

Use of Formulas in Templates

Program: Stratigraphy – Logs
File: Demo_manual_51.gsg

The Stratigraphy and Laboratory programs allow you to use formulas for automatic recalculations of selected test data. The goal of this engineering manual is to show how to easily work with formulas and how to use them to modify the output protocol.

In our case, we will add a graph for the friction ratio R_f to the output report of the CPT test, which we will first calculate using already existing data. We calculate the friction ratio from the relationship:

$$R_f = \left(\frac{f_s}{q_c} \right) * 100 [\%]$$

, where q_c is cone resistance and f_s is local friction.

Assignment

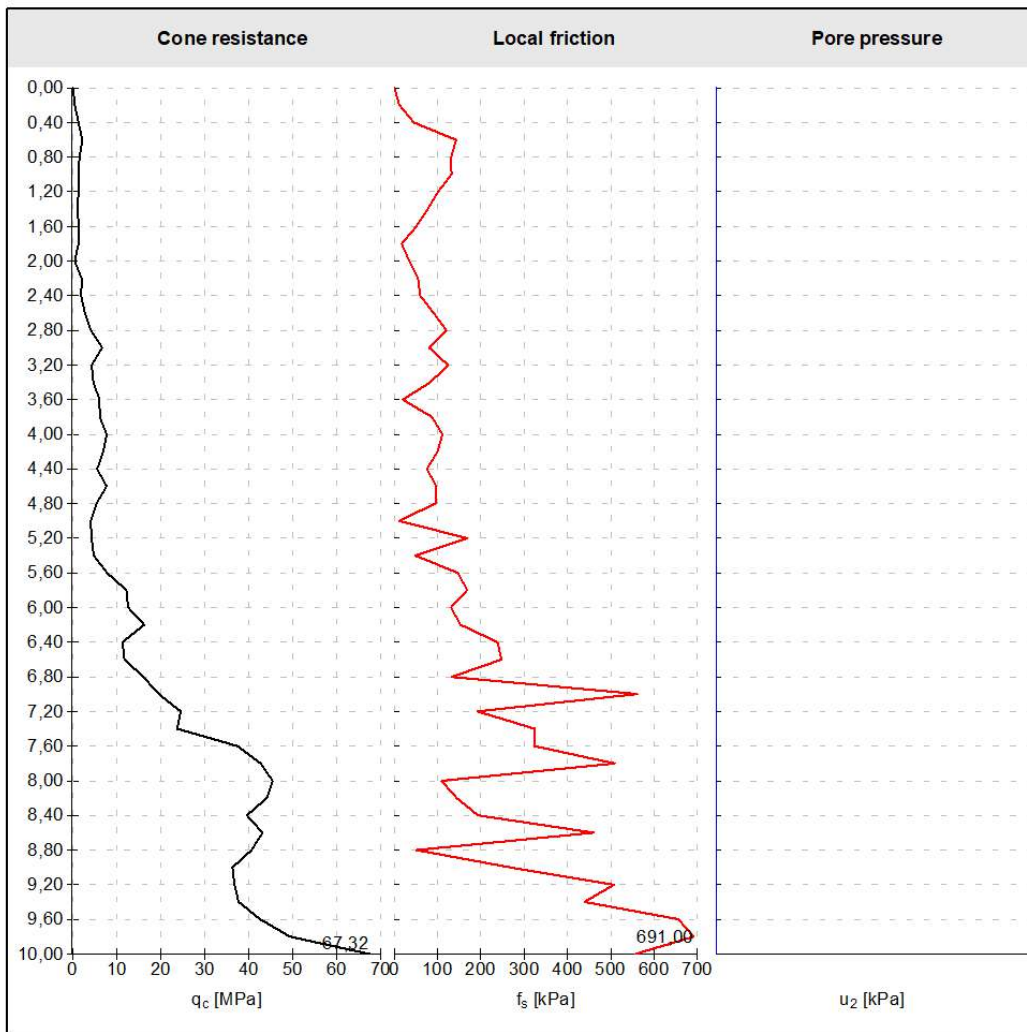
Modify the "EN-Standard" CPT template so that:

- The CPT table contained a "Friction ratio" column
- Create a formula for the new column to be calculated automatically from the entered data
- Display the friction ratio in the output log.

Modify the template with the demo file - DEMO - Templates EN.gsg, which you can find in Fine online examples. Name the newly created template set EM 51 and save it in the Template Manager for future use.

The CPT output protocol of the "EN-Standard" template set has the following form:

GEO5 Laboratoř s.r.o. Sokolovská 232, Praha 8, 18000			Cone penetration test (CPT)		CPT1
Project: Apartment building "Moonlighting" - Geological survey					
Project ID: AA_0014 - 2019		Annex no.: 17.C		Type of test: TE2	
Location: Stará 14/78, Hradec Králové					
Measured: Joe Fieldman		Coordinate System: S-JTSK / Krovak / Balt after adjustment		Type of cone: Ac=1000 mm ²	
Evaluated: Bill New		Coordinate X: 1039700,63		Application class: 2	
Date of test: 10.08.2016		Coordinate Y: 745200,84		Acc. to standard: EN ISO 22476-1	
Scale: 1:66,7		Coordinate Z: 222,00 m		Vertical offset of the origin: 0,00 m	
Equipment: PenSta A22		Filter location: U ₂		Overall depth: 10,00 m	
				GWT: 5,00 m	

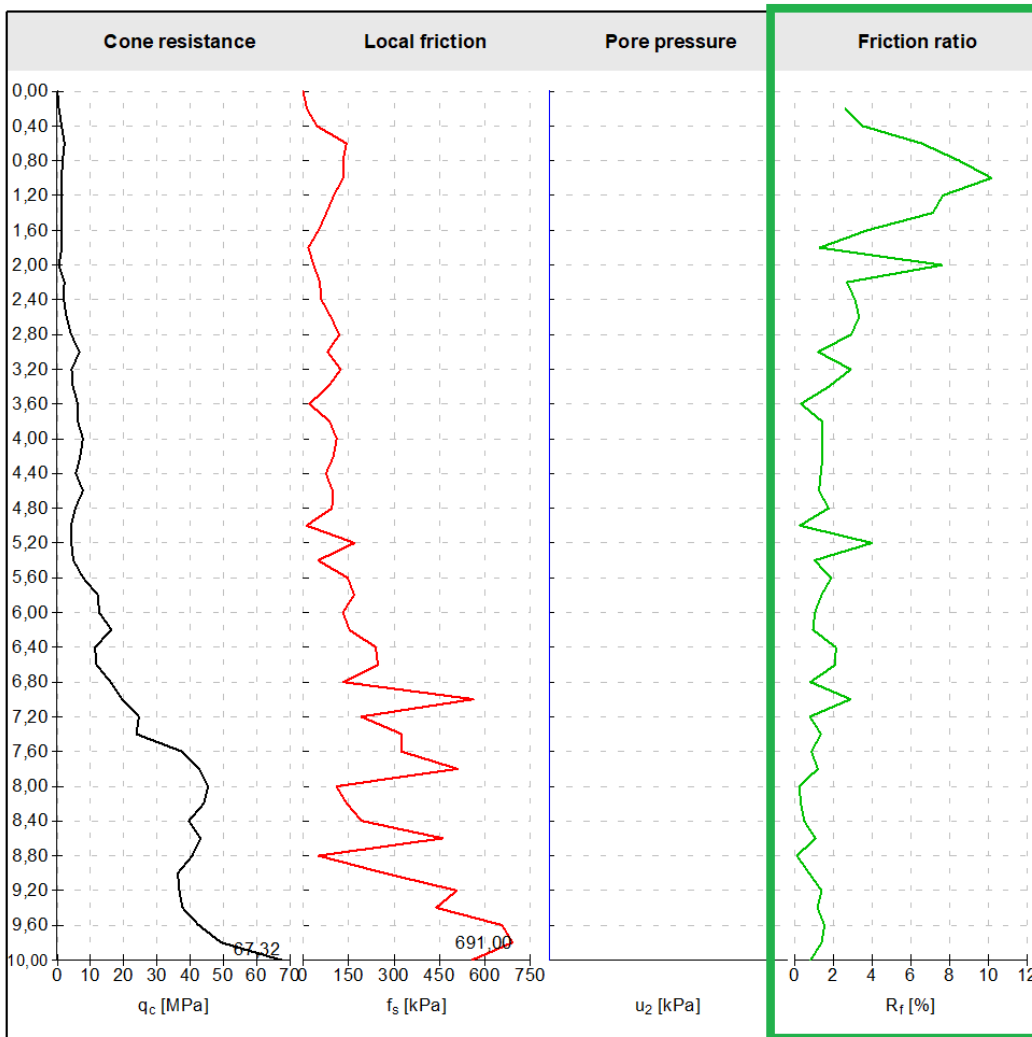


Notes:

- Sunny/ Partially cloudy/ Calm
- Raw data not modified

The required form of the protocol is this:

GEO5 Laboratoř s.r.o. Sokolovská 232, Praha 8, 18000			Cone penetration test (CPT)		CPT1
Project: Apartment building "Moonlighting" - Geological survey					
Project ID: AA_0014 - 2019		Annex no.: 17.C		Type of test: TE2	
Location: Stará 14/78, Hradec Králové				Type of cone: Ac=1000 mm ²	
Measured: Joe Fieldman		Coordinate System: S-JTSK / Krovak / Balt after adjustment		Application class: 2	
Evaluated: Bill New		Coordinate X: 1039700,63		Acc. to standard: EN ISO 22476-1	
Date of test: 10.08.2016		Coordinate Y: 745200,84		Vertical offset of the origin: 0,00 m	
Scale: 1:66,7		Coordinate Z: 222,00 m		Overall depth: 10,00 m	
Equipment: PenSta A22		Filter location: u ₂		GWT: 5,00 m	

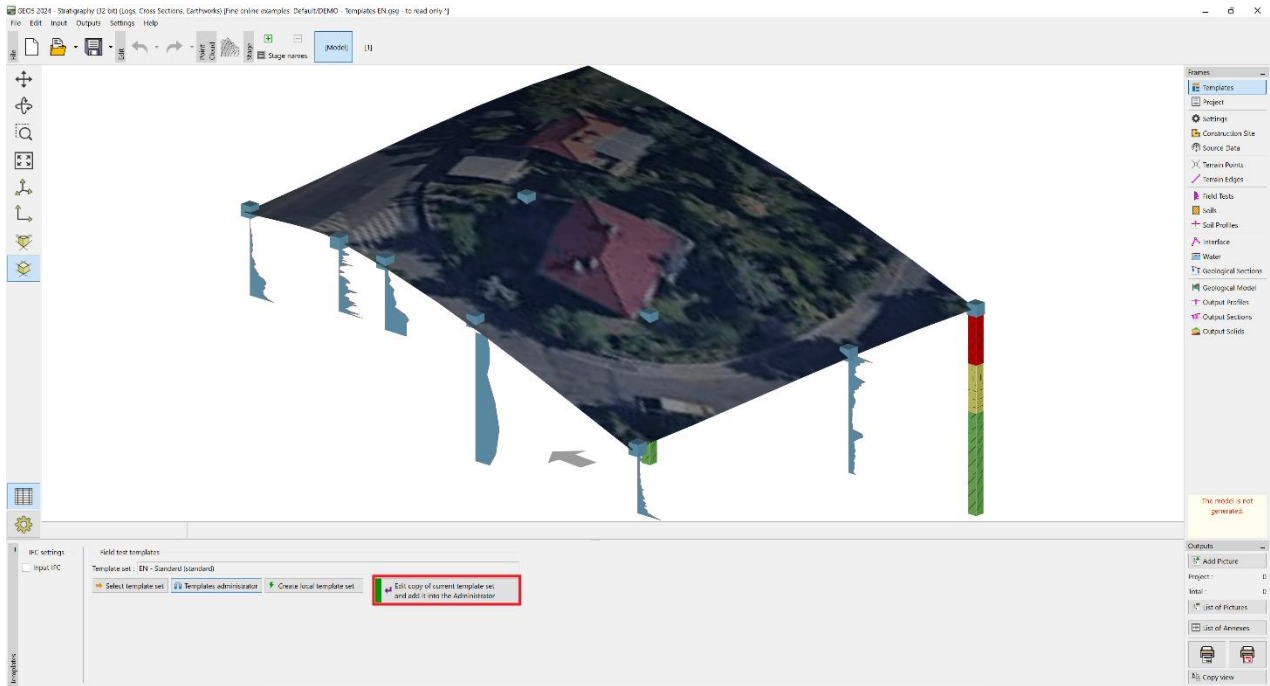


Notes:

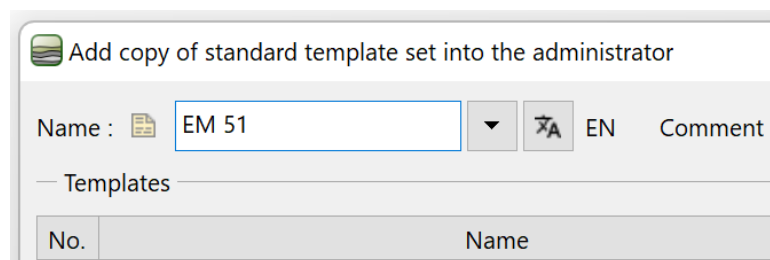
- Sunny/ Partially cloudy/ Calm
- Raw data not modified

Solution:

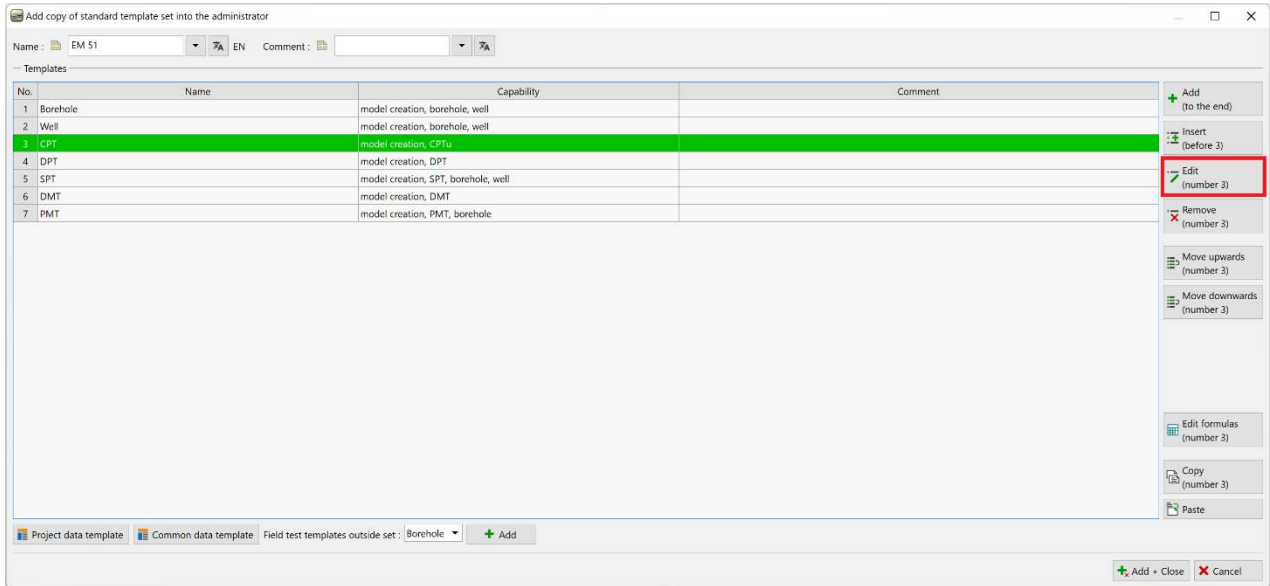
First, open the file DEMO - Templates EN.gsg, which contains the data from which we will proceed. In the Templates frame, check whether we have selected the set of templates that we want to edit - "EN-Standard" (If another set of templates is selected, choose it from the list of templates using the "Select template set" button). Press the button "Edit copy of current template set and add it into the administrator" to open the window for editing the template set.



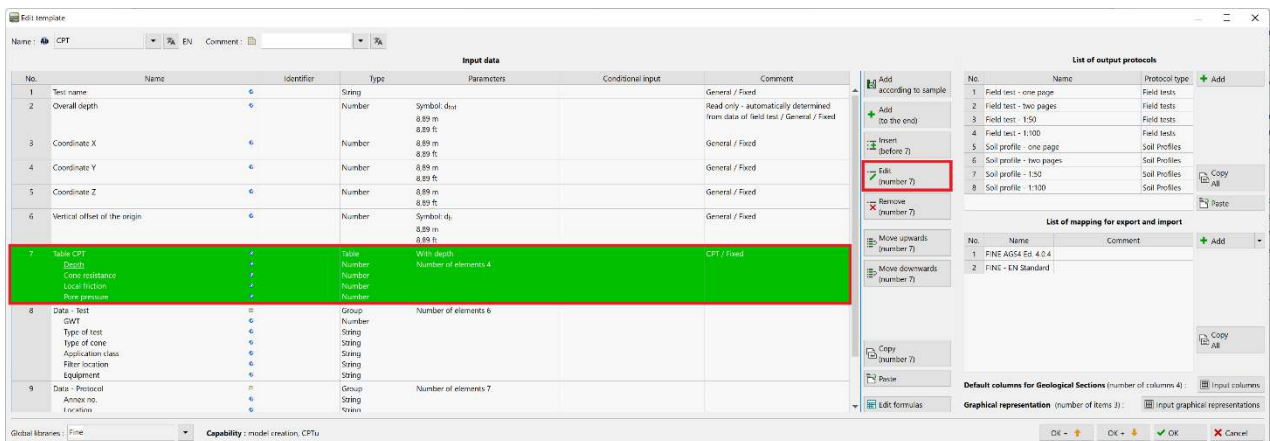
We will name the created set of templates EM 51. After editing, the template with this name will be saved into the administrator as a user template set.



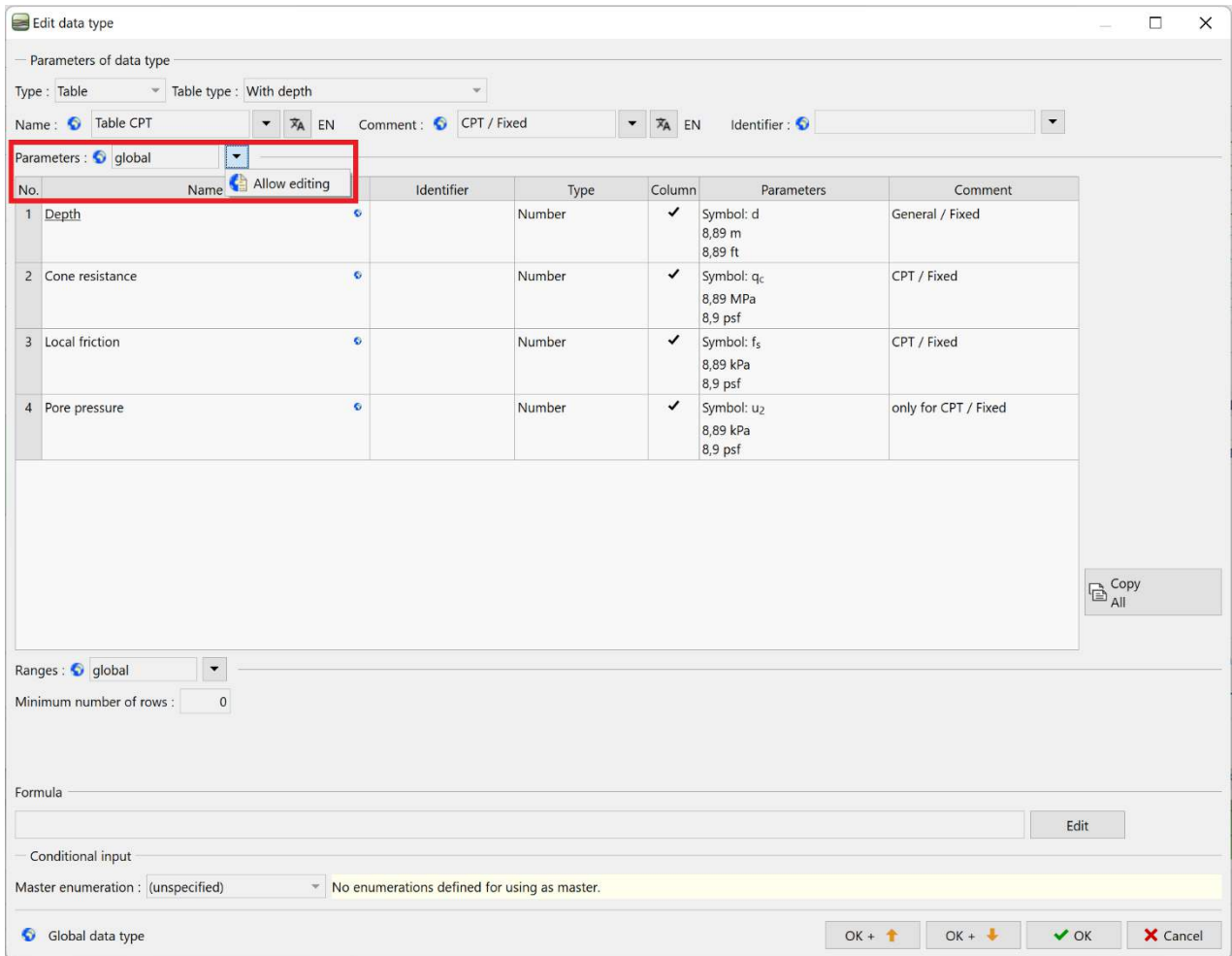
In the table, select the template for CPT and press “Edit”.



In the window “Edit template” continue with editing the item “Table CPT”.



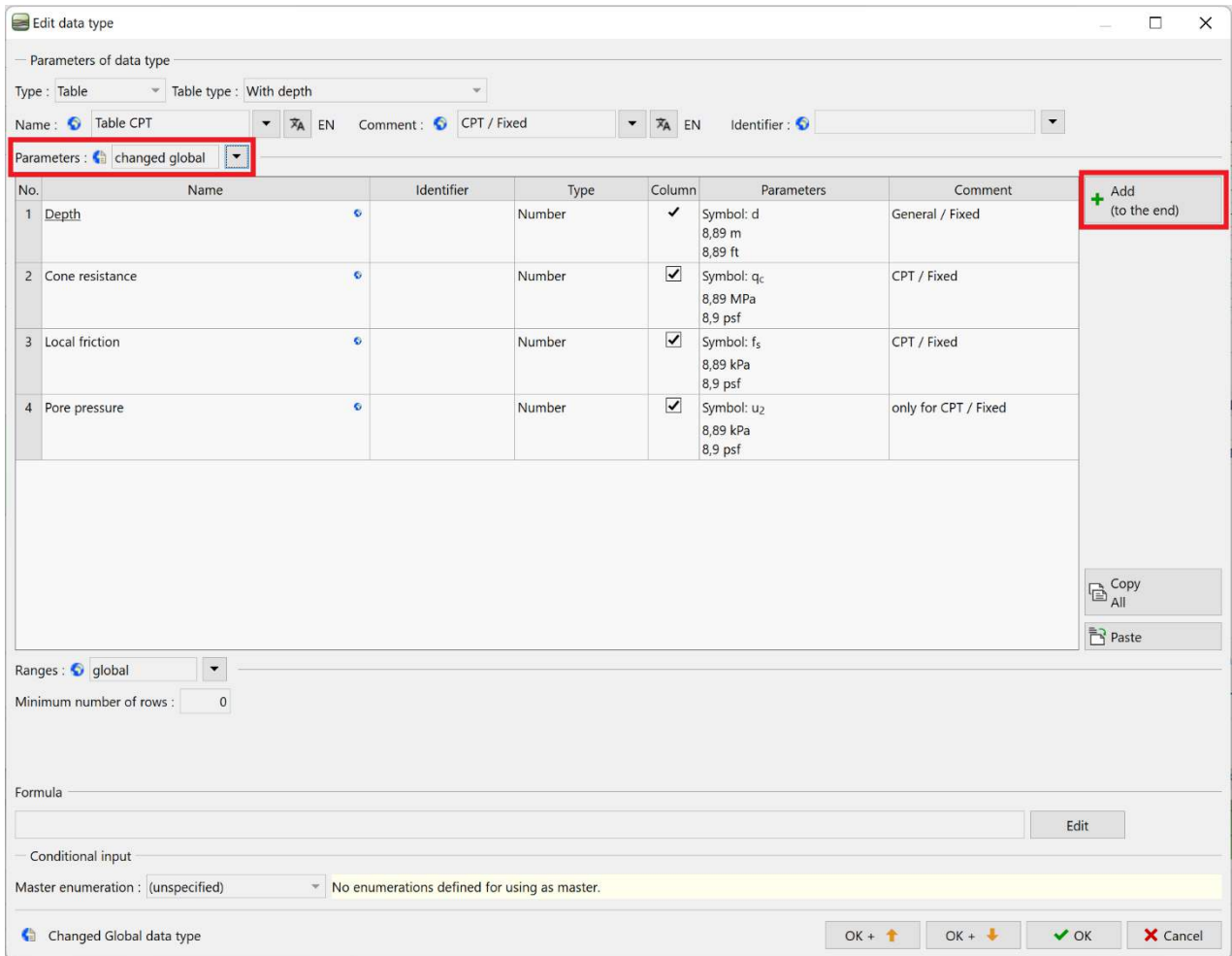
We can see that the table is part of the global library. By default, it is not possible to edit it. Therefore, it is necessary to press the button “Allow editing”, so we can add a new item into the table.



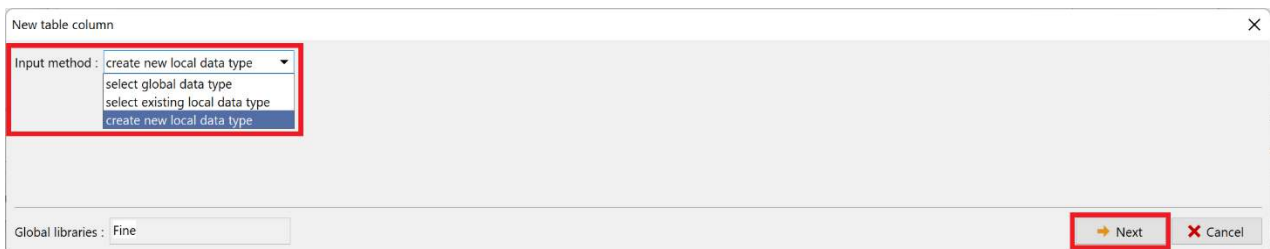
Note: Each data has a symbol next to the name, which corresponds with the data type.

1. **globe** - indicates that the data type was selected from the “Global Library”. The global library contains predefined data types that the user can insert into his template. The global library is selected in the bottom left corner of the dialog window.
2. **Paper sheet** - indicates that the data type was created and named by the user
3. **globe/paper sheet** - indicates that the data type was selected from the global library and subsequently modified by the user

Data type changed to “changed global” for table parameters. Now we can continue by adding a new item.



Use the “Add” button to add a new table column. In our case, we are specifying an item that is not in the global library. So, we select “new local data type”. Confirm with the “Next” button.



We select the type of the data type (number) and the type of unit (ratio). **These two types must be correctly defined the first time they are entered. Later modification of these types is not possible. In case of a mistake, it is necessary to delete the created data type and enter it again.** Enter other data: name, symbol and choose metric and imperial units for the data type - in our case percents. These data can be changed at any time in the future. Confirm with the “Add” button. The dialog box will not close automatically so that we can optionally enter additional data types. It is therefore necessary to close it with the button with a cross or the “Cancel” button.

New table column

Parameters of data type

Type : Number Unit type : ratio Allow input of string

Name : Friction ratio EN Comment :

Parameters

Symbol : Rf

Empty text :

Metric : % English : %

decimal places : 1 Exponential format 1,1 %

decimal places : 1 Exponential format 1,1 %

In the CPT table, we can now see the new data type. Now confirm the edits of the table and the CPT template using the “OK” buttons.

Edit data type

Parameters of data type

Type : Table Table type : With depth

Name : Table CPT EN Comment : CPT / Fixed Identifier :

Parameters : changed global

No.	Name	Identifier	Type	Column	Parameters	Comment
1	Depth		Number	<input checked="" type="checkbox"/>	Symbol: d 8,89 m 8,89 ft	General / Fixed
2	Cone resistance		Number	<input checked="" type="checkbox"/>	Symbol: q _c 8,89 MPa 8,9 psf	CPT / Fixed
3	Local friction		Number	<input checked="" type="checkbox"/>	Symbol: f _s 8,89 kPa 8,9 psf	CPT / Fixed
4	Pore pressure		Number	<input checked="" type="checkbox"/>	Symbol: u ₂ 8,89 kPa 8,9 psf	only for CPT / Fixed
5	Friction ratio		Number	<input checked="" type="checkbox"/>	Symbol: R _f 8,9 % 8,9 %	

Ranges : global

Minimum number of rows : 0

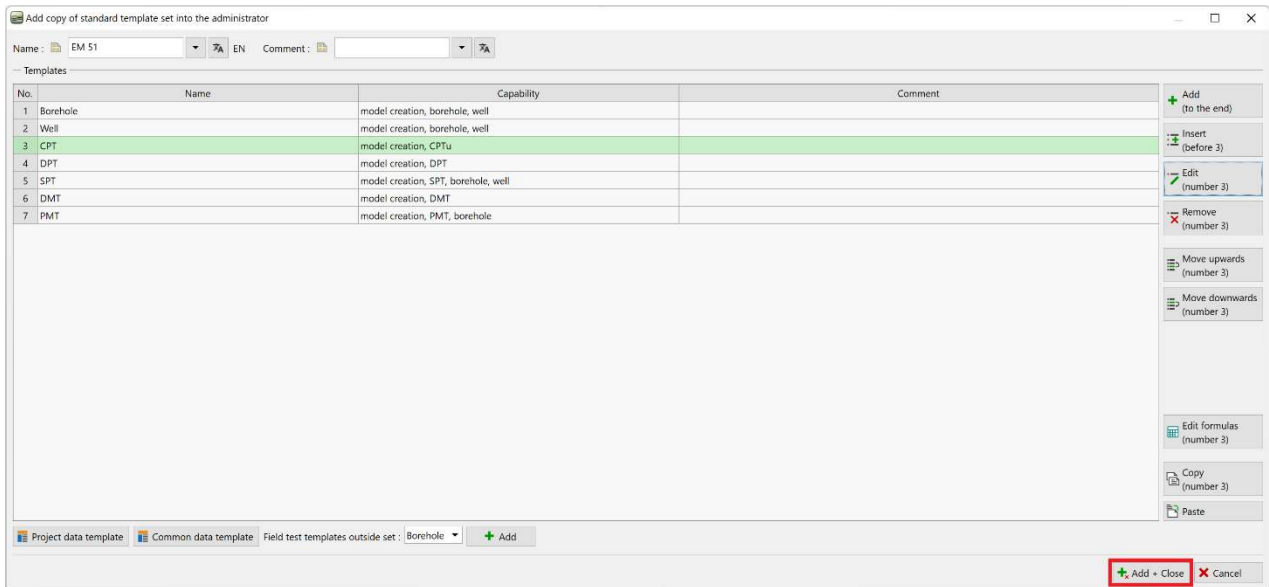
Formula

Conditional input

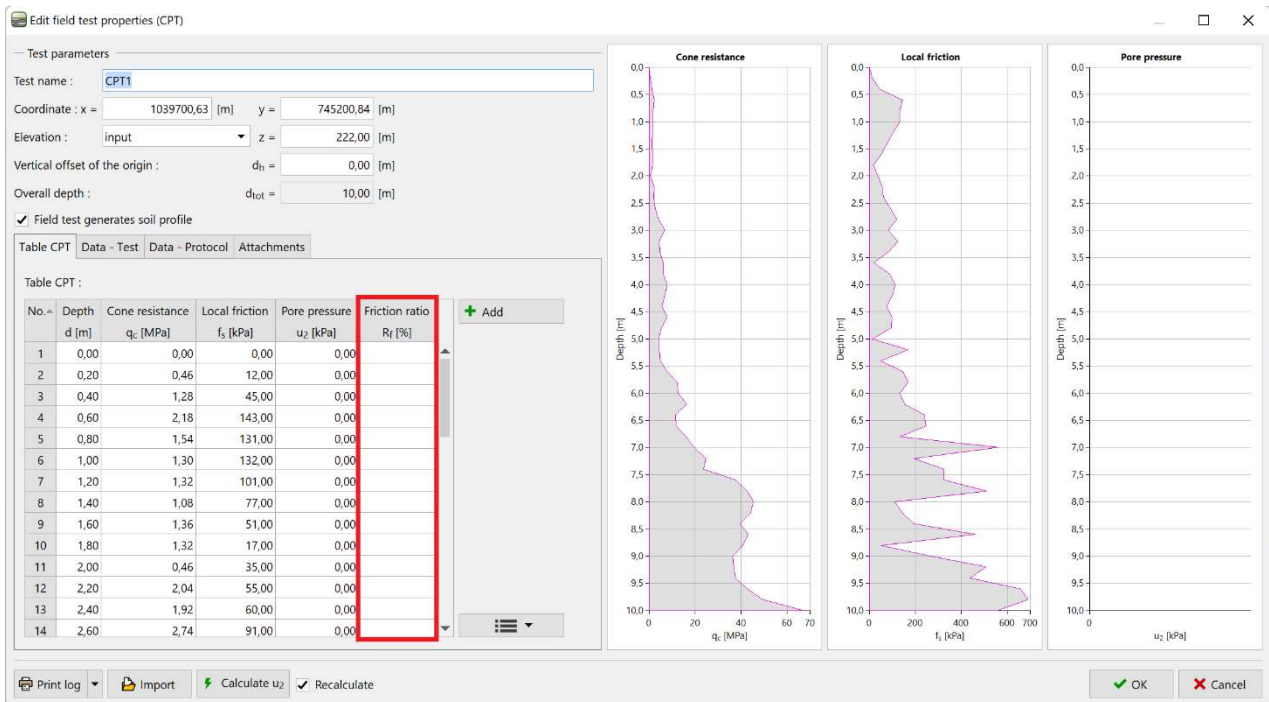
Master enumeration : (unspecified) No enumerations defined for using as master.

Changed Global data type

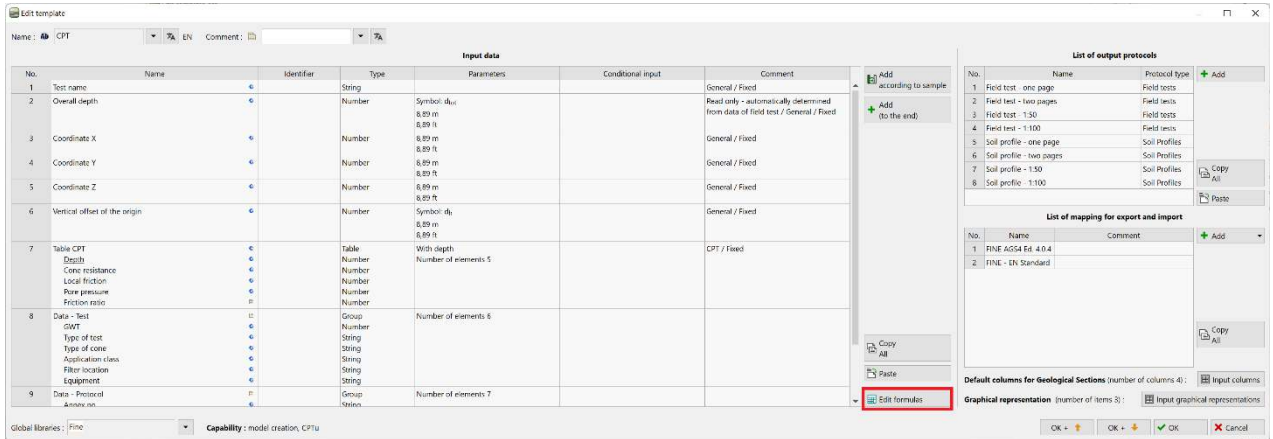
With the “Add + Close” button, confirm the modification of the template set and save the modified set under the name "EM 51" in the administrator.



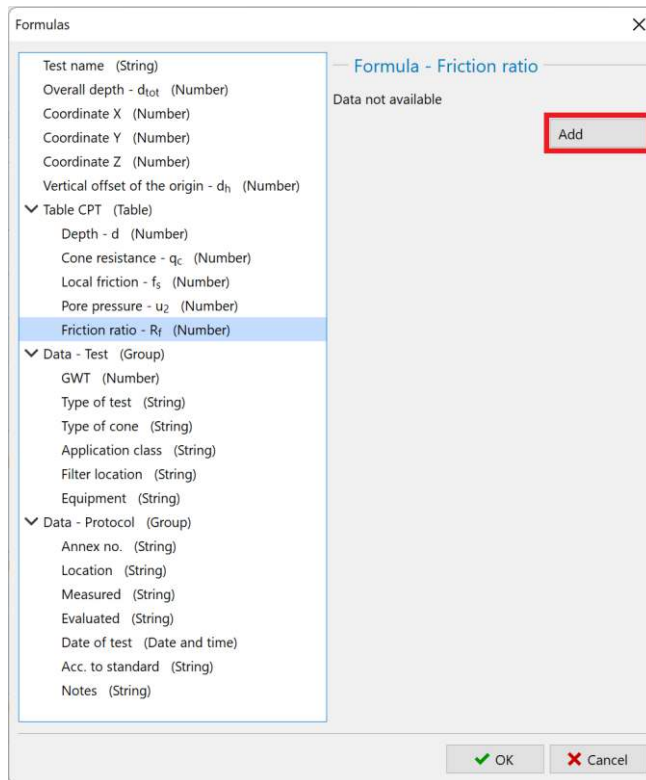
In the frame “Field Tests” frame, open the “CPT1” test. In the table, you can see the newly created column that does not yet contain any data. It is now possible to enter the data into the column in the standard way. However, we want to use a formula to define the automatic recalculation of this column.



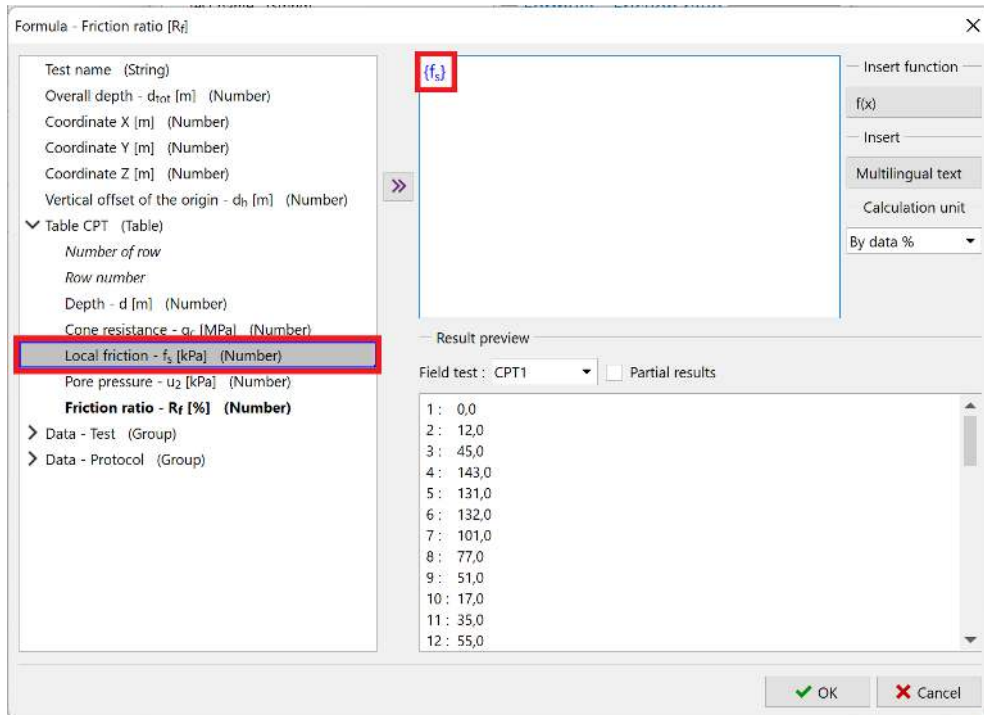
So, let's go back to editing the template for CPT and press the “Edit formulas” button.



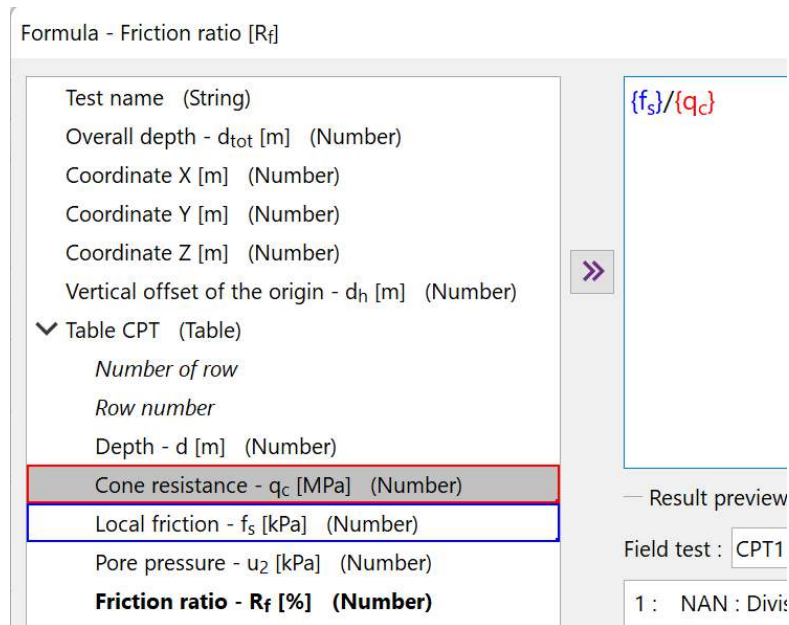
Here we will select the created data type “Friction ratio” in the list, to which we will add the formula, and press the “Add” button.



By double-clicking in the data list, we can add data references to the formula.

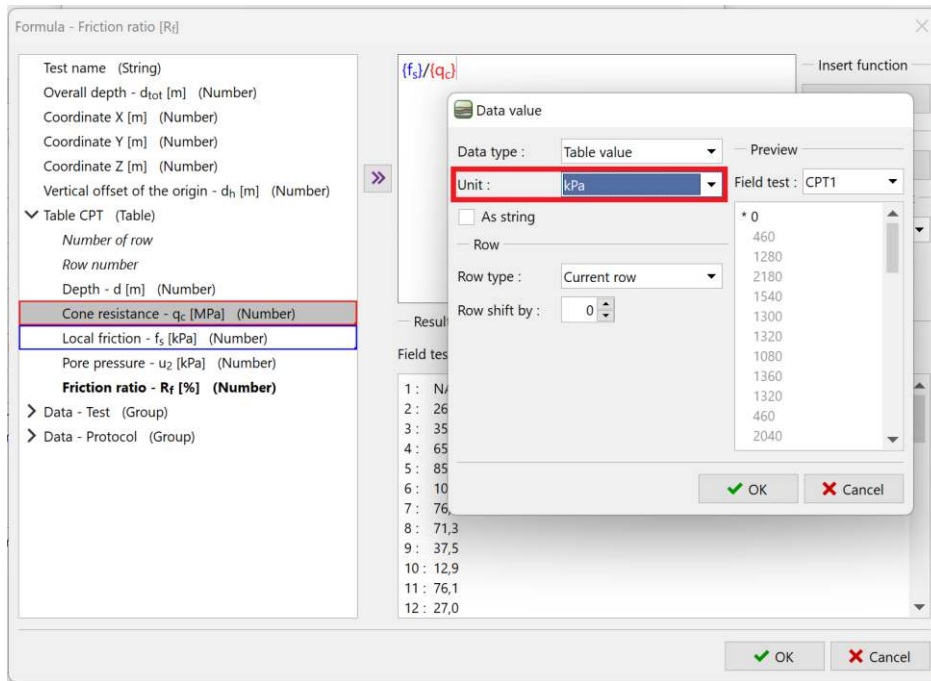


Input formula: $\frac{f_s}{q_c}$

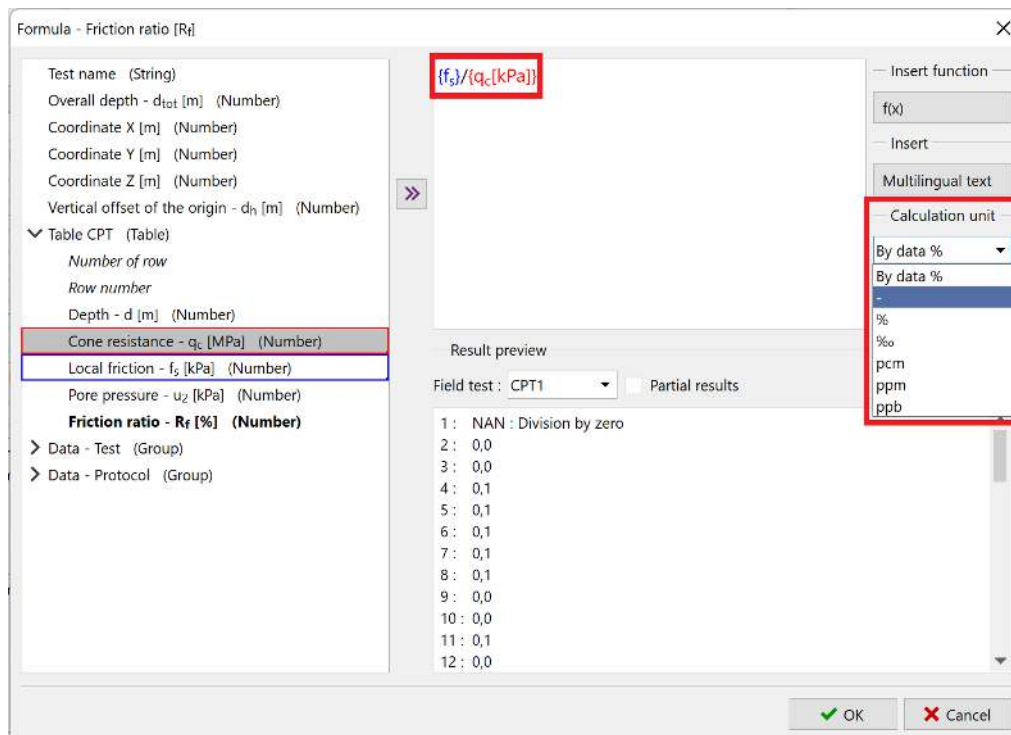


Note: Common mathematical operations as well as more complex functions can be used in the calculation. Entering functions is very similar to MS Excel.

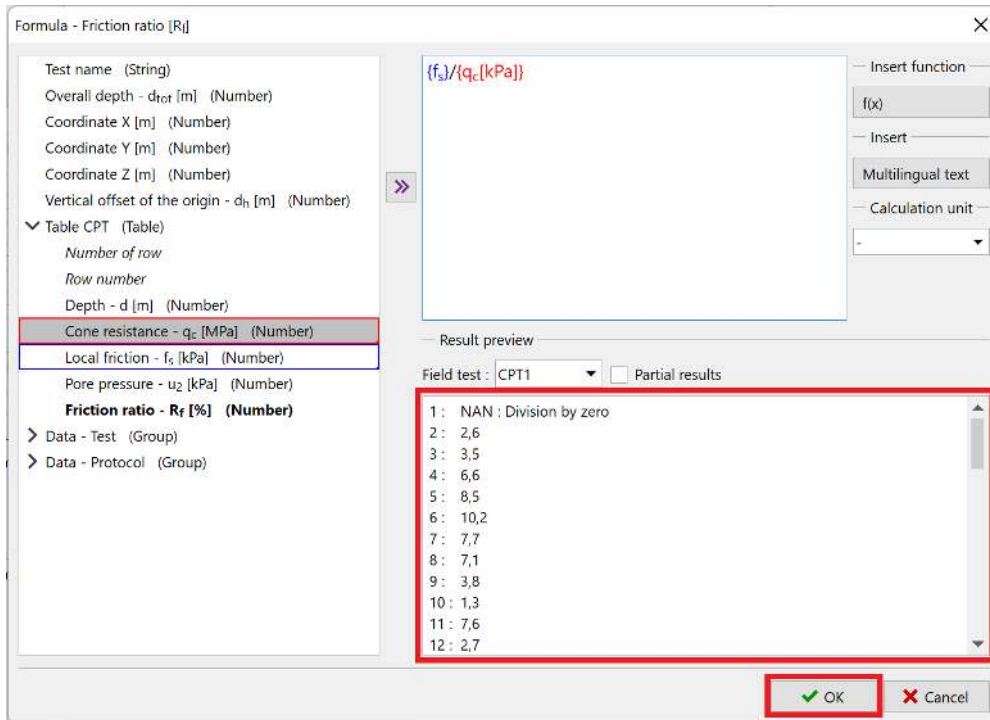
In the list, we see that while local friction has a unit of [kPa], cone resistance has a unit of [MPa]. To set the correct unit for the calculation, click on the q_c data type in the formula. This opens a dialog box in which we set the unit as [kPa]. The program then converts the unit before performing the calculation.



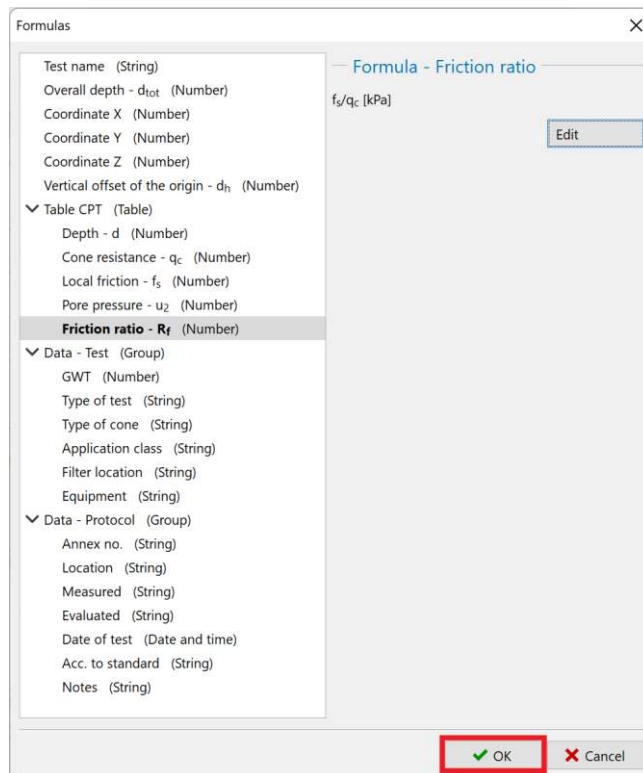
When defining the data type, we specified that the unit of the friction ratio is percentage [%]. However, the result of the specified formula is dimensionless. So, we need to choose the unit of the calculation result as dimensionless [-]. The program then performs the multiplication to percentages automatically. When entering more complex formulas, this function eliminates unit conversion errors.



In the lower part of the window, we can always see a preview of the calculation result. Confirm the entered formula with the “OK” button.



Data, which are calculated using formulas are displayed in bold in the list.



If we now return to the field test input frame, we can see the automatically calculated column. Automatic recalculation can be turned on or off at the bottom of the window.

Edit field test properties (CPT)

Test parameters

Test name:

Coordinate: x = [m] y = [m]

Elevation: z = [m]

Vertical offset of the origin: d_h = [m]

Overall depth: d_{tot} = [m]

Field test generates soil profile

Table CPT | Data - Test | Data - Protocol | Attachments

Table CPT:

No. -	Depth d [m]	Cone resistance q _c [MPa]	Local friction f _s [kPa]	Pore pressure u ₂ [kPa]	Friction ratio R _f [%]
1	0,00	0,00	0,00	0,00	
2	0,20	0,46	12,00	0,00	2,6
3	0,40	1,28	45,00	0,00	3,5
4	0,60	2,18	143,00	0,00	6,6
5	0,80	1,54	131,00	0,00	8,5
6	1,00	1,30	132,00	0,00	10,2
7	1,20	1,32	101,00	0,00	7,7
8	1,40	1,08	77,00	0,00	7,1
9	1,60	1,36	51,00	0,00	3,8
10	1,80	1,32	17,00	0,00	1,3
11	2,00	0,46	35,00	0,00	7,6
12	2,20	2,04	55,00	0,00	2,7
13	2,40	1,92	60,00	0,00	3,1
14	2,60	2,74	91,00	0,00	3,3

Print log | Import | Calculate u₂ | Recalculate | OK | Cancel

In the next phase, we will define the graphical representation of the calculated column - we add a fourth graph to the field test input window.

We will return to editing the template and press the button “Input graphical representations”.

The screenshot shows the 'Edit template' dialog box. The 'Input data' table is the central focus, with columns for No., Name, Identifier, Type, Parameters, Conditional input, and Comment. The 'List of output protocols' panel on the right shows a list of protocols with columns for No., Name, and Protocol type. The 'List of mapping for export and import' panel shows a list of mappings with columns for No., Name, and Comment. A red box highlights the 'Input graphical representations' button in the bottom right corner of the dialog box.

Here we add the newly defined column “Friction ratio” and confirm.

The screenshot shows the 'Graphical representation' dialog box. It contains a table with the following data:

No.	Type of graphical representations	Content	Default
1	field test graph	Table CPT - Cone resistance	<input checked="" type="radio"/>
2	field test graph	Table CPT - Local friction	<input type="radio"/>
3	field test graph	Table CPT - Pore pressure	<input type="radio"/>

A red box highlights the '+ Add (to the end)' button. Below the table, there is a yellow box with the following text:

- Graphical representations are sorted according the order in the table
- Graphical representation in 3D view is done by the column "Default"

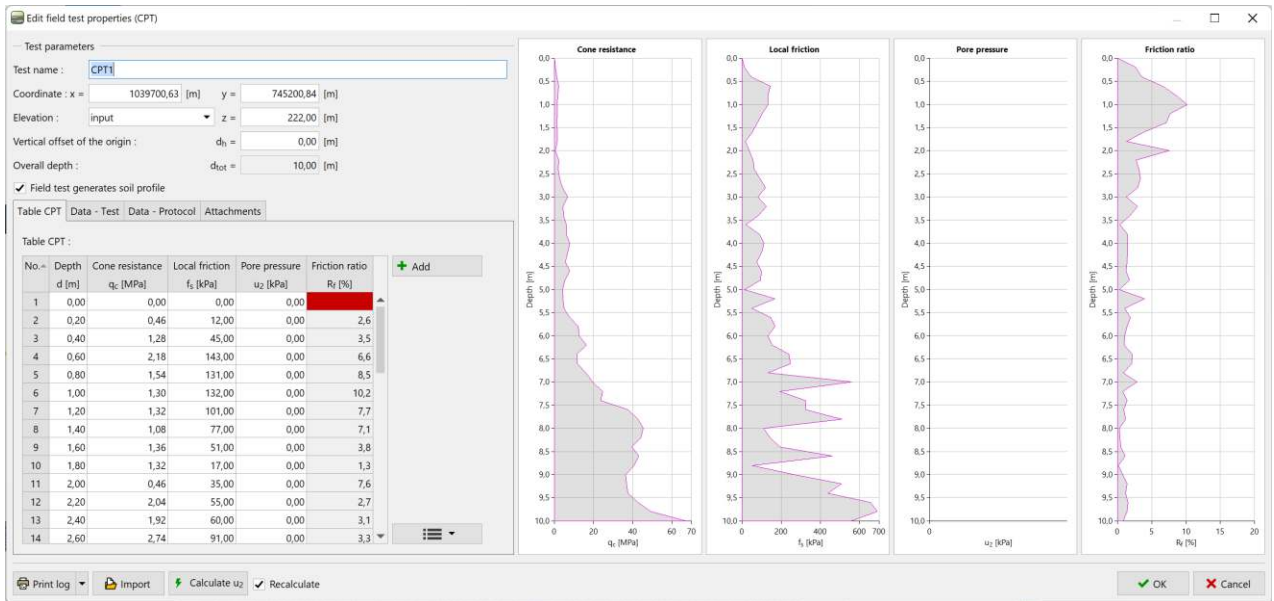
At the bottom, there are 'OK' and 'Cancel' buttons.

The screenshot shows the 'New graphical representation' dialog box. It contains the following fields:

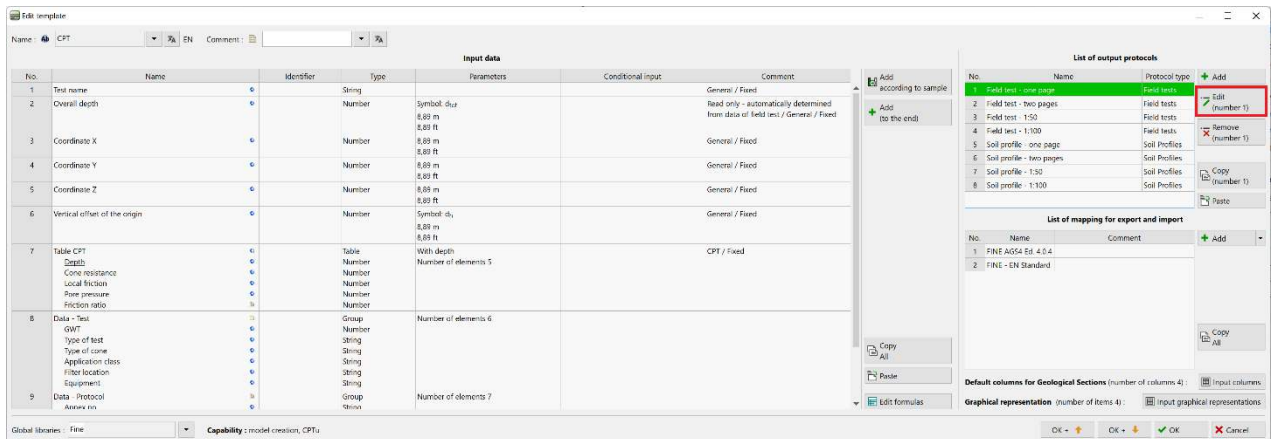
- Type of graphical representations: field test graph
- Table: Table CPT
- Column: Friction ratio

A red box highlights the '+ Add' button. At the bottom, there are 'Add' and 'Cancel' buttons.

After returning to the field test input window, we see the newly added graph for the calculated column.



The last change required is to add a new graph to the output log. Let's go back to editing the template, select the desired output protocol and press the "Edit" button.



We will proceed to the “Columns” section, where we see the original graph.

	A: 1.0	B: 1.0	C: 1.0	D: 1.0	E: 1.0	F: 1.0	G: 1.0	H: 1.0	I: 1.0
1: 2.0	GEO5 Laboratoř s.r.o. Sokolovská 232, Praha 8, 18000								CPT1
2: 1.0	Project: Apartment building "Moonlighting" - Geological survey								
3: 1.0	Project ID: AA_0014 - 2019			Annex no.: 17.C			Type of test: TE2		
4: 1.0	Location: Stará 14/78, Hradec Králové			Measured: Joe Fieldman			Type of cone: Ac=1000 mm ²		
5: 1.0	Evaluated: Bill New			Coordinate System: S-JTSK / Krovak / Bait after adjustment			Application class: 2		
6: 1.0	Date of test: 10.08.2016			Coordinate X: 1039700,63			Acc. to standard: EN ISO 22476-1		
7: 1.0	Scale: one page			Coordinate Y: 745200,84			Vertical offset of the origin: 0,00 m		
8: 1.0	Equipment: PenSta A22			Coordinate Z: 222,00 m			Overall depth: 10,00 m		
9: 1.0				Filter location: U ₂			GWT: 5,00 m		

By pressing the “Add” button, we will add a column with which we will continue to work.

Insert one column behind the existing column D.

Insert column
✕

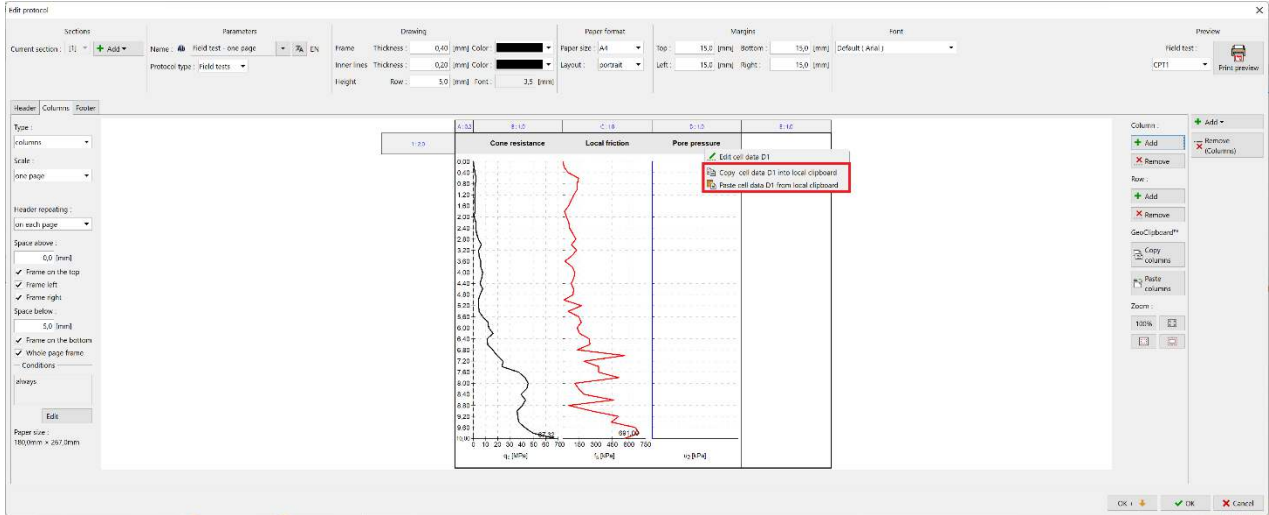
Insert column : Behind D

Number : 1

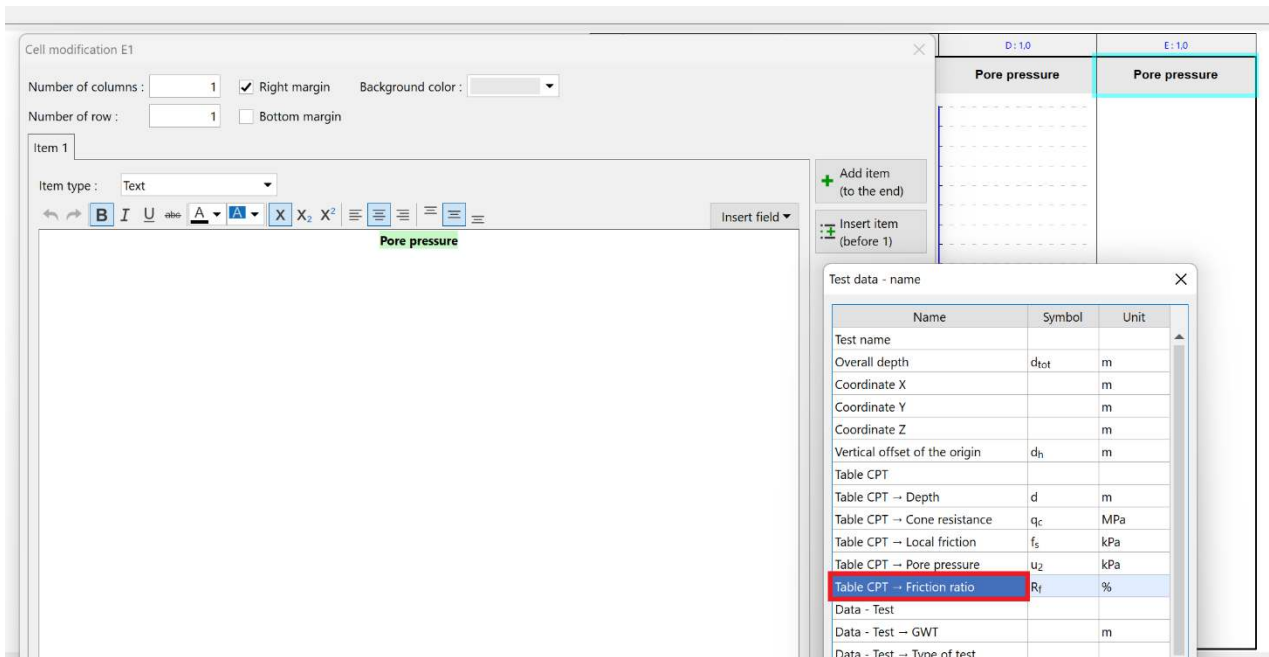
✔ OK
✕ Cancel

Columns contain a header and a body.

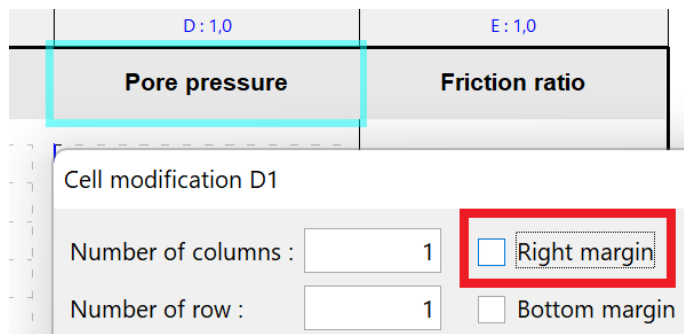
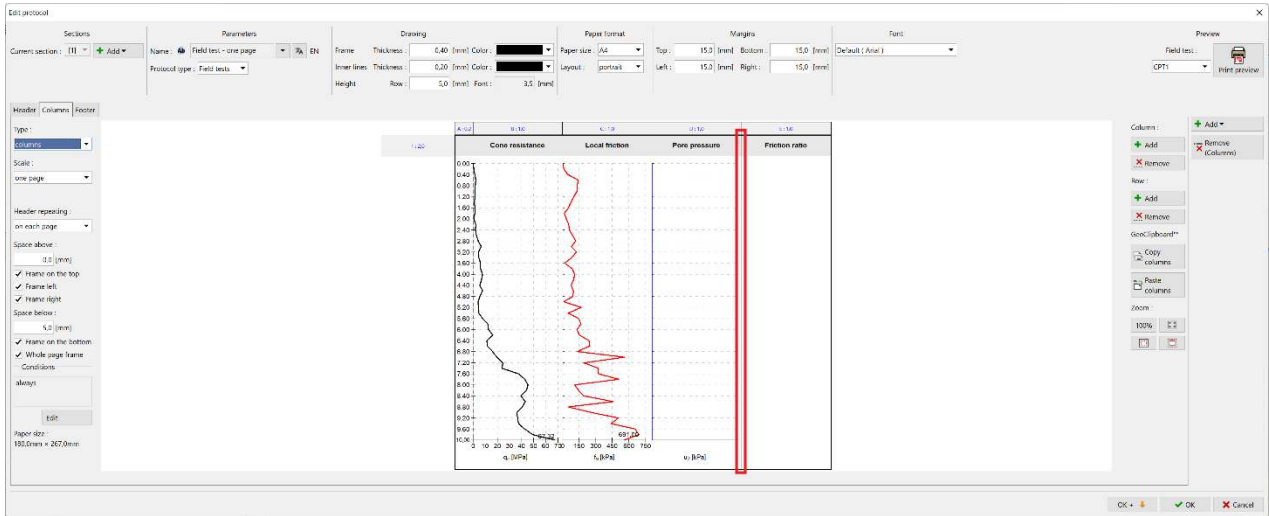
Let's start by editing the header. To save time with formatting, we can copy the cell titled "Pore pressure" and paste it into the cell in the header of the newly added column. The options for copying and pasting are displayed by pressing the right mouse button on the desired cell.



With the left mouse button in the header of column E, we open the cell editing. We click on the name "Pore pressure" and change it to "Friction ratio" by selecting from the list.

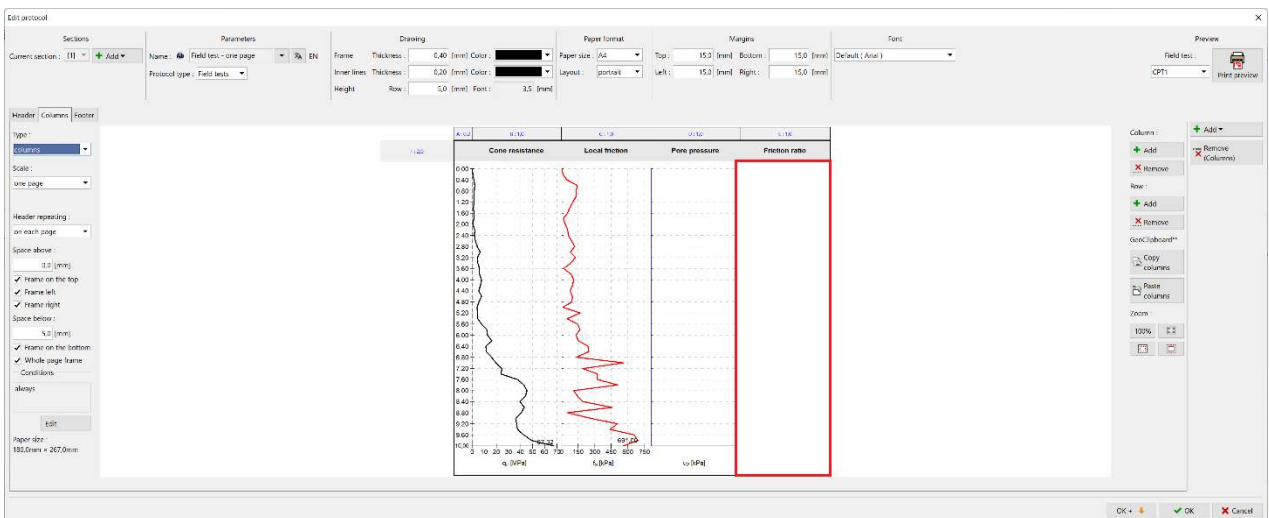


Now we have the column header correct, but we can see that there is a separator line between the original column and the new column. To remove it, open the modification of the cell titled “Pore pressure” and turn off the right margin.

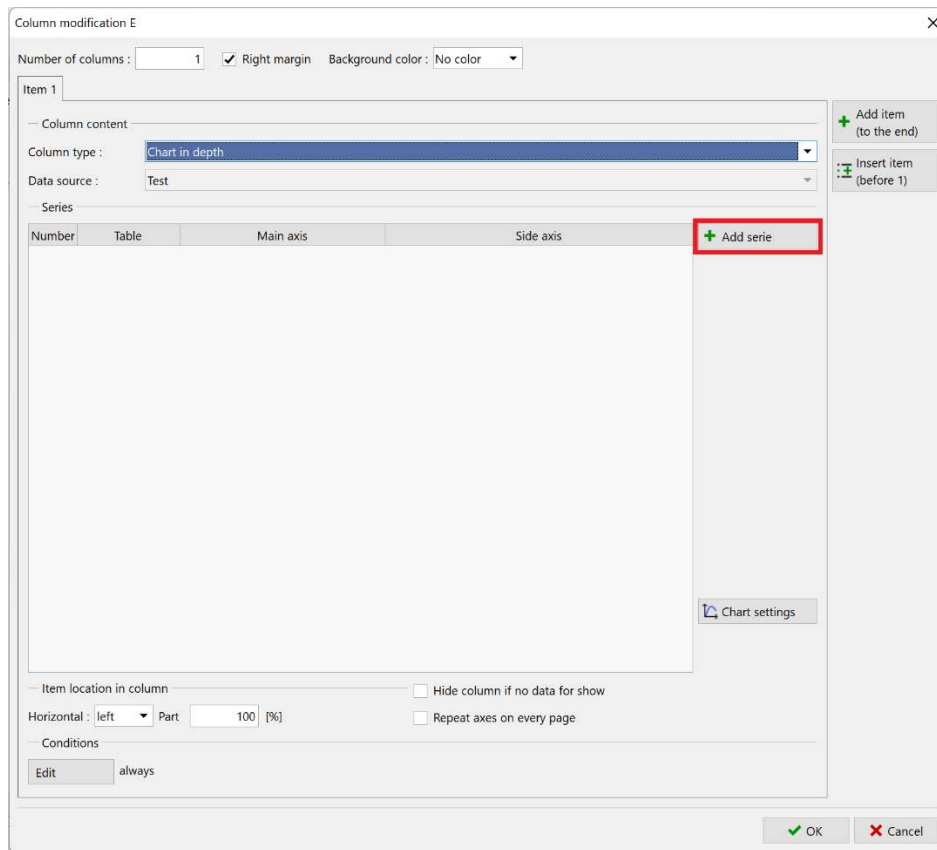


Proceed in the same way for the body with the pore pressure graph.

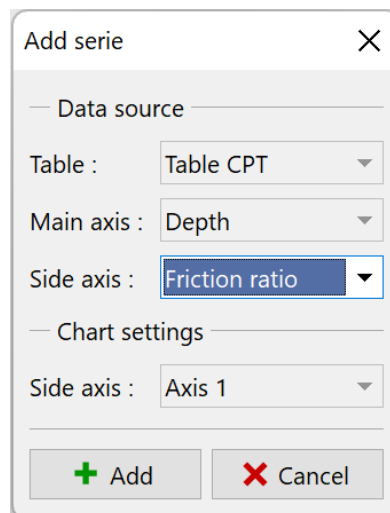
The last necessary modification is the actual addition of the chart to the new column. By clicking in the empty space of the column, we open its modification.



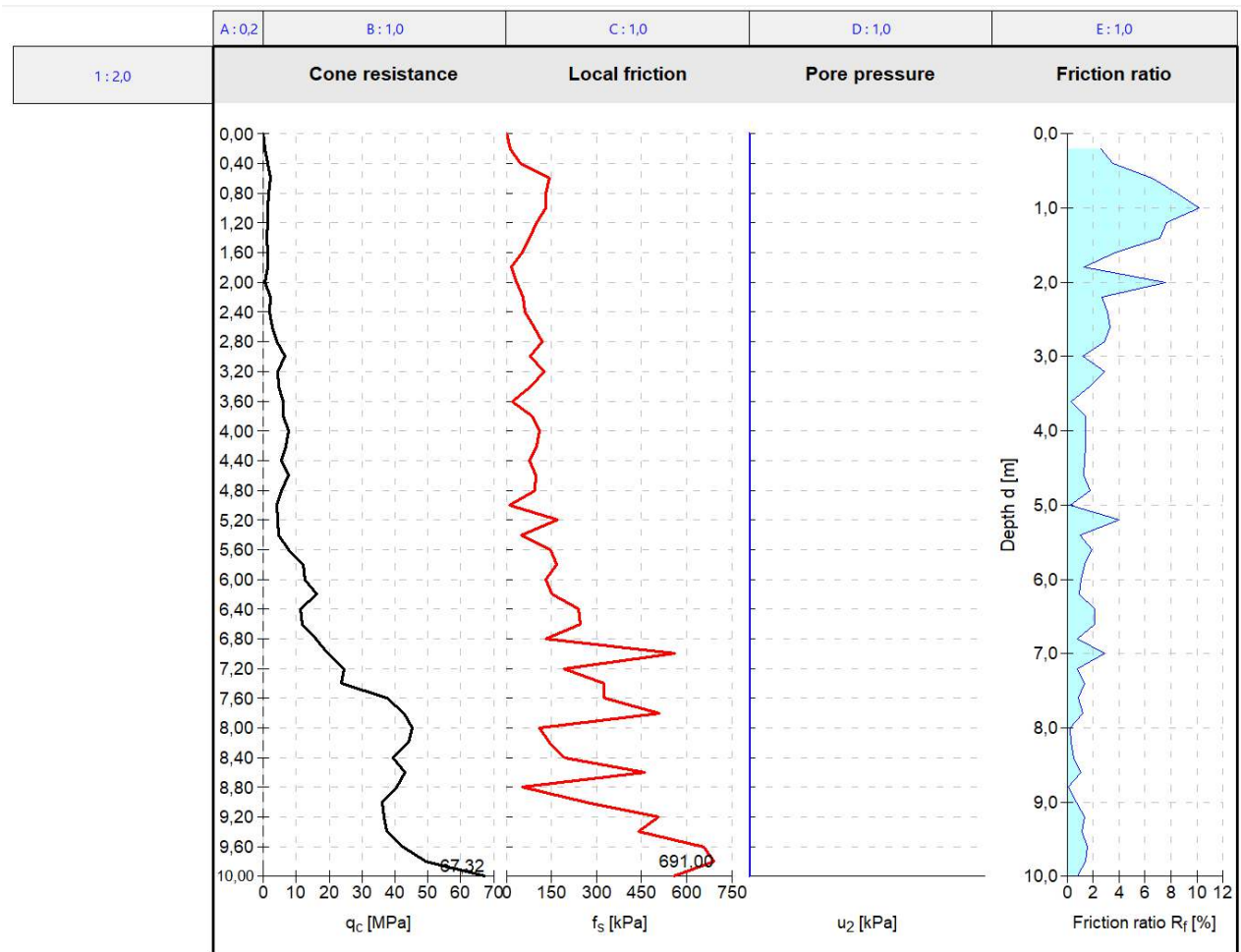
Here, select the column type as “Chart in depth” and press the “Add serie” button.



We select the corresponding data – “Friction ratio”.



Now we can see the desired graph in the column. However, we still need to adjust its visual appearance to correspond with the other graphs.



Let's start by editing the main axis (vertical). This is common to all graphs - we will not display it for the edited graph.

Column modification E

Number of columns: Right margin Background color:

Item 1

Column content

Column type:

Data source:

Series

Number	Table	Main axis	Side axis
1	Table CPT	Depth [m]	Friction ratio [%]

Item location in column Hide column if no data for show

Horizontal: Part [%] Repeat axes on every page

Conditions

always

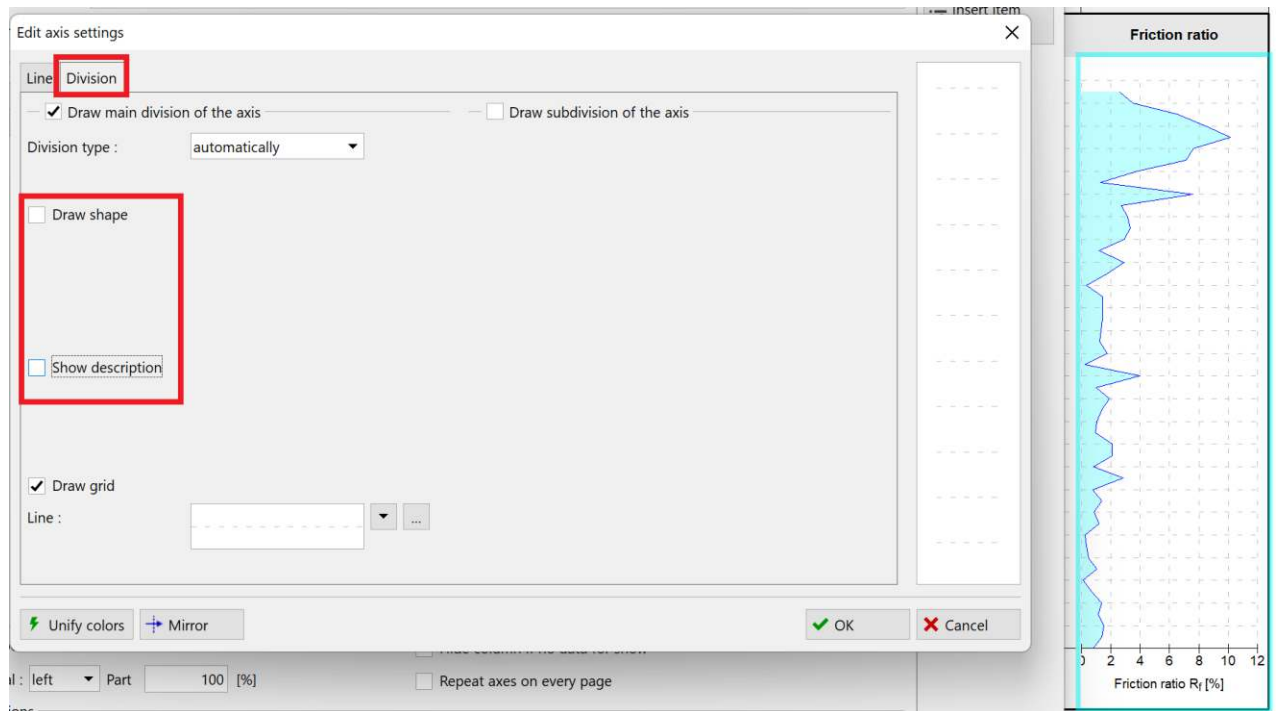
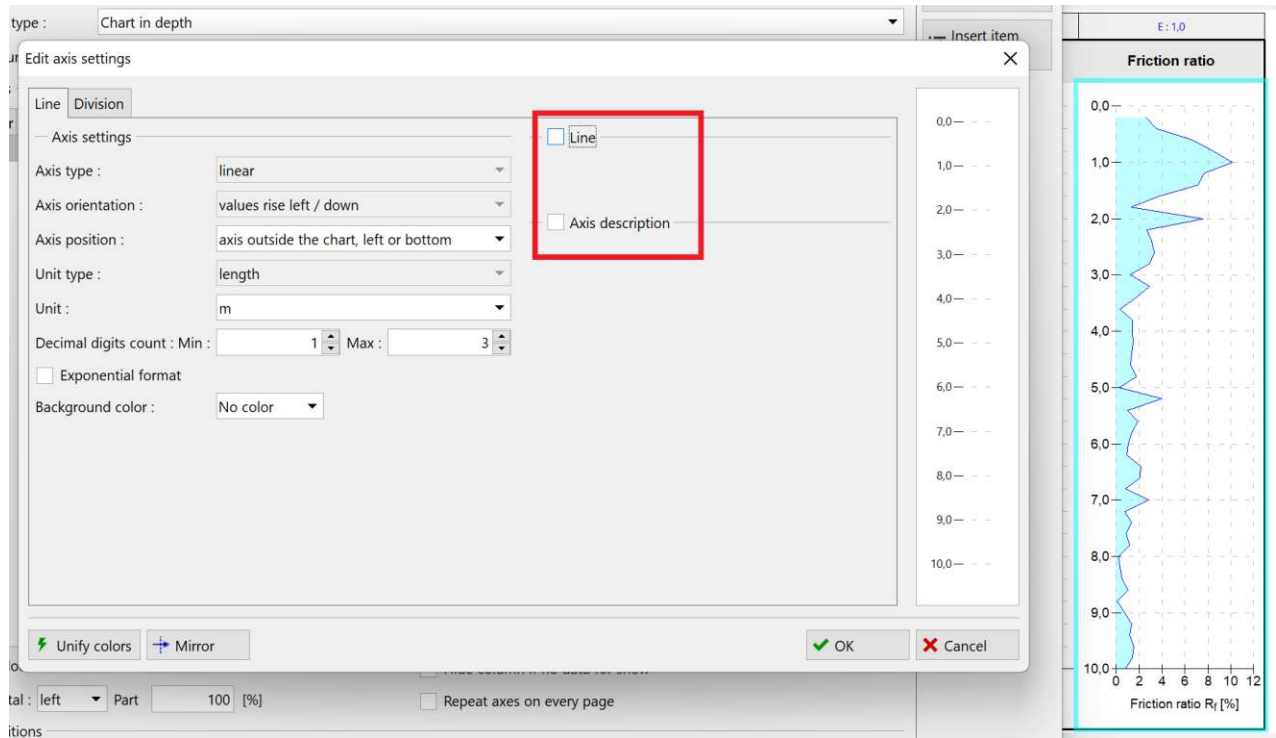
Bottom: [mm]

Right: [mm]

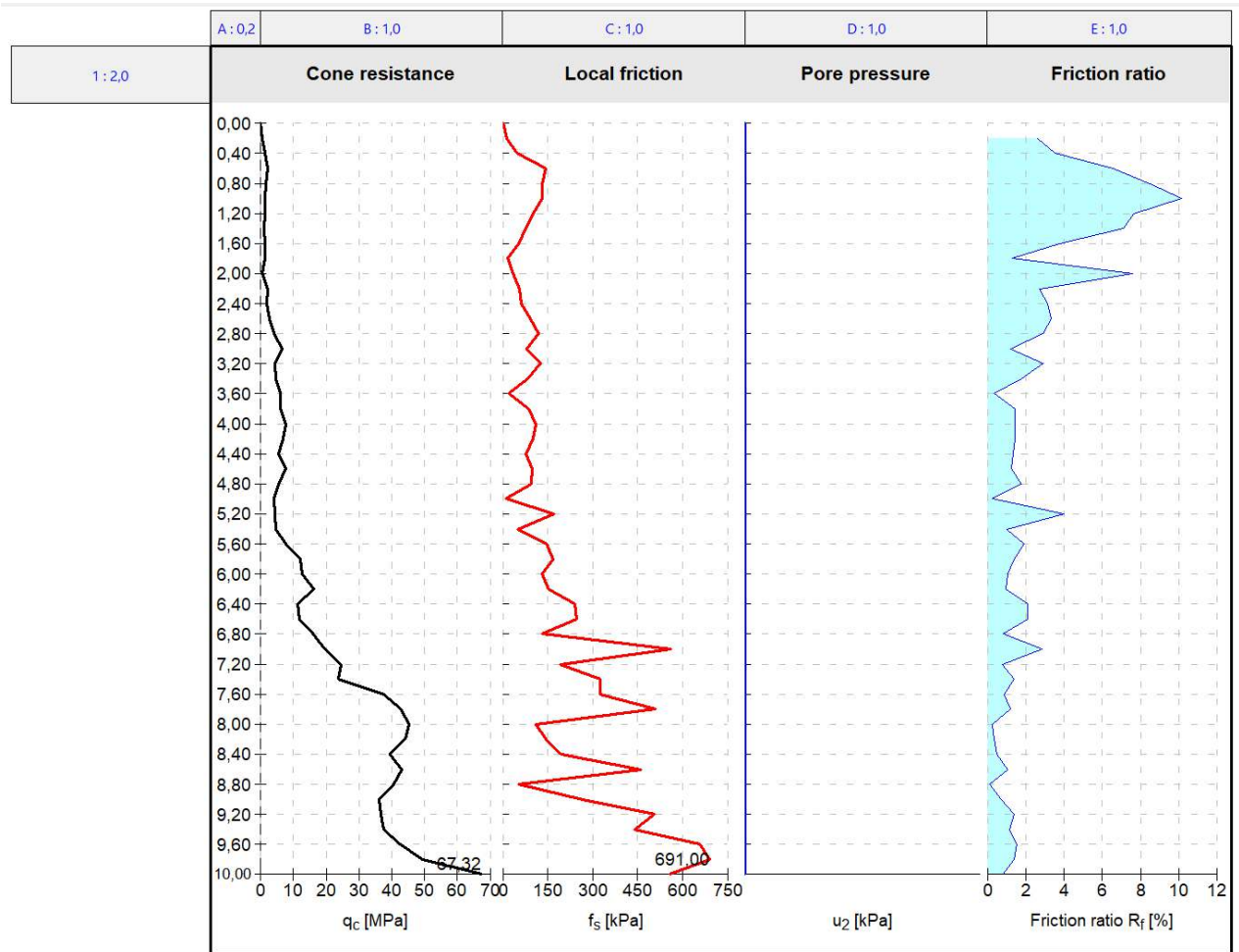
E: 1,0

Friction ratio

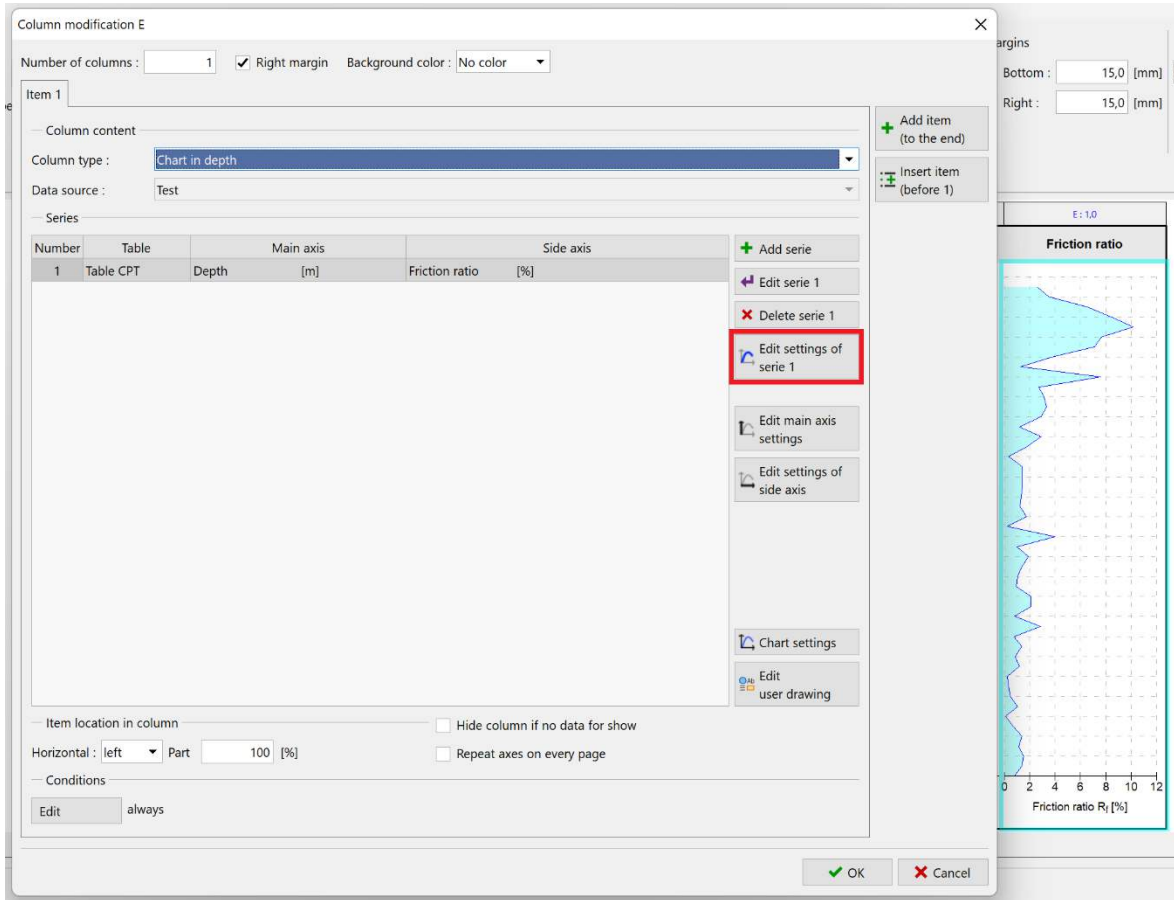
We will turn off the display of the line, the description of the axis, and in the “Division” tab, also the shape and description.



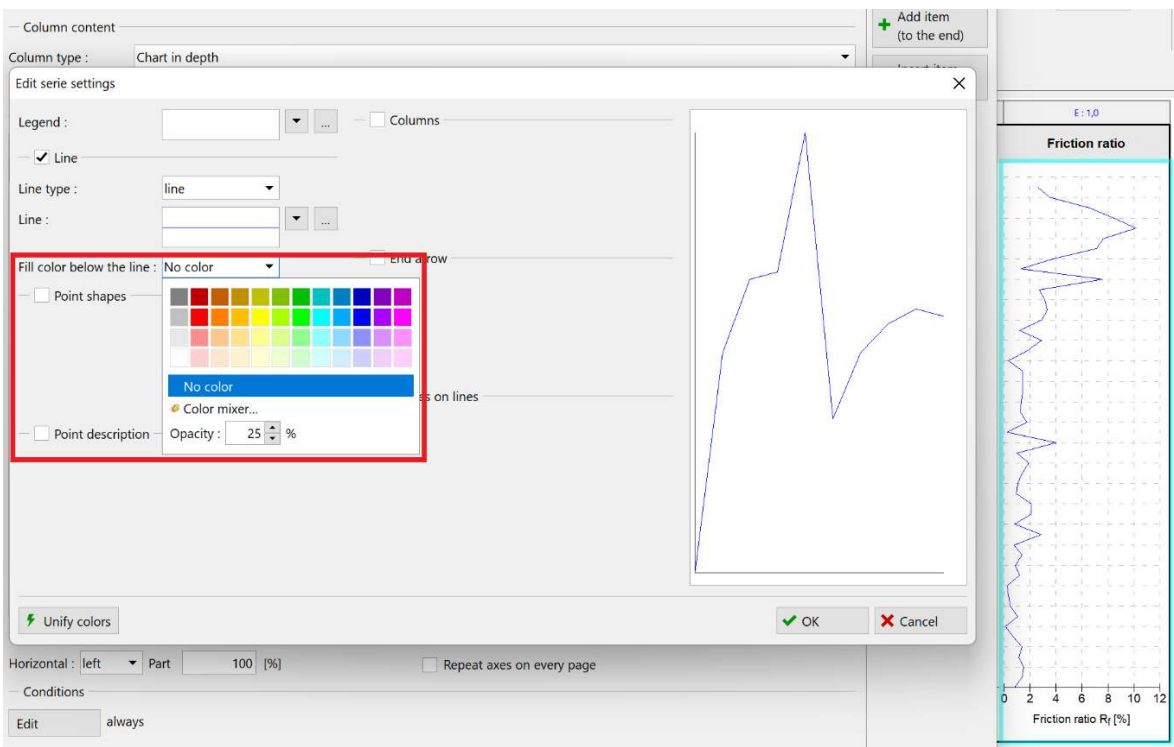
Now we will adjust the visualization of the series itself to match the other charts.



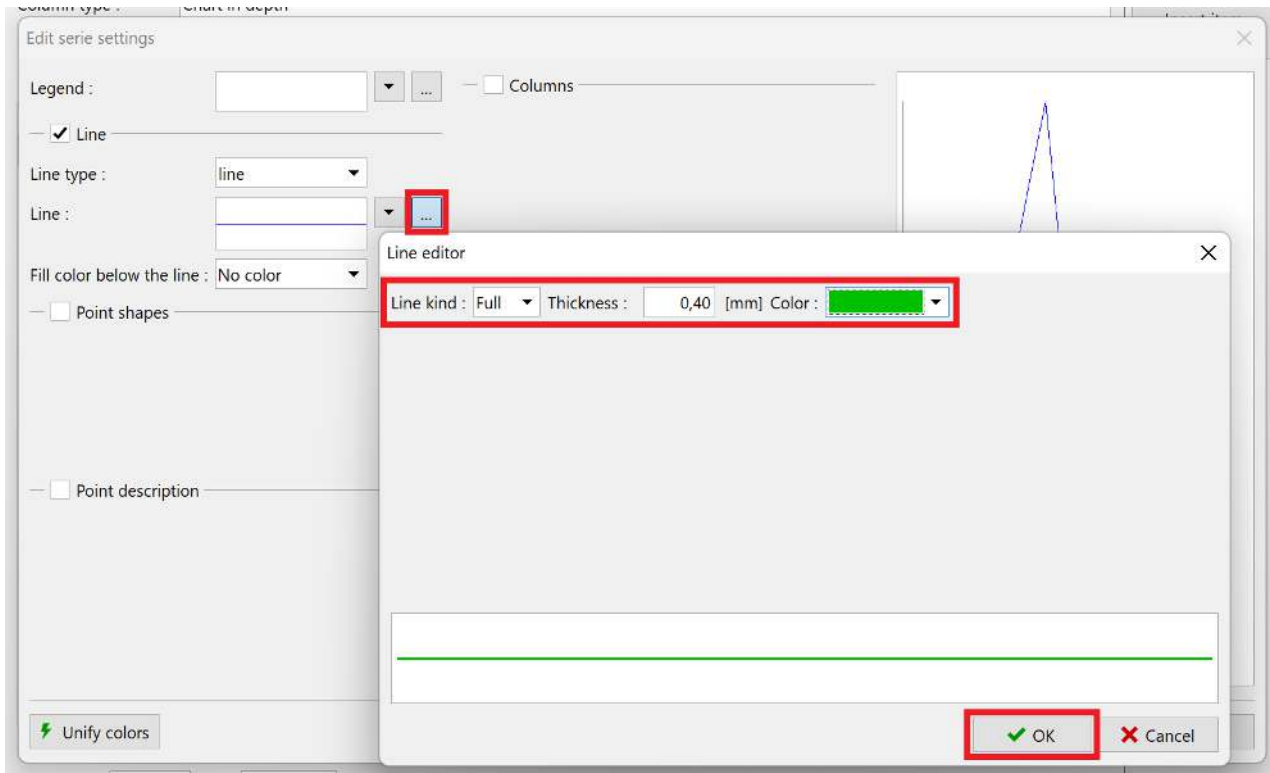
Press button “Edit settings of serie 1”.



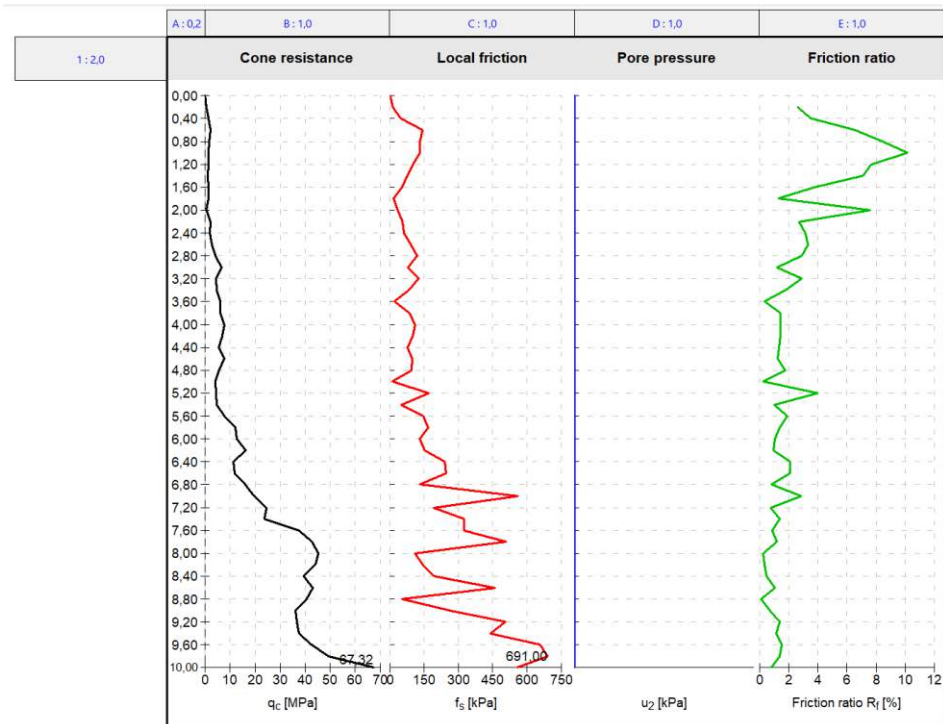
Here, we will do the necessary modifications – turn off the color fill below the line.



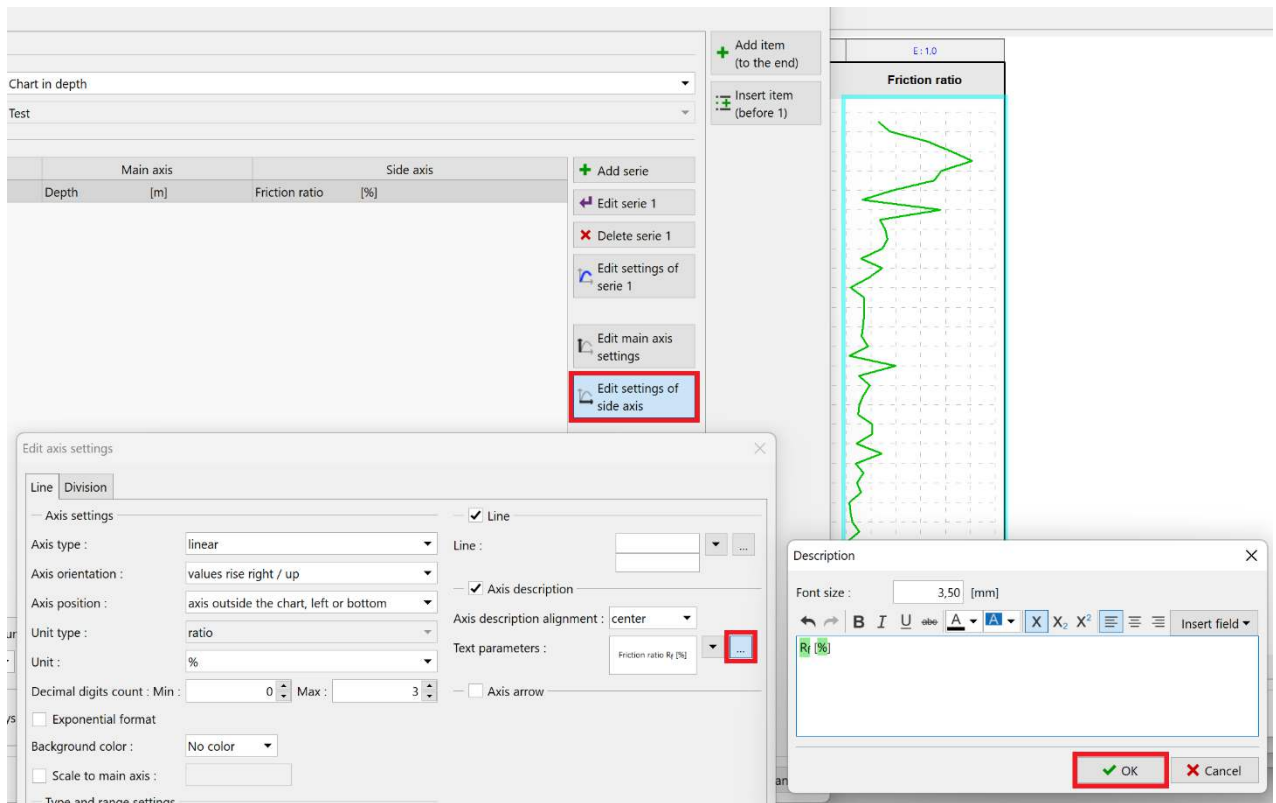
Next, by pressing the button with three dots, we will edit the line itself. We will unify the thickness to 0.4 mm and select the green color, which is not yet used.



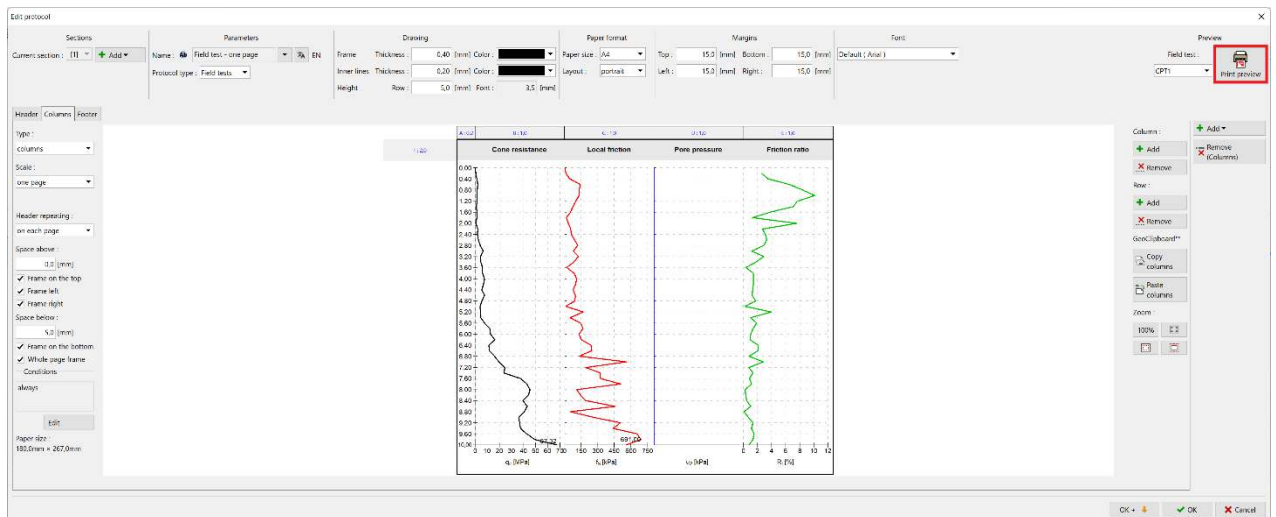
We will also adjust the description of the side axis to match the other graphs.

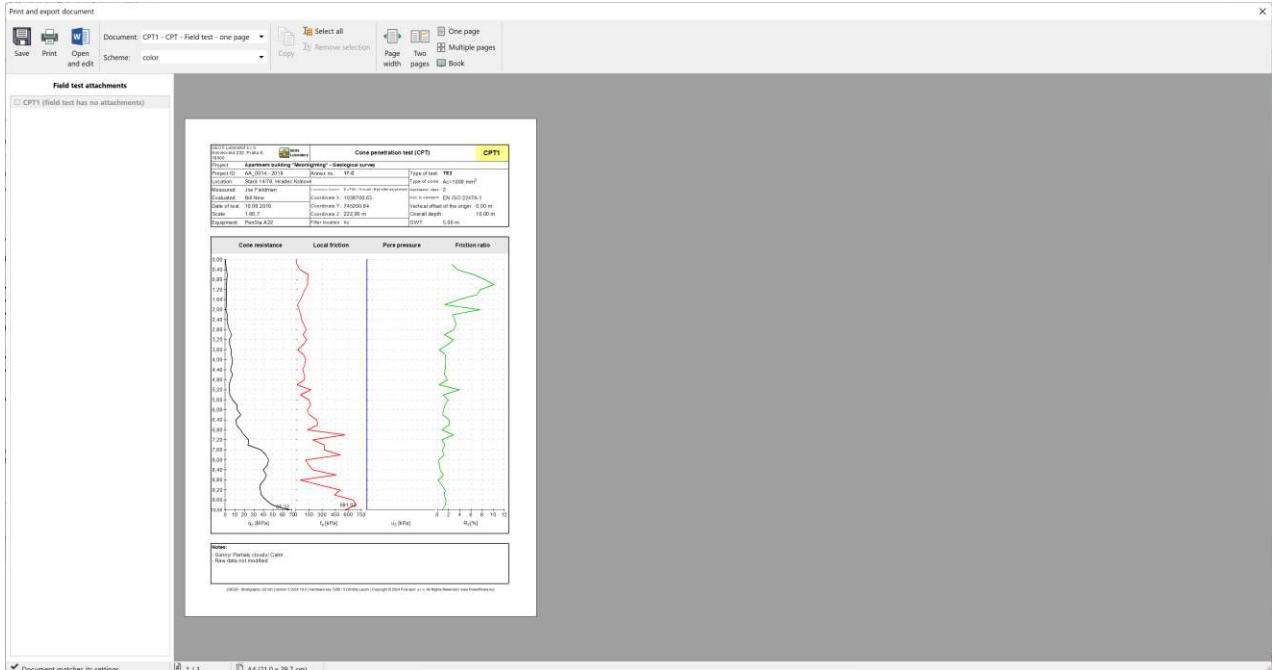


The procedure here is similar to other modifications – we open the side axis editor and modify the description of the axis so that it contains only the symbol.

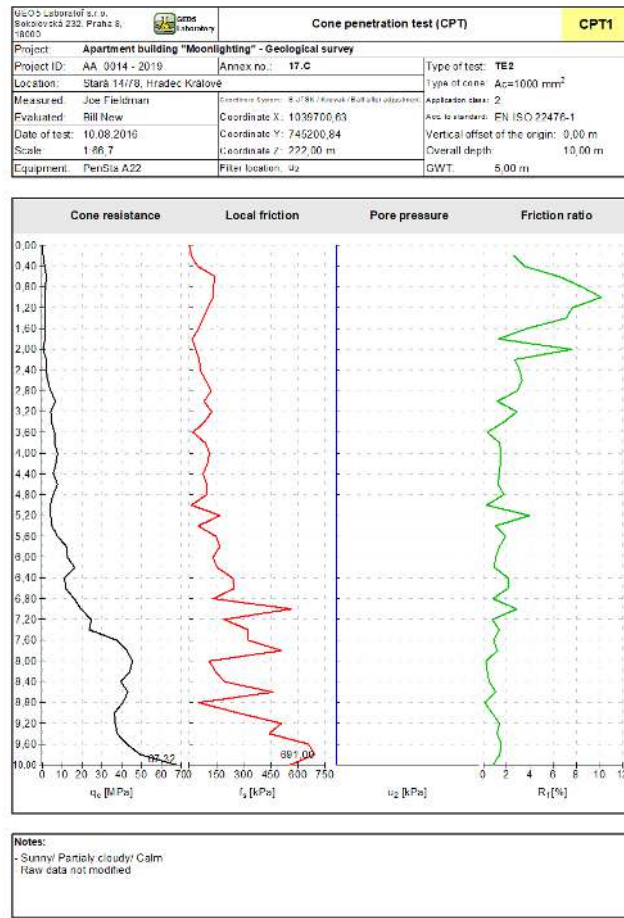


By pressing the “Print preview” button, we can check whether our log corresponds to the required assignment.

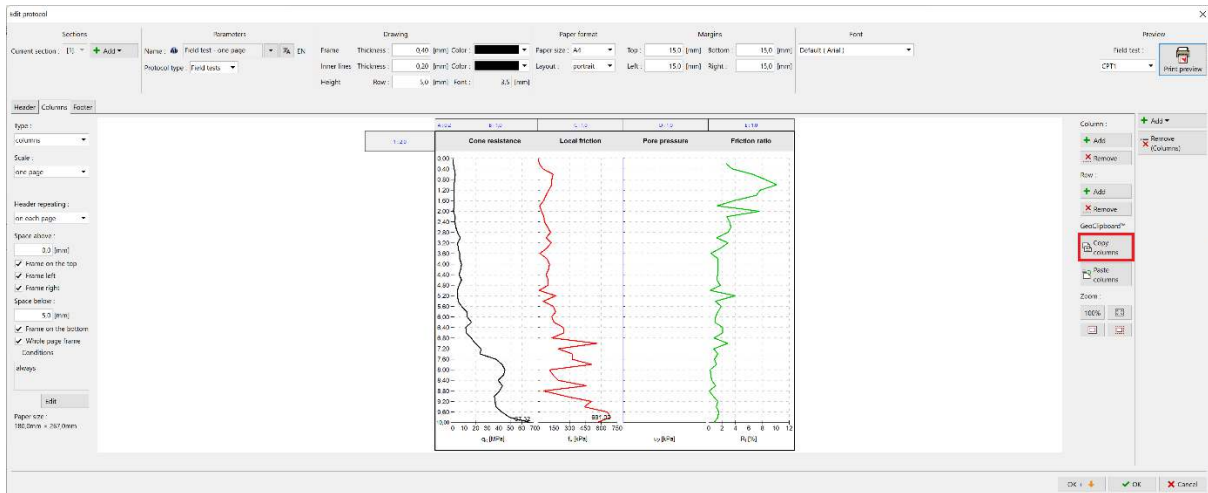




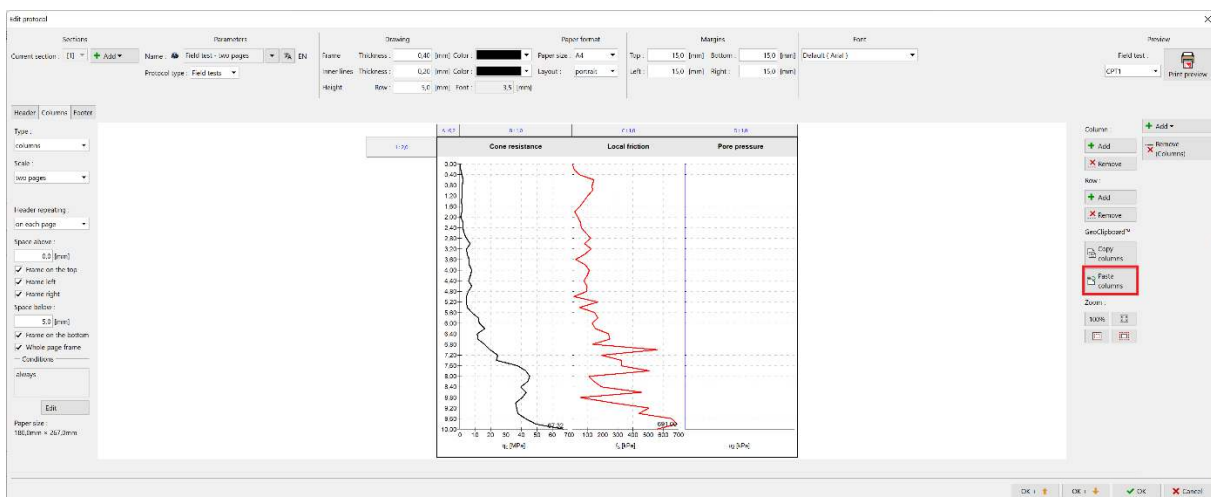
The created protocol corresponds to our assignment.



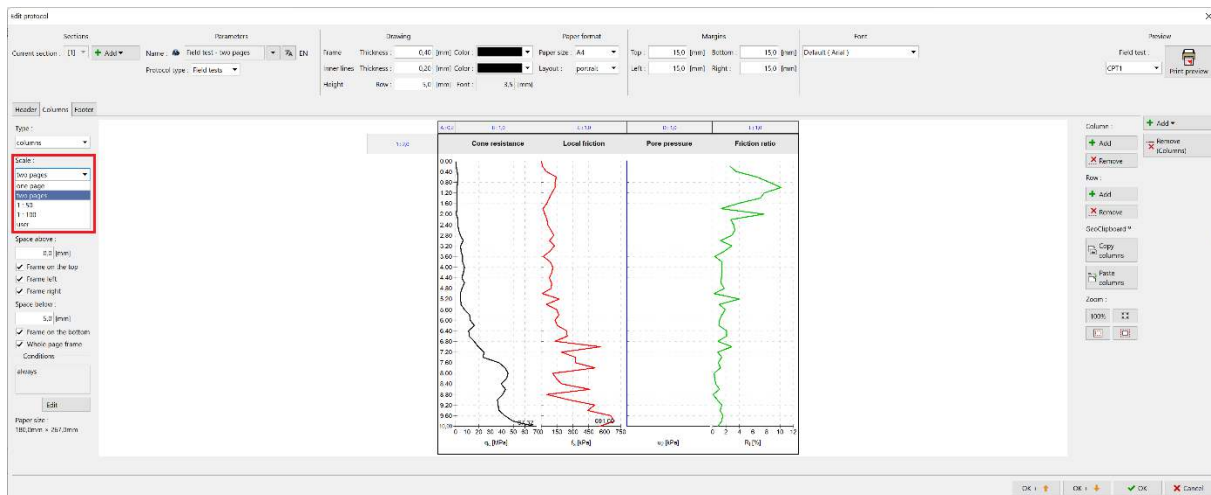
If we want to modify the graph in other protocols, it can be copied very quickly. In the edited log, click on the column tab and press “Copy columns”.



Now open the second log - in our case a two-page log and insert the columns.



Now just adjust the appropriate scale - two pages.



In this way, we can easily modify other protocols as well.

