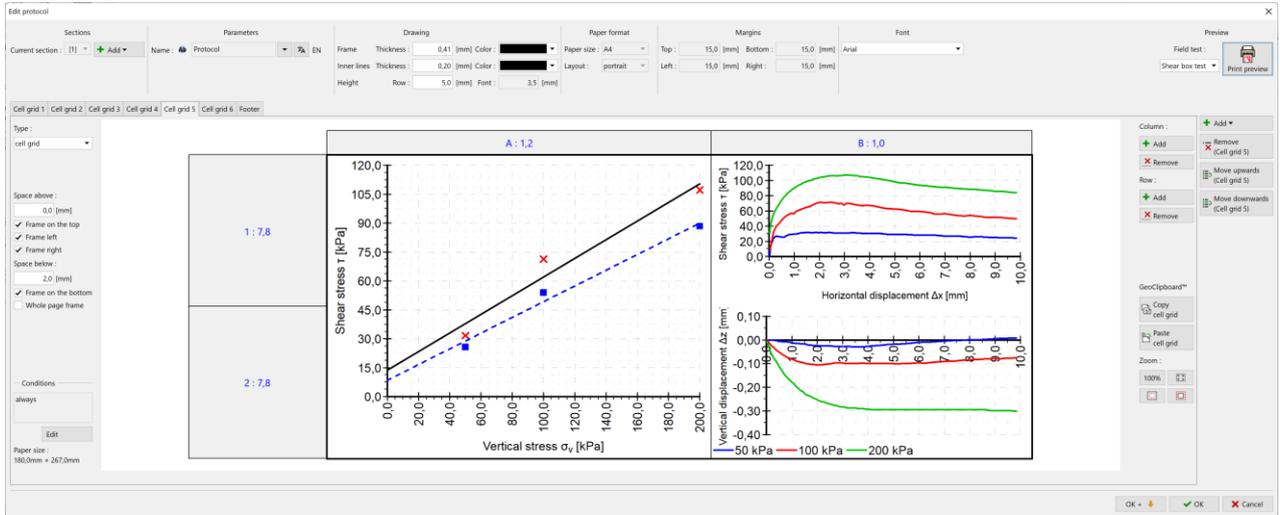
Conditions

always

Add the post peak strength trendline in the same way. We can see the two new series in the graph:



Finally, we modify the visualization of the two new series to suit our requirements:



*Note: The editing of graphical visualization of the graphs is explained in Engineering Manual 51.*

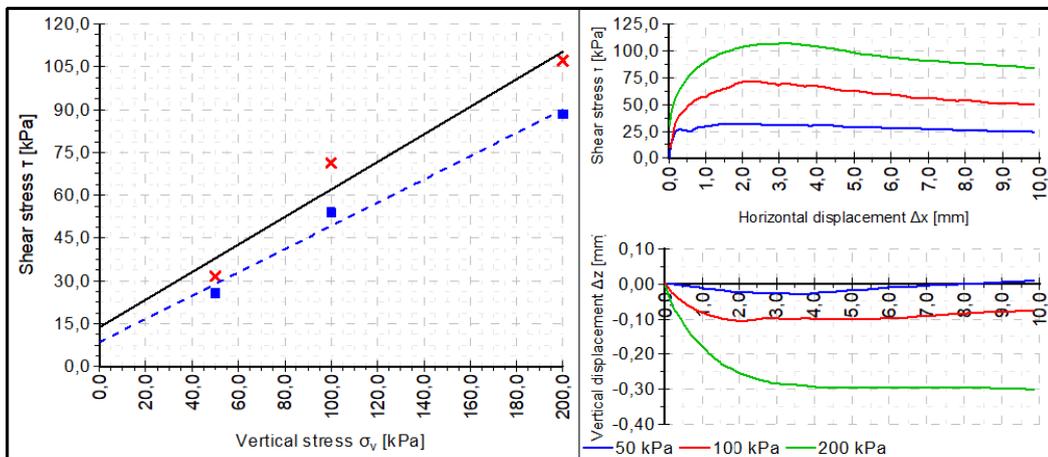
This modified protocol corresponds to the specification.

	<b>Shear Box Test</b>	
	Project: Apartment building "Moonlighting" - Survey for building permit	
Test ID: Shear box test		Project ID: 2022/3548
Supplier: GEO5 Laboratory Ltd.		Customer: Survey ABC Ltd.
Date of measurement: 27.03.2023		Performed by: John Young

<b>Sample</b>	
Field test: BH5	Sample type: undisturbed
Sample index: VA1/1254	Geotechnical type: GT2
Depth from: 7,00 m	Description:
Depth to: 7,80 m	Clay with low plasticity, stiff, gray-blue color

<b>Specimen</b>				
Specimen ID: VA1/1254-12				
Consolidation time: 24,0 hour				
Depth: 7,35 m				
Shear rate: 0,001 mm/min				
	<b>Before test</b>	<b>Specimen Nr. 1</b>	<b>Specimen Nr. 2</b>	<b>Specimen Nr. 3</b>
Dimensions (width/height) [mm]	-	60,00 / 21,00	60,00 / 21,00	60,00 / 21,00
Moisture content [%]	22,45	24,40	24,30	22,10
Consolidation (before test) [mm]	-	0,210	0,550	1,170
Vertical stress [kPa]	-	50	100	200
Max. shear stress [kPa]	-	31,7	71,3	107,2
Wet unit weight [kg/m <sup>3</sup> ]	1802,0	1848,0	1921,0	1967,0
Dry unit mass [kg/m <sup>3</sup> ]	1472,2	1485,5	1545,4	1610,9
Displacement at failure [mm]	-	1,530	2,061	3,080

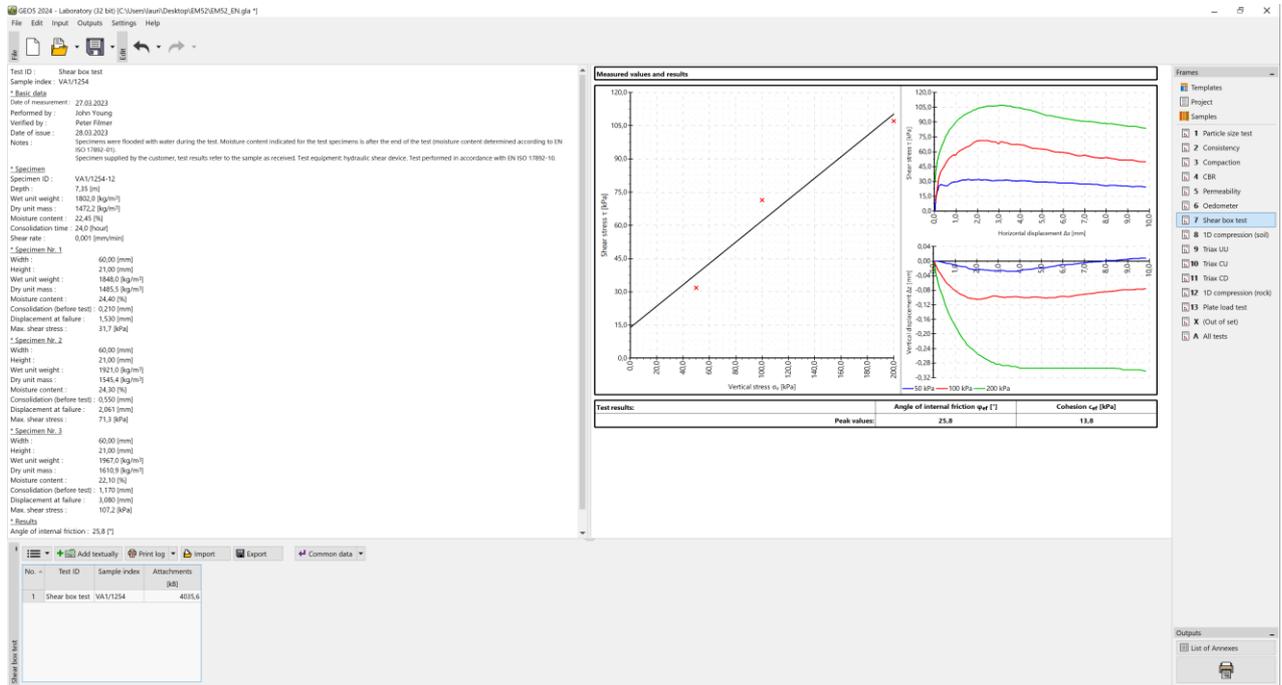
**Measured values and results**



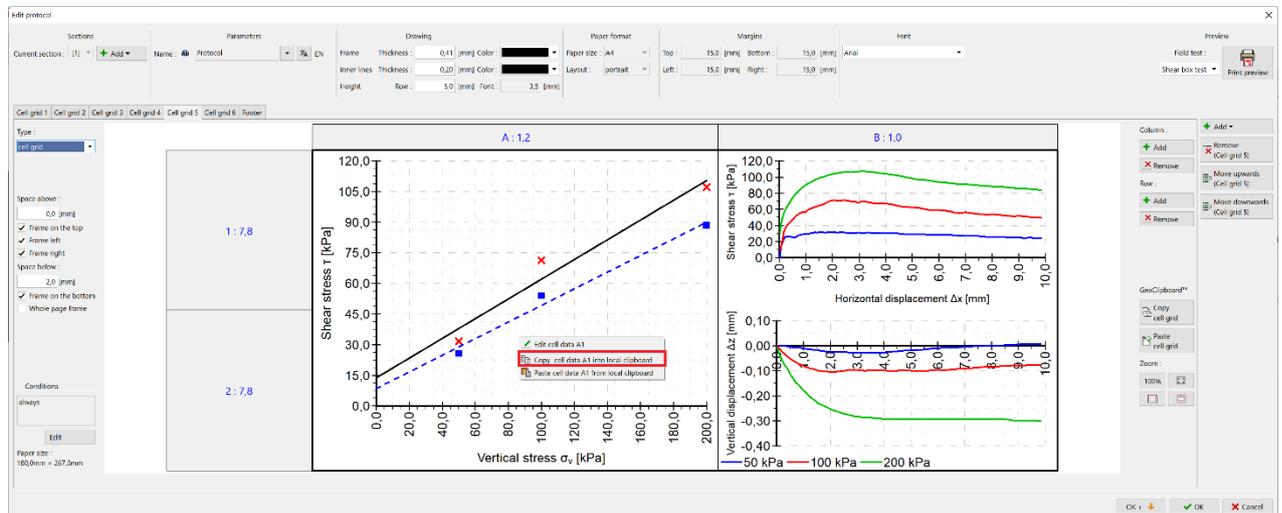
<b>Test results:</b>	<b>Peak values:</b>	<b>Angle of internal friction <math>\phi_{ef}</math> [°]</b>	<b>Cohesion <math>c_{ef}</math> [kPa]</b>
	<b>Post peak values at displacement 8,0 mm:</b>	25,8	13,8
		22,1	8,5

<b>Notes</b>	
Specimens were flooded with water during the test. Moisture content indicated for the test specimens is after the end of the test (moisture content determined according to EN ISO 17892-01).	
Specimen supplied by the customer, test results refer to the sample as received. Test equipment: hydraulic shear device. Test performed in accordance with EN ISO 17892-10.	
Verified by: Peter Filmer	Date of issue: 28.03.2023
Stamp and signature	

However, if we go back to the main program window, we see that the graph has remained unchanged. The graph here is displayed from the output protocol called "Desktop Preview", so we need to modify it as well.



Just copy and paste the graph and the result table into the preview.



GEOS 2024 - Laboratory (32 bit) [C:\Users\laun\Desktop\EM52\EM52\_EN.gja ']

File Edit Input Outputs Settings Help

Test ID: Shear box test  
 Sample index: VAA17254

**- Basic data**  
 Date of measurement: 27.03.2023  
 Performed by: John Young  
 Verified by: Peter Florer  
 Date of issue: 28.03.2023  
 Notes: Specimens were flooded with water during the test. Moisture content indicated for the test specimens is after the end of the test (moisture content determined according to EN 650 71800-01).  
 Specimens supplied by the customer, test results refer to the sample as received. Test performed in accordance with EN ISO 17892-10.

**- Specimens**  
 Specimen ID: VAA17254-12  
 Depth: 7.35 [m]  
 Wet unit weight: 1852.0 [kg/m<sup>3</sup>]  
 Dry unit mass: 1472.2 [kg/m<sup>3</sup>]  
 Moisture content: 22.45 [%]  
 Consolidation time: 24.0 [hour]  
 Shear rate: 0.000 [mm/min]

**- Specimen Nr. 1**  
 Width: 60.00 [mm]  
 Height: 21.00 [mm]  
 Wet unit weight: 1848.0 [kg/m<sup>3</sup>]  
 Dry unit mass: 1465.5 [kg/m<sup>3</sup>]  
 Moisture content: 24.40 [%]  
 Consolidation (before test): 0.210 [mm]  
 Displacement at failure: 1.530 [mm]  
 Max. shear stress: 31.7 [kPa]

**- Specimen Nr. 2**  
 Width: 60.00 [mm]  
 Height: 21.00 [mm]  
 Wet unit weight: 1921.0 [kg/m<sup>3</sup>]  
 Dry unit mass: 1545.4 [kg/m<sup>3</sup>]  
 Moisture content: 24.30 [%]  
 Consolidation (before test): 0.550 [mm]  
 Displacement at failure: 2.061 [mm]  
 Max. shear stress: 71.3 [kPa]

**- Specimen Nr. 3**  
 Width: 60.00 [mm]  
 Height: 21.00 [mm]  
 Wet unit weight: 1967.0 [kg/m<sup>3</sup>]  
 Dry unit mass: 1619.9 [kg/m<sup>3</sup>]  
 Moisture content: 22.50 [%]  
 Consolidation (before test): 1.170 [mm]  
 Displacement at failure: 3.080 [mm]  
 Max. shear stress: 107.2 [kPa]

**- Results**  
 Angle of internal friction: 25.8 [°]

**Measured values and results**

**Test results:**

	Peak values:	Angle of internal friction $\varphi$ [°]	Cohesion $c_d$ [kPa]
Post peak values at displacement 8.0 mm:		25.8	13.8
		22.1	8.5

Frames:  
 Templates  
 Project  
 Samples  
 1 Particle size test  
 2 Consistency  
 3 Compaction  
 4 CBR  
 5 Permeability  
 6 Oedometer  
 7 Shear box test  
 8 1D compression (soil)  
 9 Triax LIU  
 10 Triax CU  
 11 Triax CD  
 12 1D compression (rock)  
 13 Plate load test  
 X Out of set  
 A All tests

Outputs:  
 List of Annexes

Shear box test

No. Test ID Sample index Attachments  
 1 Shear box test VAA17254 40316,6

Other protocols can be modified in the same way.