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.

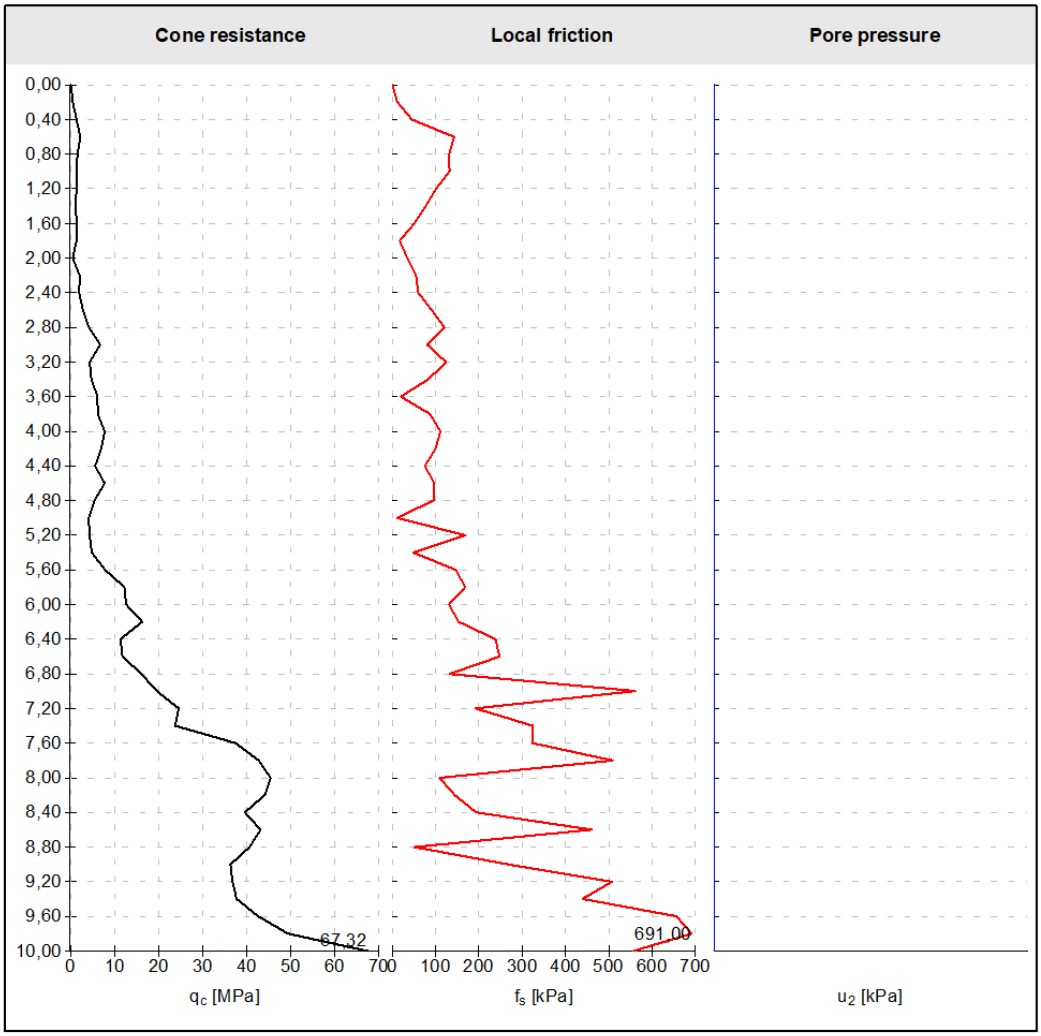
Assignment
Modify the "EN-Standard" CPT template so that:

- 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:

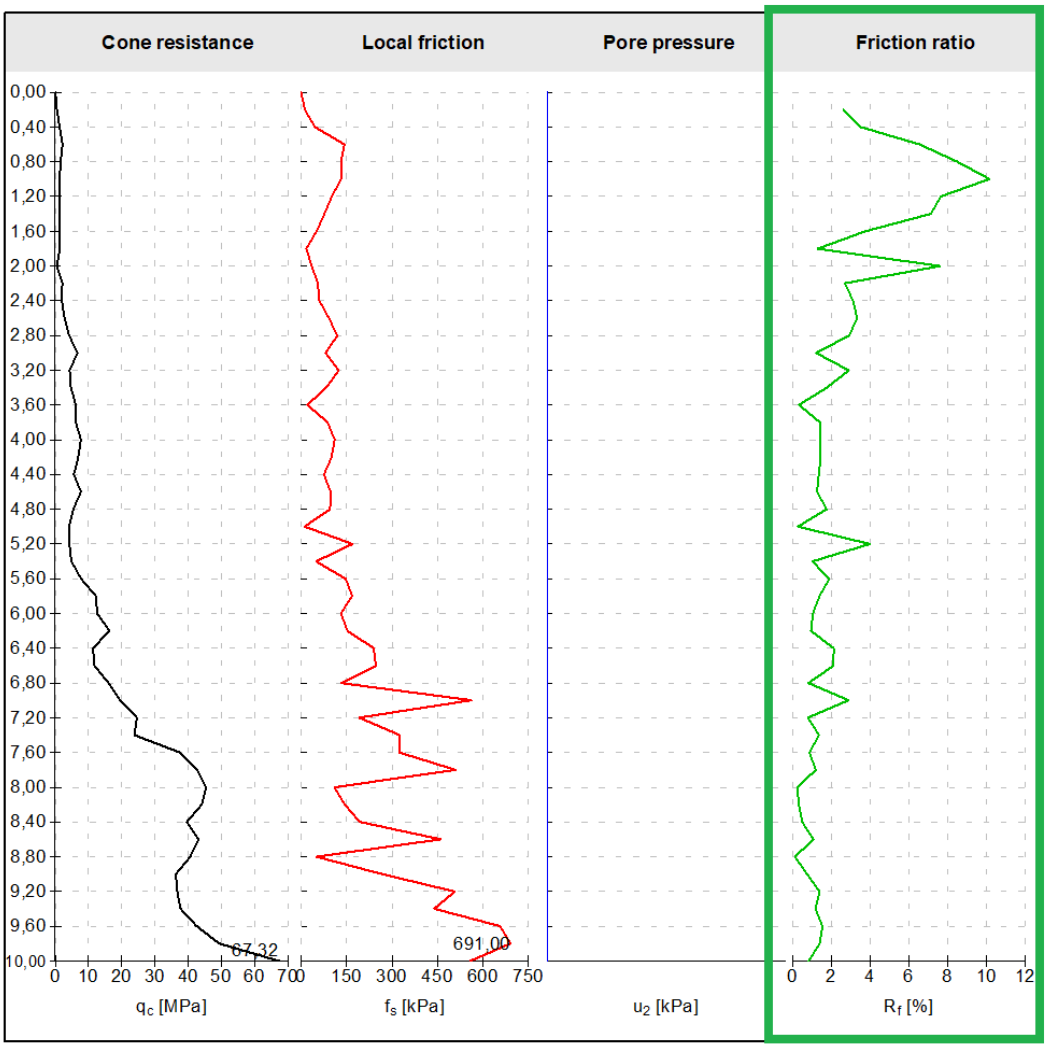
GEO5 Laboratoř s.r.o. Sokolovská 232, Praha 8, 18000	GEO5 Laboratory	**Cone penetration test (CPT)**		**CPT1**
Project:	**Apartment building "Moonlighting" - Geological survey**			
Project ID:	AA_0014 - 2019	Annex no.: **17.C**	Type of test:	**TE2**
Location:	Stará 14/78, Hradec Králové		Type of cone:	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/ Partialy cloudy/ Calm
- Raw data not modified

The required form of the protocol is this:

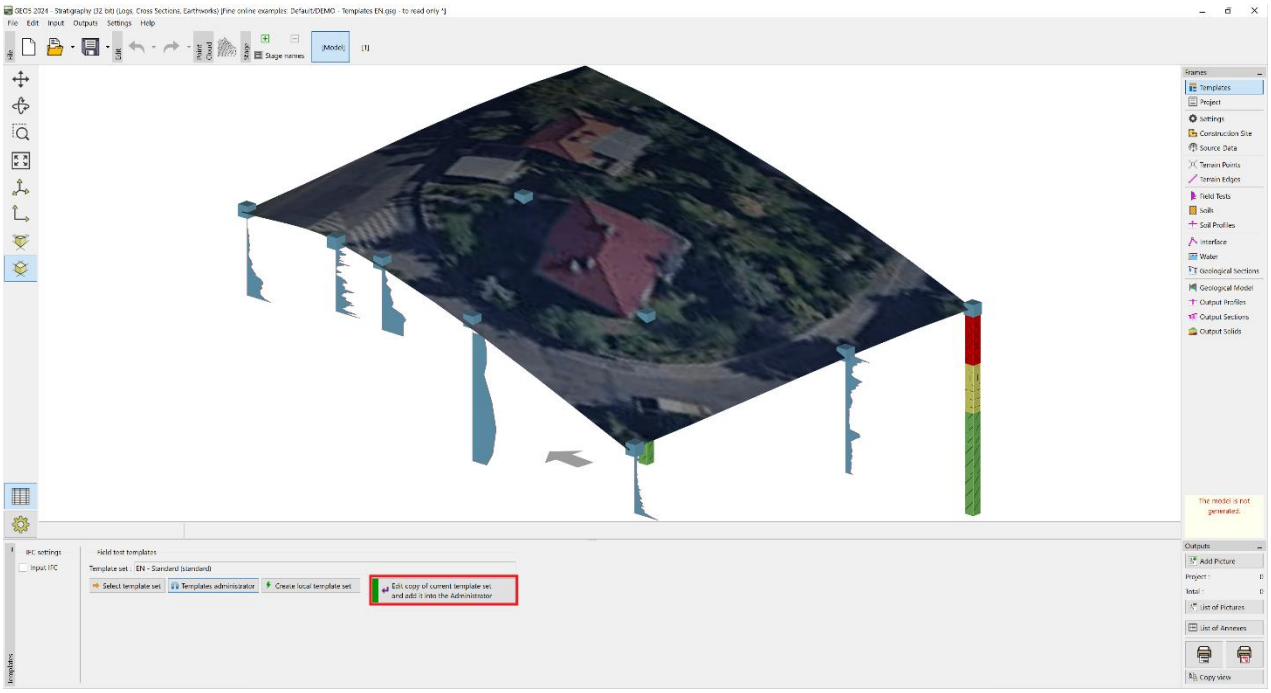
GEO5 Laboratoř s.r.o. Sokolovská 232, Praha 8, 18000	GEO5 Laboratory	**Cone penetration test (CPT)**		**CPT1**
Project:	**Apartment building "Moonlighting" - Geological survey**			
Project ID:	AA_0014 - 2019	Annex no.: **17.C**	Type of test:	**TE2**
Location:	Stará 14/78, Hradec Králové		Type of cone:	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



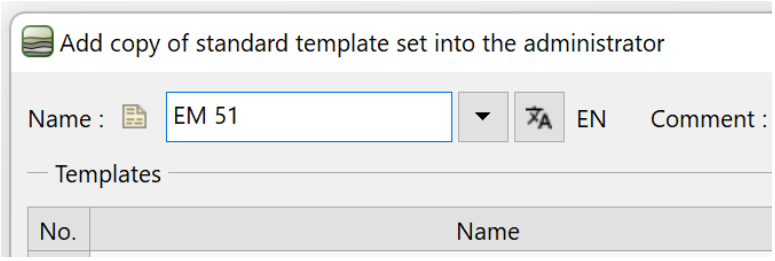
Notes:
- Sunny/ Partialy cloudy/ Calm
- Raw data not modified

Solution:

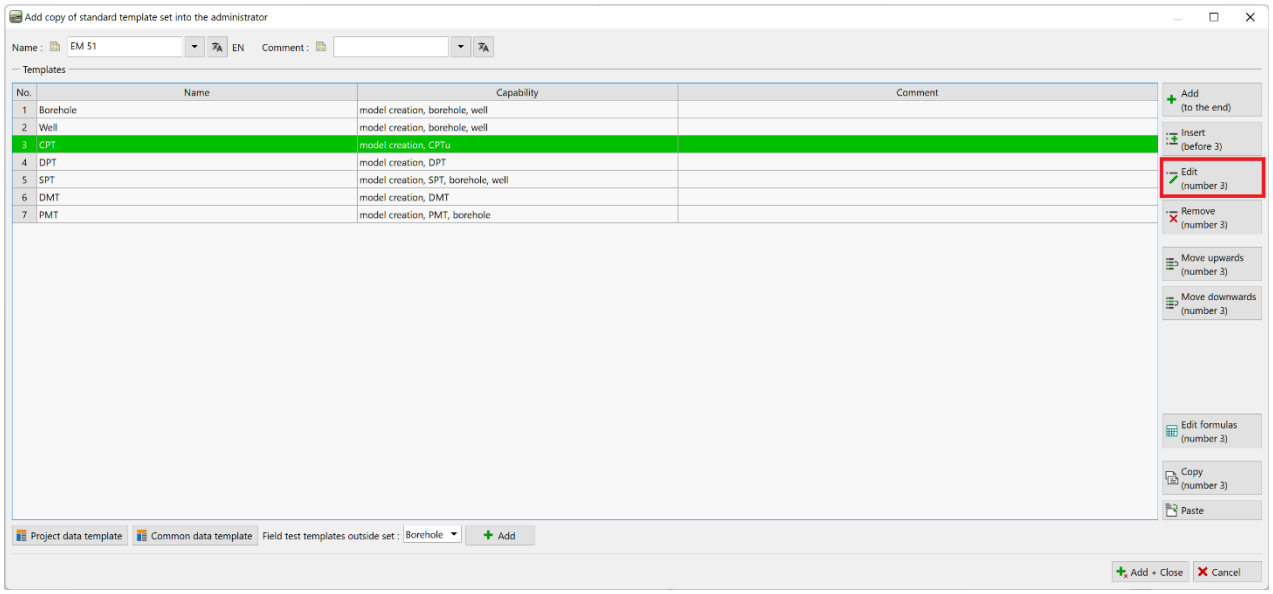
First, open the file DEMO - Templates EN.gsg, which contains the data from which we will proceed. In the Templates frame, check whether we have selected the set of templates that we want to edit - "EN-Standard" (If another set of templates is selected, choose it from the list of templates using the "Select 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.



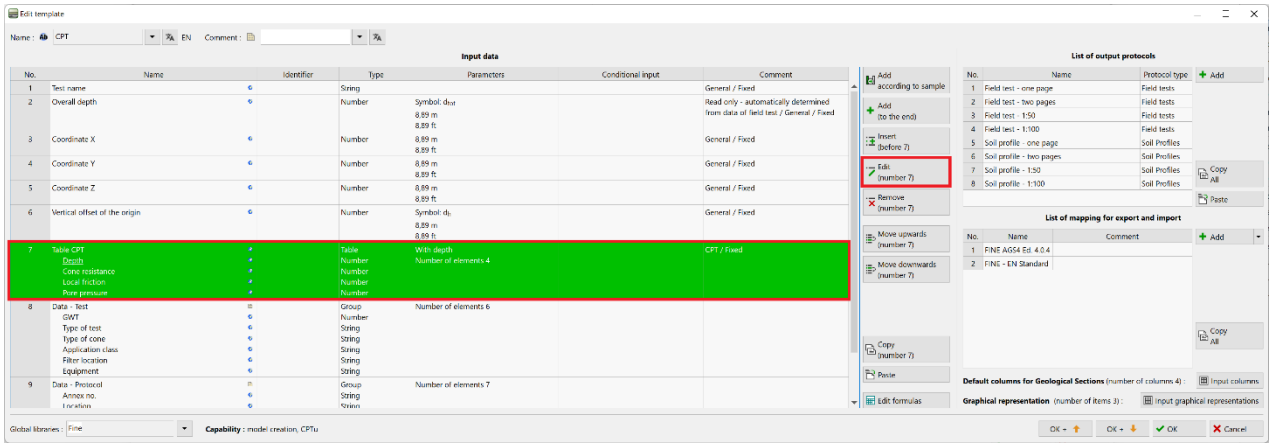
We will name the created set of templates EM 51. After editing, the template with this name will be saved into the administrator as a user template set.



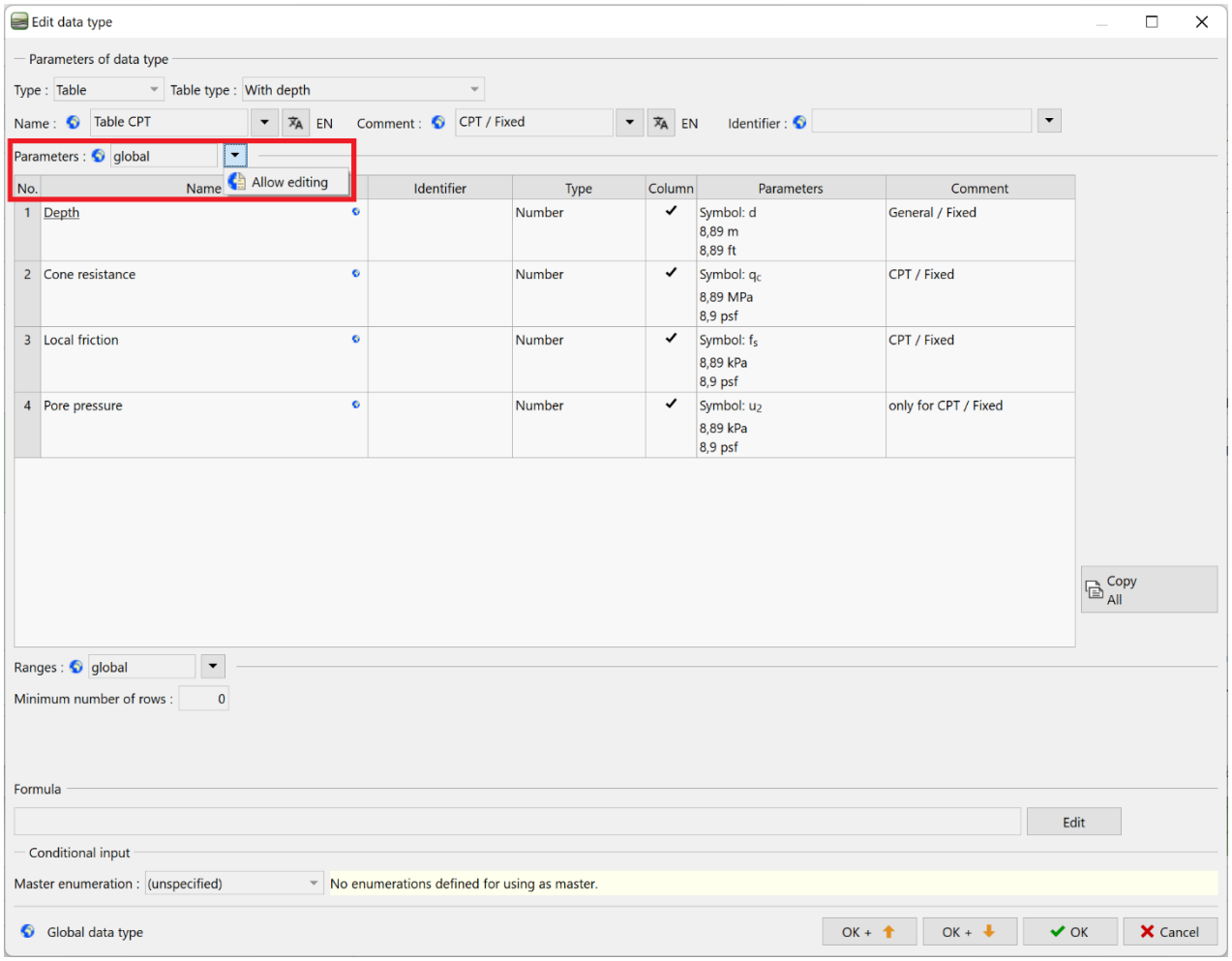
In the table, select the template for CPT and press “Edit”.



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



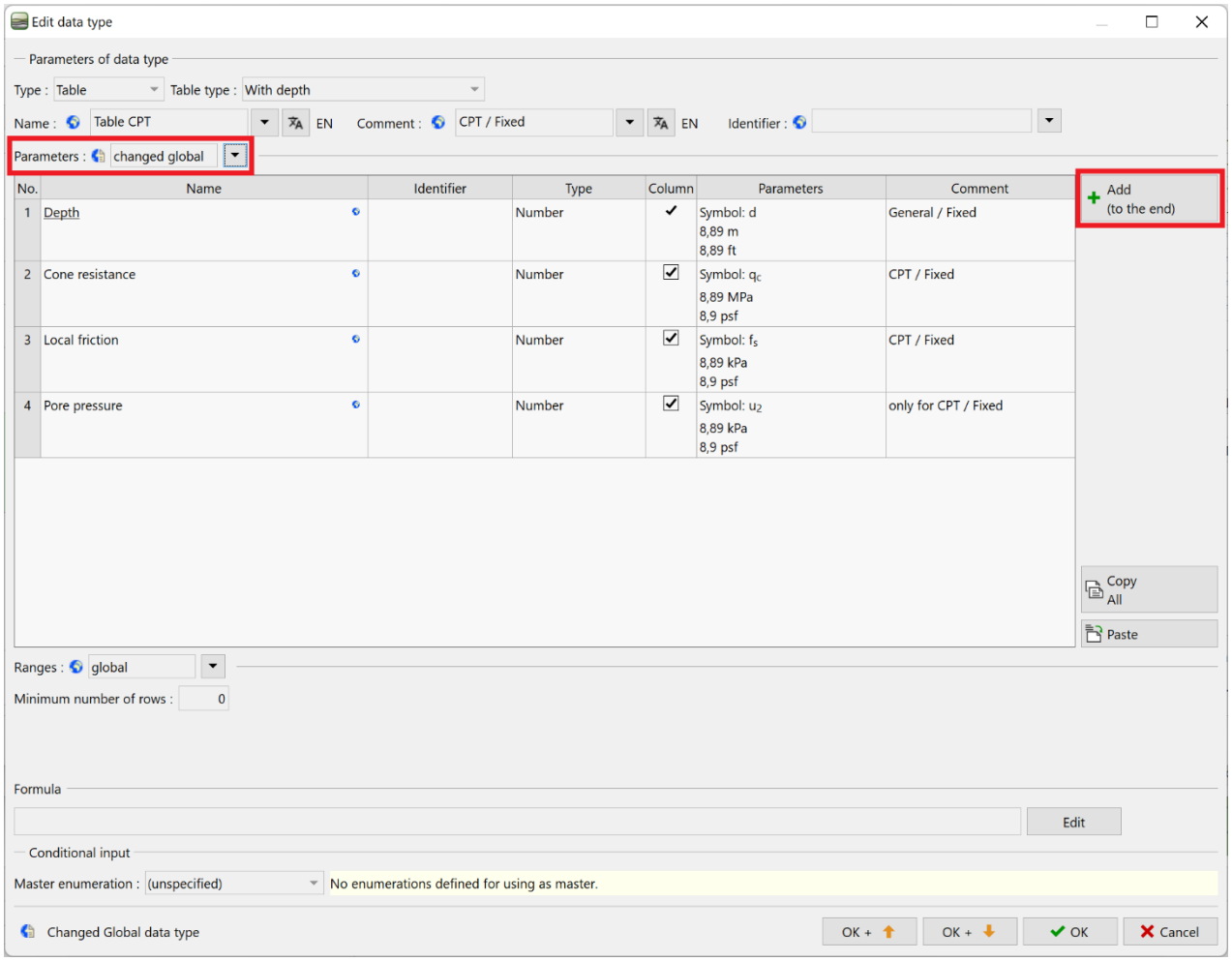
We can see that the table is part of the global library. By default, it is not possible to edit it. Therefore, it is necessary to press the button “Allow editing”, so we can add a new item into the table.



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

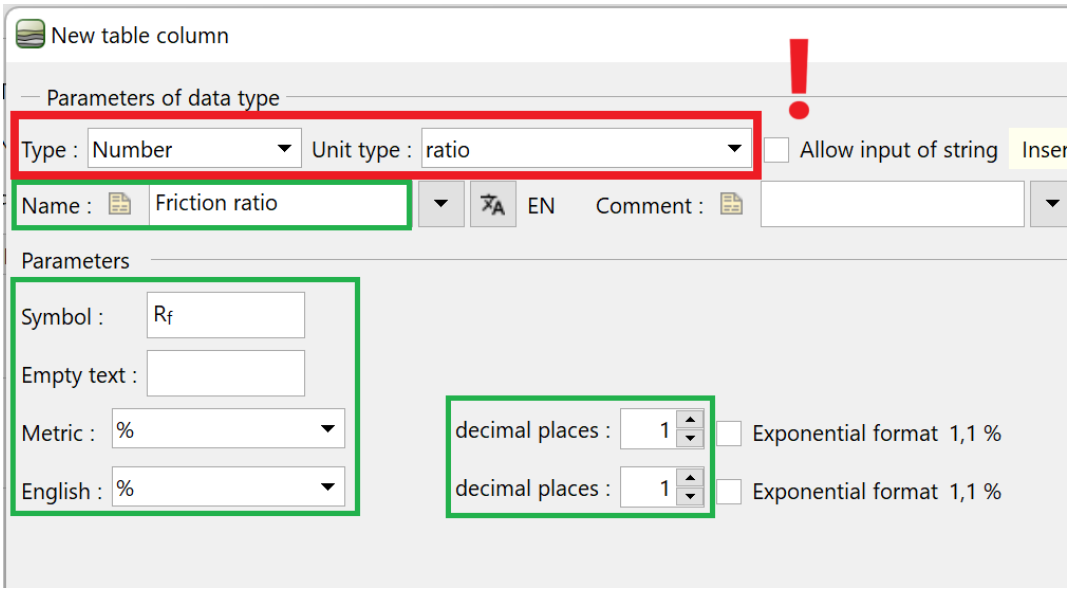
1. ***globe*** - *indicates that the data type was selected from the “Global Library”. The global library contains predefined data types that the user can insert into his template. The global library is selected in the bottom left corner of the dialog window.*
2. ***Paper sheet*** - *indicates that the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

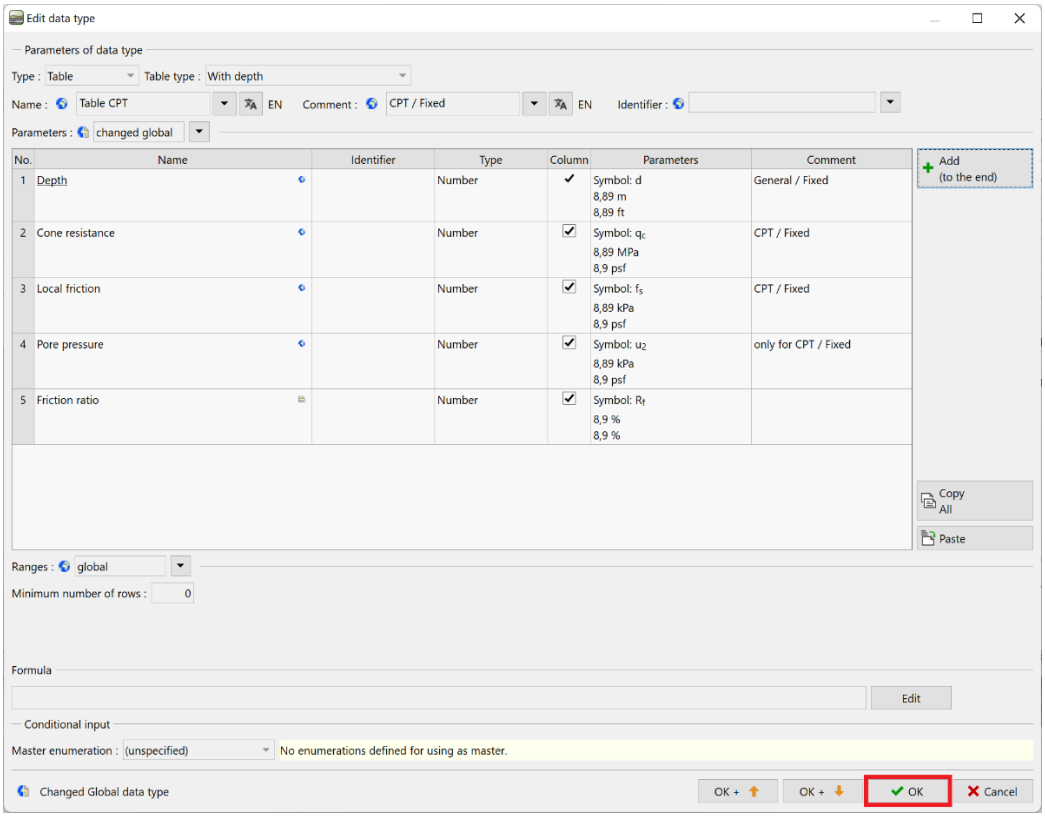


Use the “Add” button to add a new table column. In our case, we are specifying an item that is not in the global library. So, we select “new local data type”. Confirm with the “Next” button.

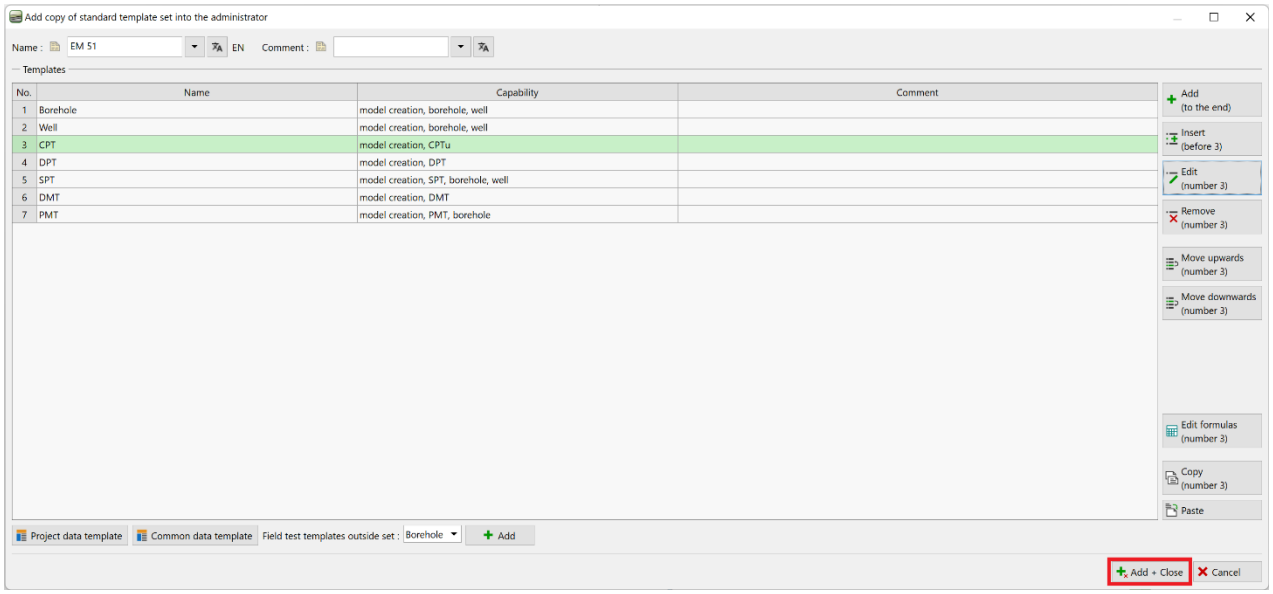
We select the type of the data type (number) and the type of unit (ratio). **These two types must be correctly defined the first time they are entered. Later modification of these types is not possible. In case of a mistake, it is necessary to delete the created data type and enter it again.** Enter 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.



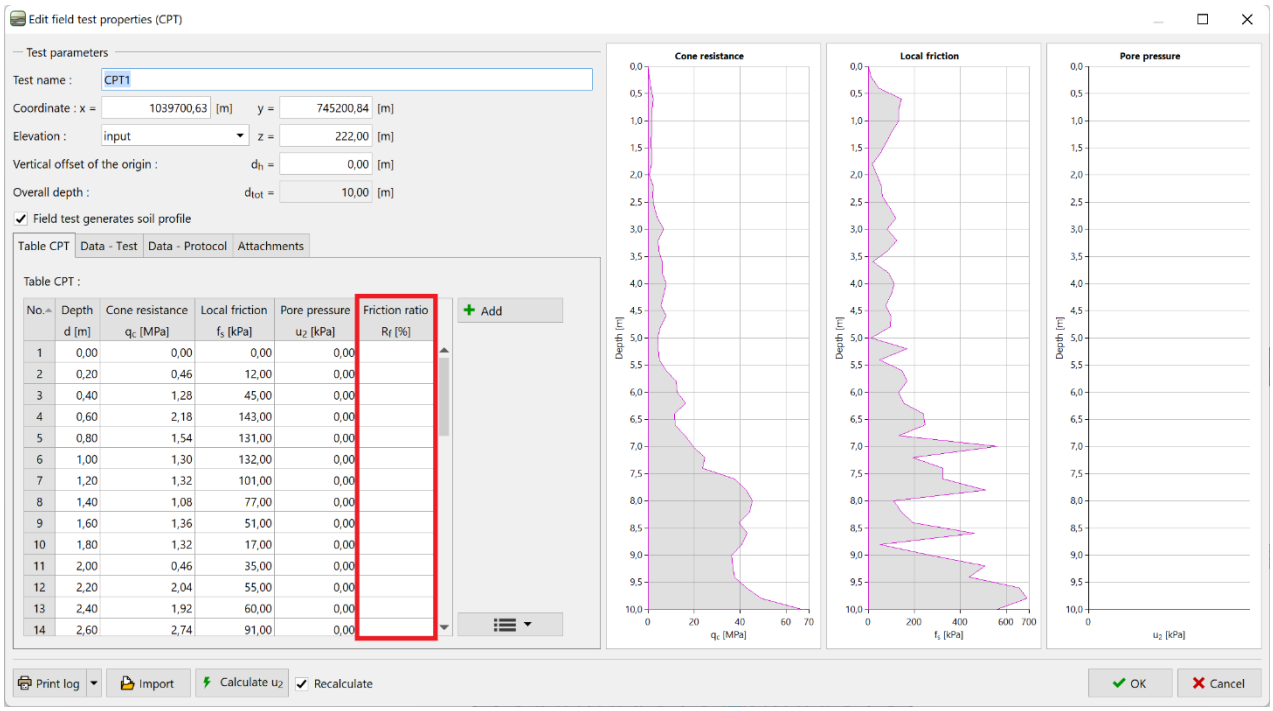
In the CPT table, we can now see the new data type. Now confirm the edits of the table and the CPT template using the "OK" buttons.



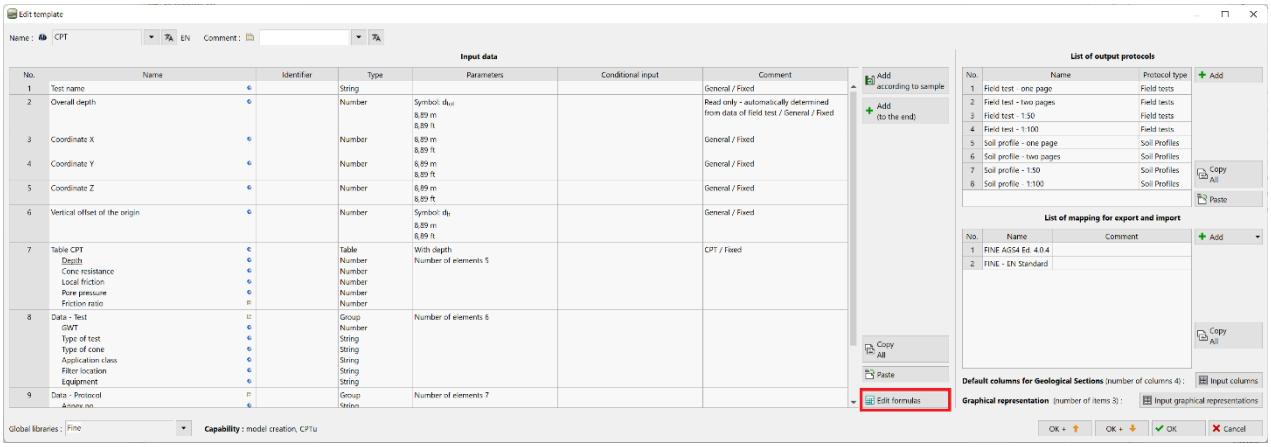
With the “Add + Close” button, confirm the modification of the template set and save the modified set under the name "EM 51" in the administrator.



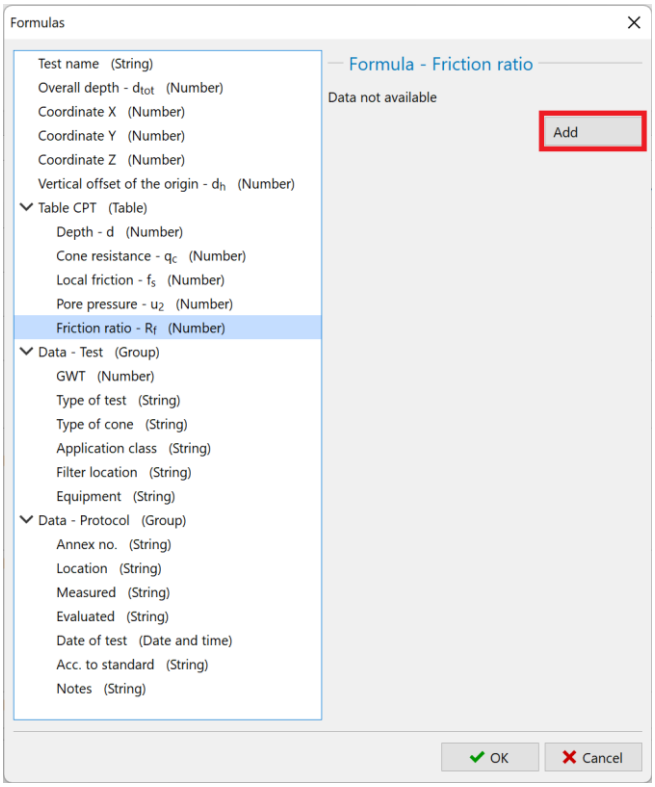
In the frame “Field Tests” frame, open the “CPT1” test. In the table, you can see the newly created column that does not yet contain any data. It is now possible to enter the data into the column in the standard way. However, we want to use a formula to define the automatic recalculation of this column.



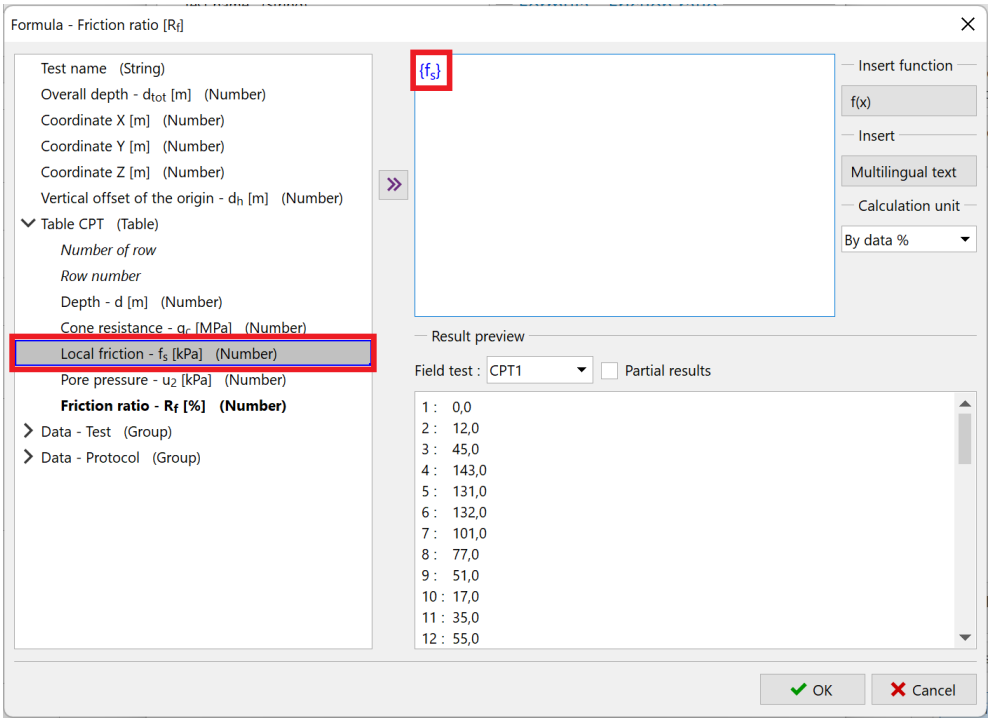
So, let's go back to editing the template for CPT and press the “Edit formulas” button.



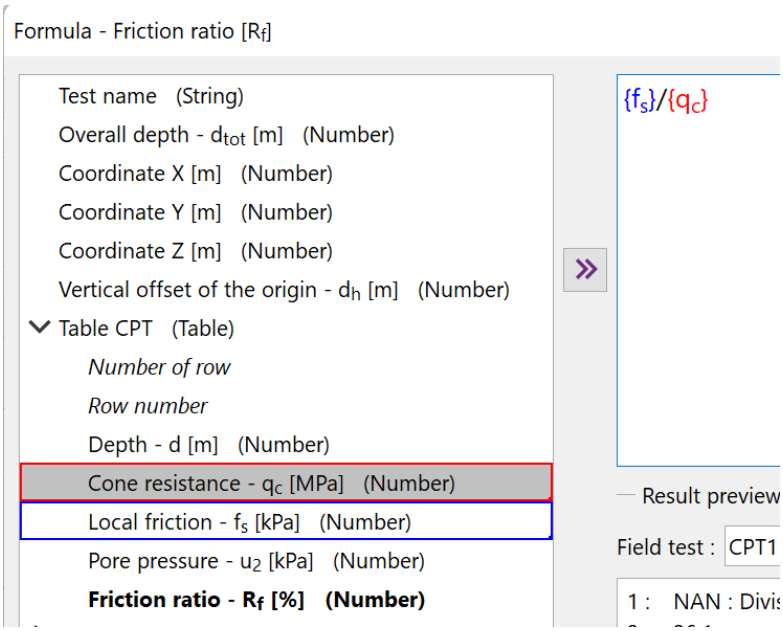
Here we will select the created data type “Friction ratio” in the list, to which we will add the formula, and press the “Add” button.



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

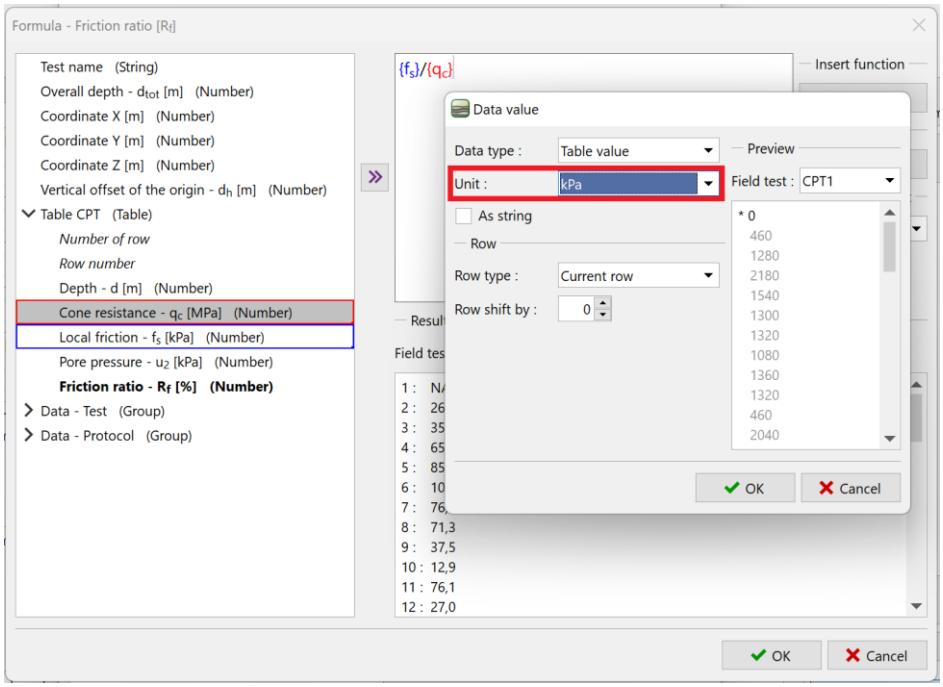


Input formula: $\frac{f_s}{q_c}$

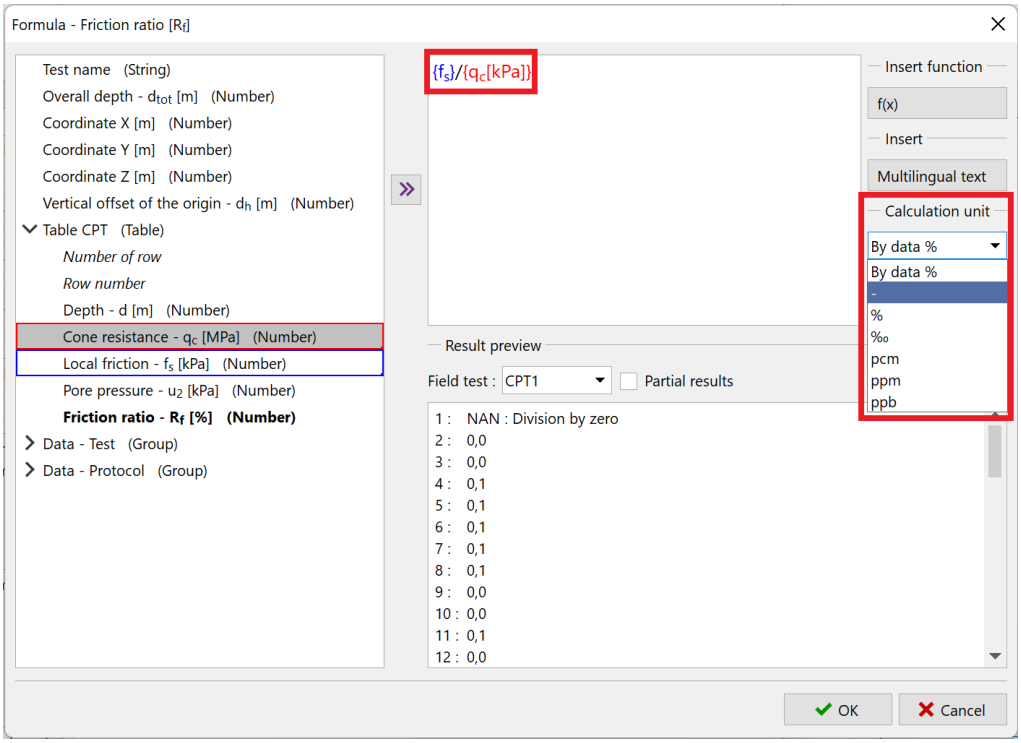


Note: Common mathematical operations as well as more complex functions can be used in the calculation. Entering functions is very similar to MS Excel.

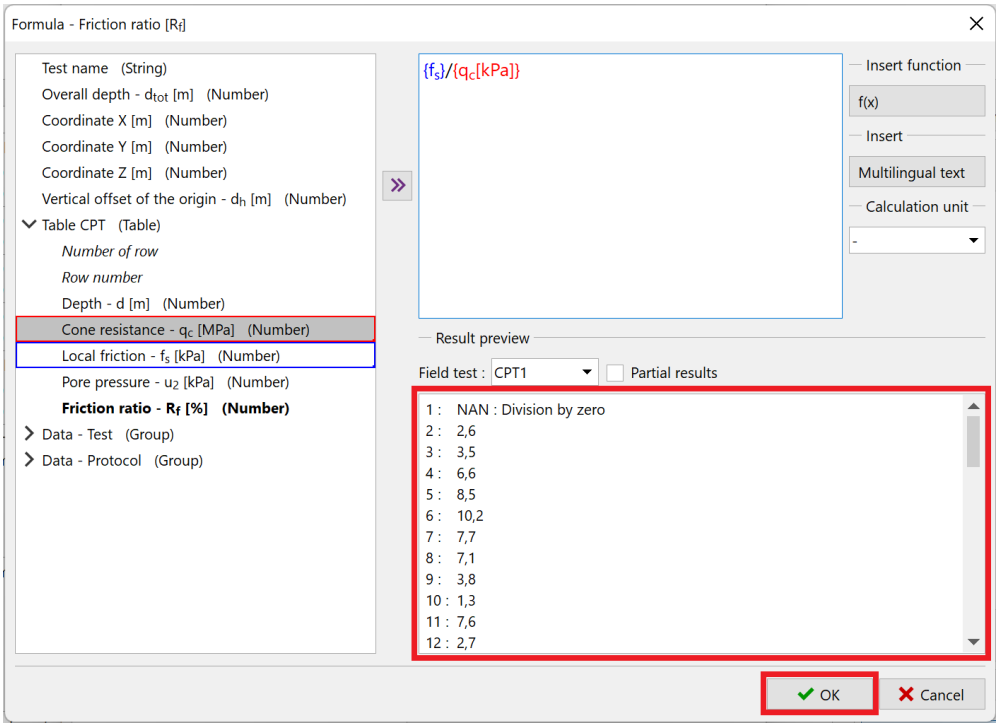
In the list, we see that while local friction has a unit of [kPa], cone resistance has a unit of [MPa]. To set the correct unit for the calculation, click on the q_c data type in the formula. This opens a dialog box in which we set the unit as [kPa]. The program then converts the unit before performing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



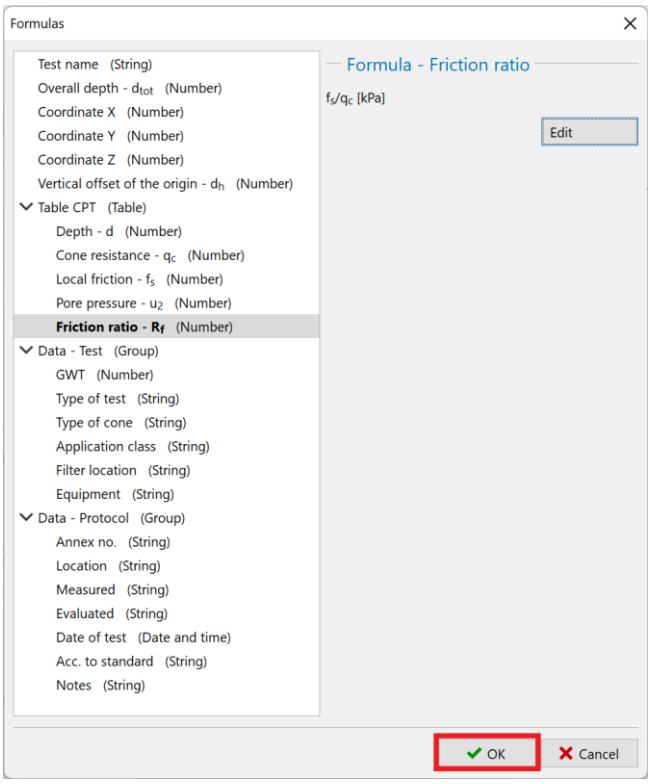
When defining the data type, we specified that the unit of the friction ratio is percentage [%]. However, the result of the specified formula is dimensionless. So, we need to choose the unit of the calculation result as dimensionless [-]. The program then performs the multiplication to percentages automatically.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



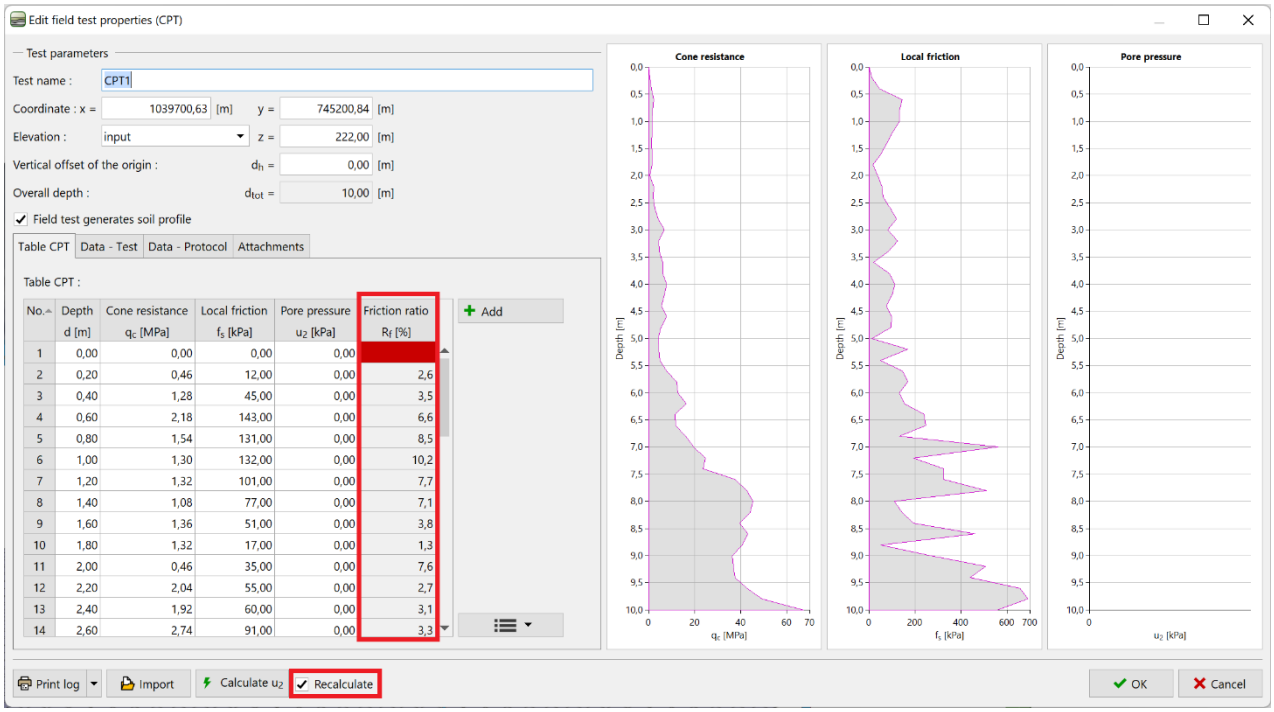
In the lower part of the window, we can always see a preview of the calculation result. Confirm the entered formula with the “OK” button.



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



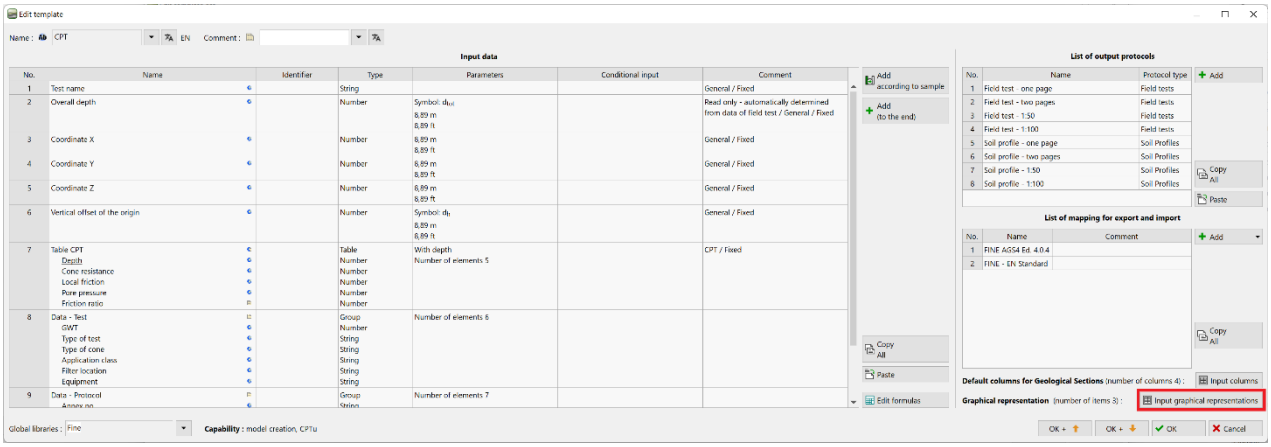
If we now return to the field test input frame, we can see the automatically calculated column. Automatic recalculation can be turned on or off at the bottom of the window.



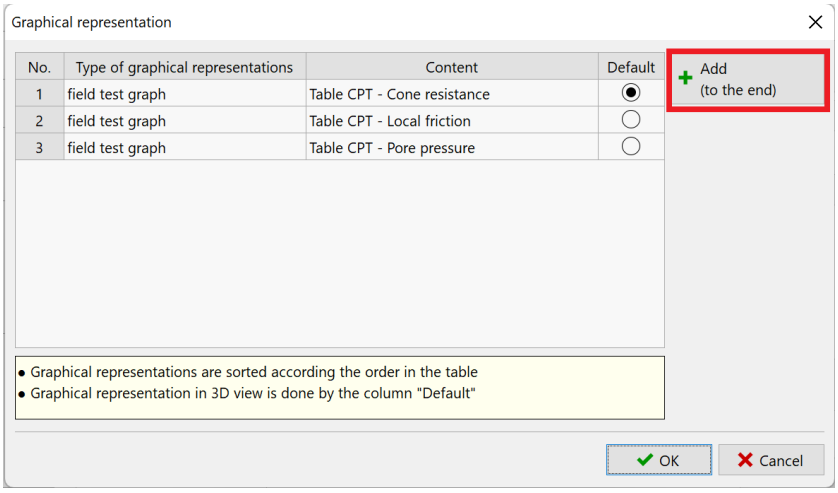
No.	Depth d [m]	Cone resistance q_c [MPa]	Local friction f_s [kPa]	Pore pressure u_2 [kPa]	Friction ratio R_f [%]
1	0,00	0,00	0,00	0,00	
2	0,20	0,46	12,00	0,00	2,6
3	0,40	1,28	45,00	0,00	3,5
4	0,60	2,18	143,00	0,00	6,6
5	0,80	1,54	131,00	0,00	8,5
6	1,00	1,30	132,00	0,00	10,2
7	1,20	1,32	101,00	0,00	7,7
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

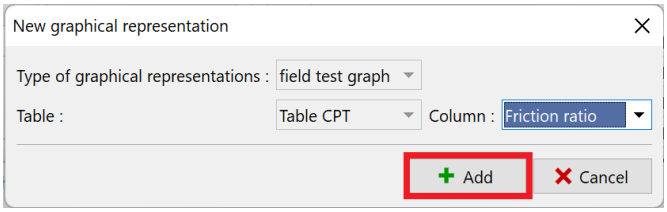
In the next phase, we will define the graphical representation of the calculated column - we add a fourth graph to the field test input window.

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

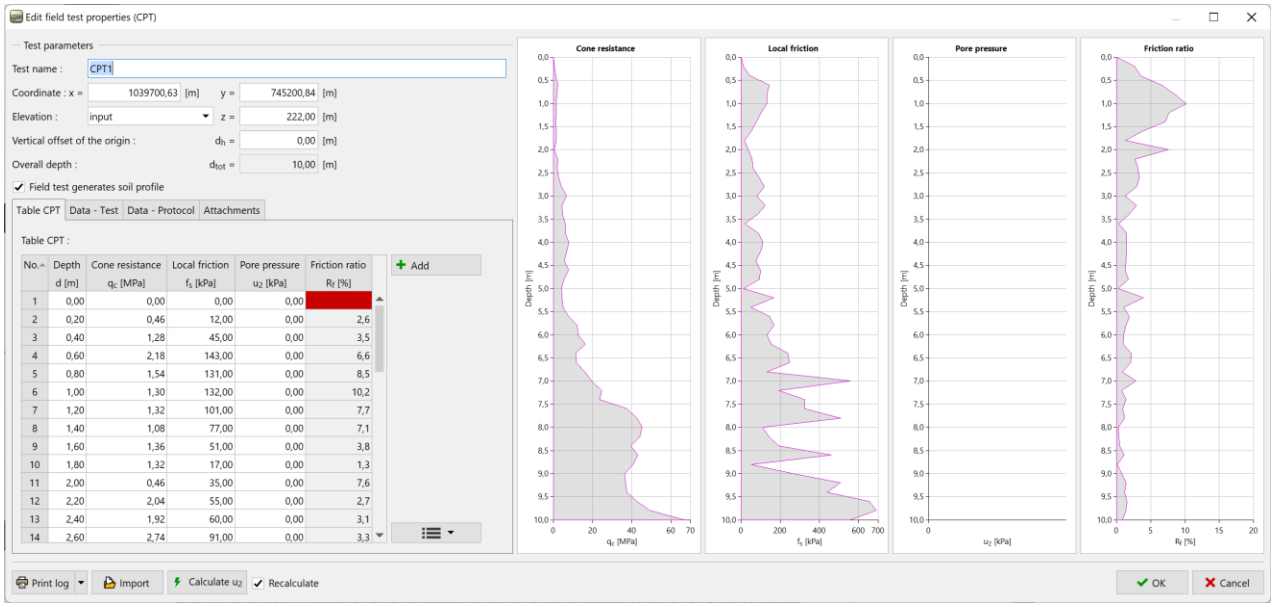


Here we add the newly defined column “Friction ratio” and confirm.

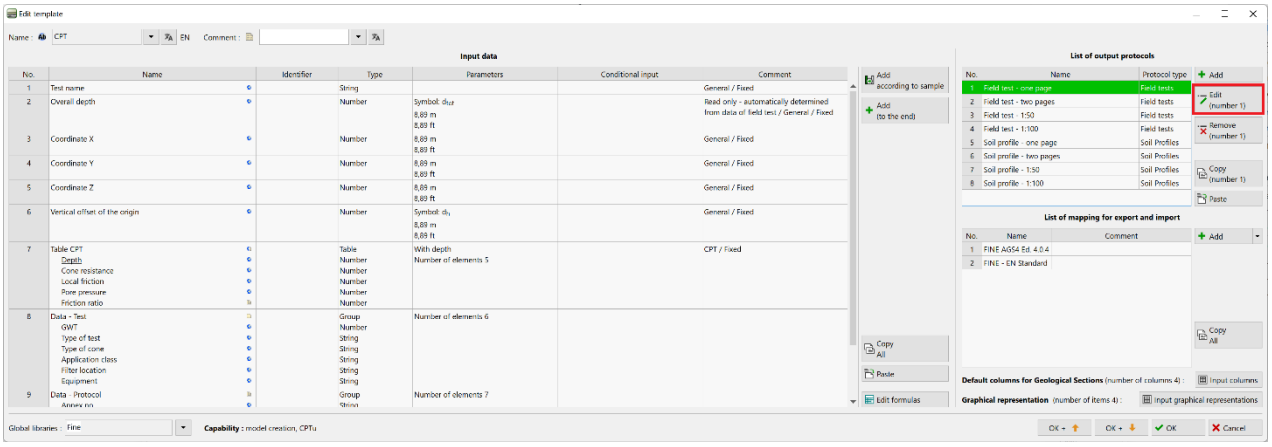




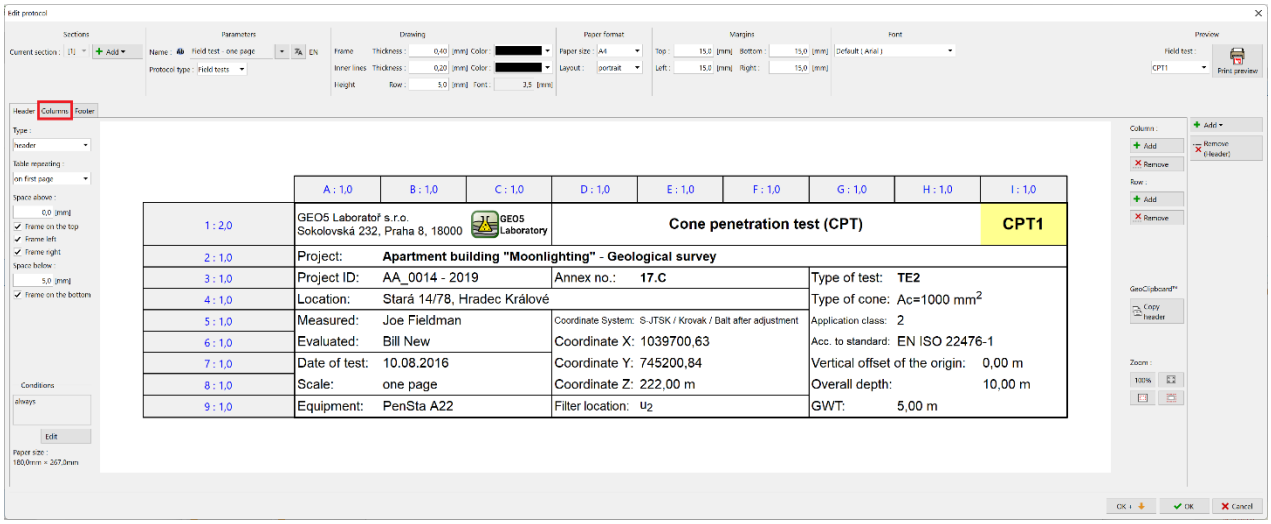
After returning to the field test input window, we see the newly added graph for the calculated column.



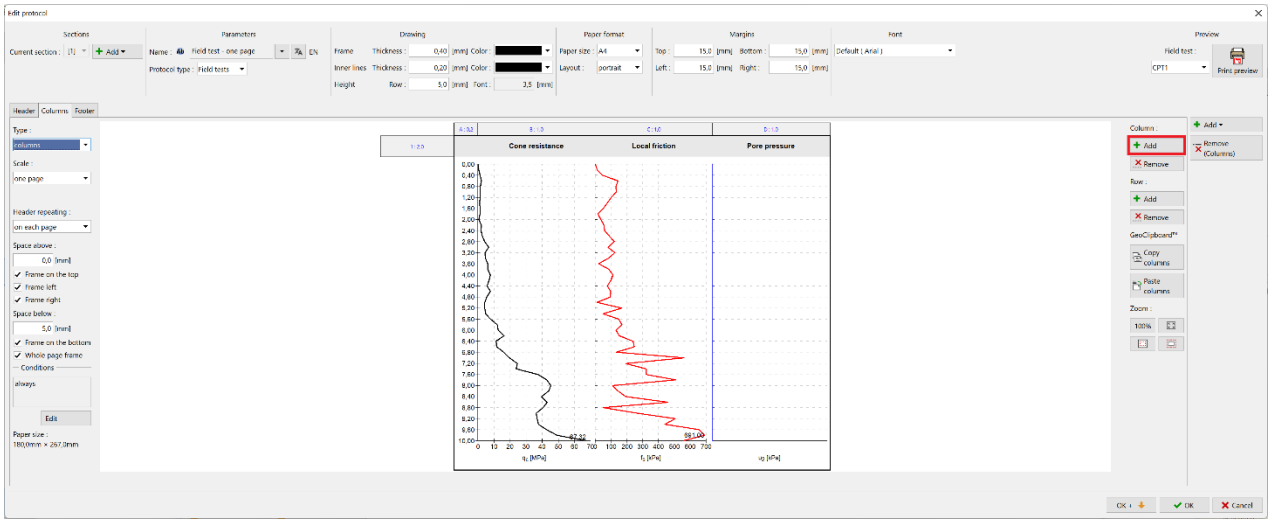
The last change required is to add a new graph to the output log. Let's go back to editing the template, select the desired output protocol and press the “Edit” button.



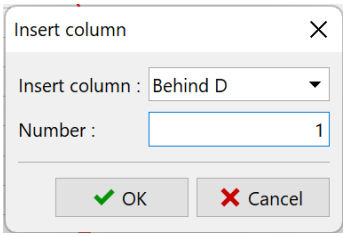
We will proceed to the “Columns” section, where we see the original graph.



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



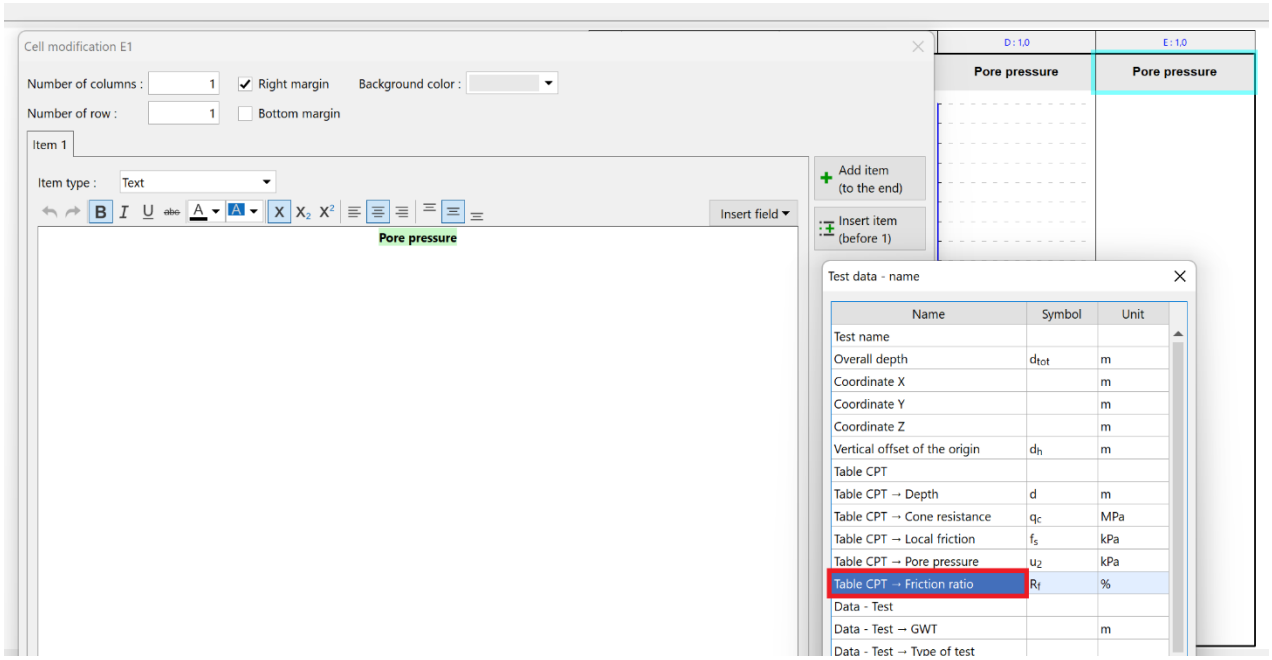
Insert one column behind the existing column D.



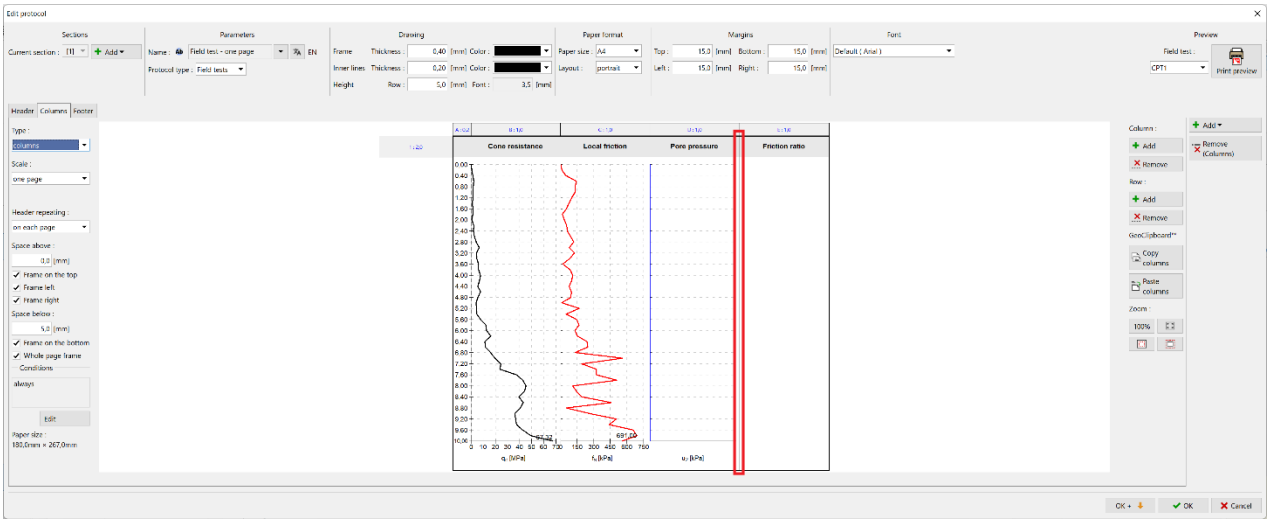
Columns contain a header and a body.

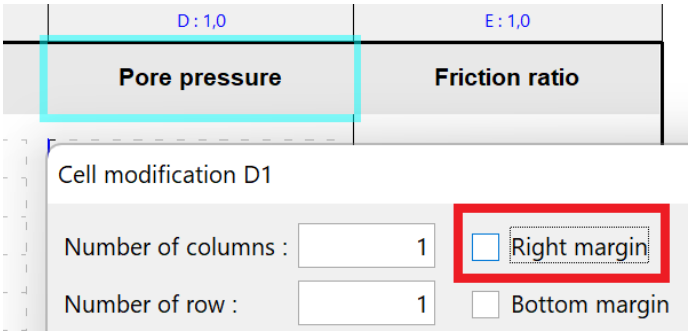
Let's start by editing the header. To save time with formatting, we can copy the cell titled “Pore pressure” and paste it into the cell in the header of the newly added column. The options for copying and pasting are displayed by pressing the right mouse button on the desired cell.

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.



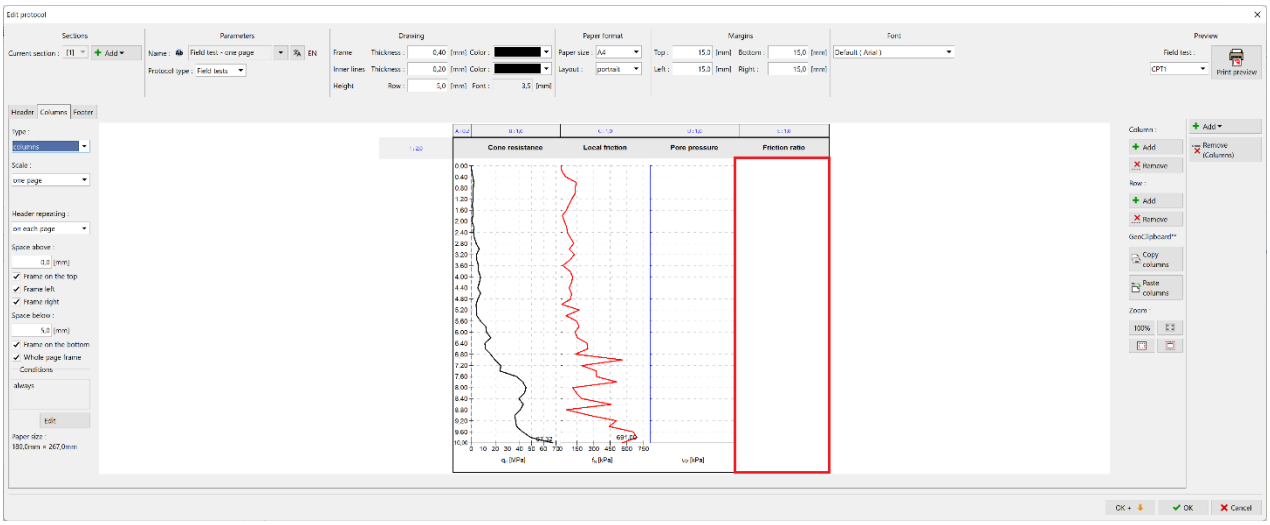
Now we have the column header correct, but we can see that there is a separator line between the original column and the new column. To remove it, open the modification of the cell titled “Pore pressure” and turn off the right margin.



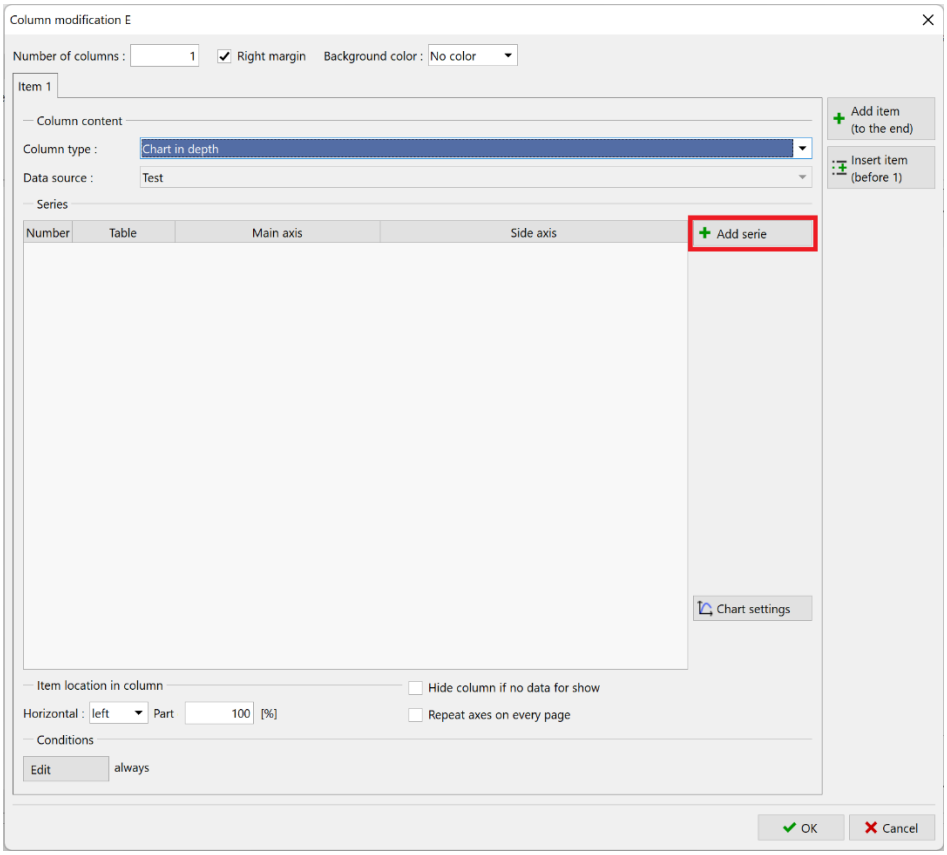


Proceed in the same way for the body with the pore pressure graph.

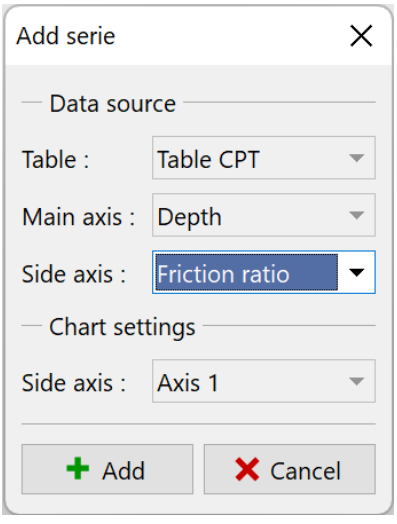
The last necessary modification is the actual addition of the chart to the new column. By clicking in the empty space of the column, we open its modification.



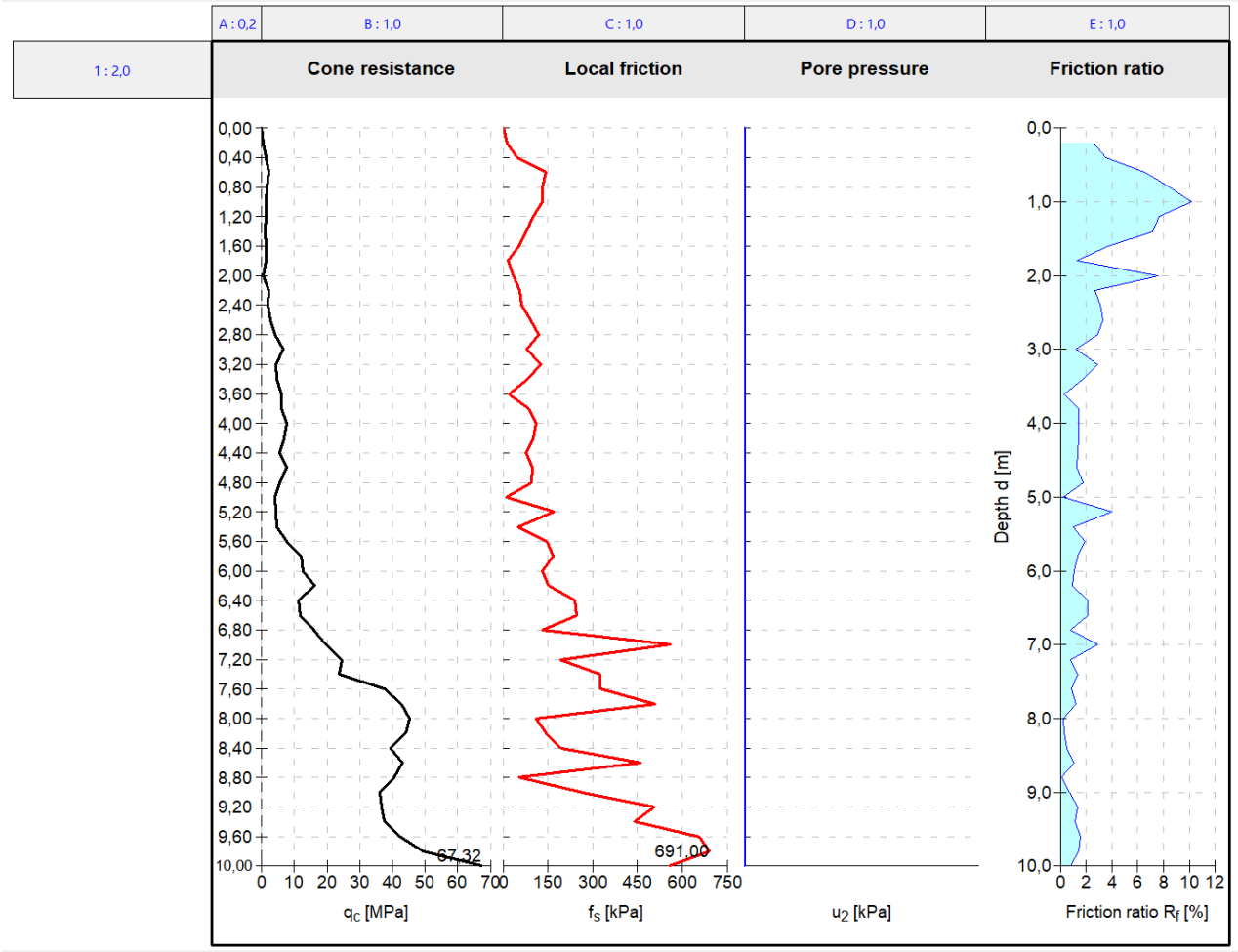
Here, select the column type as “Chart in depth” and press the “Add serie” button.



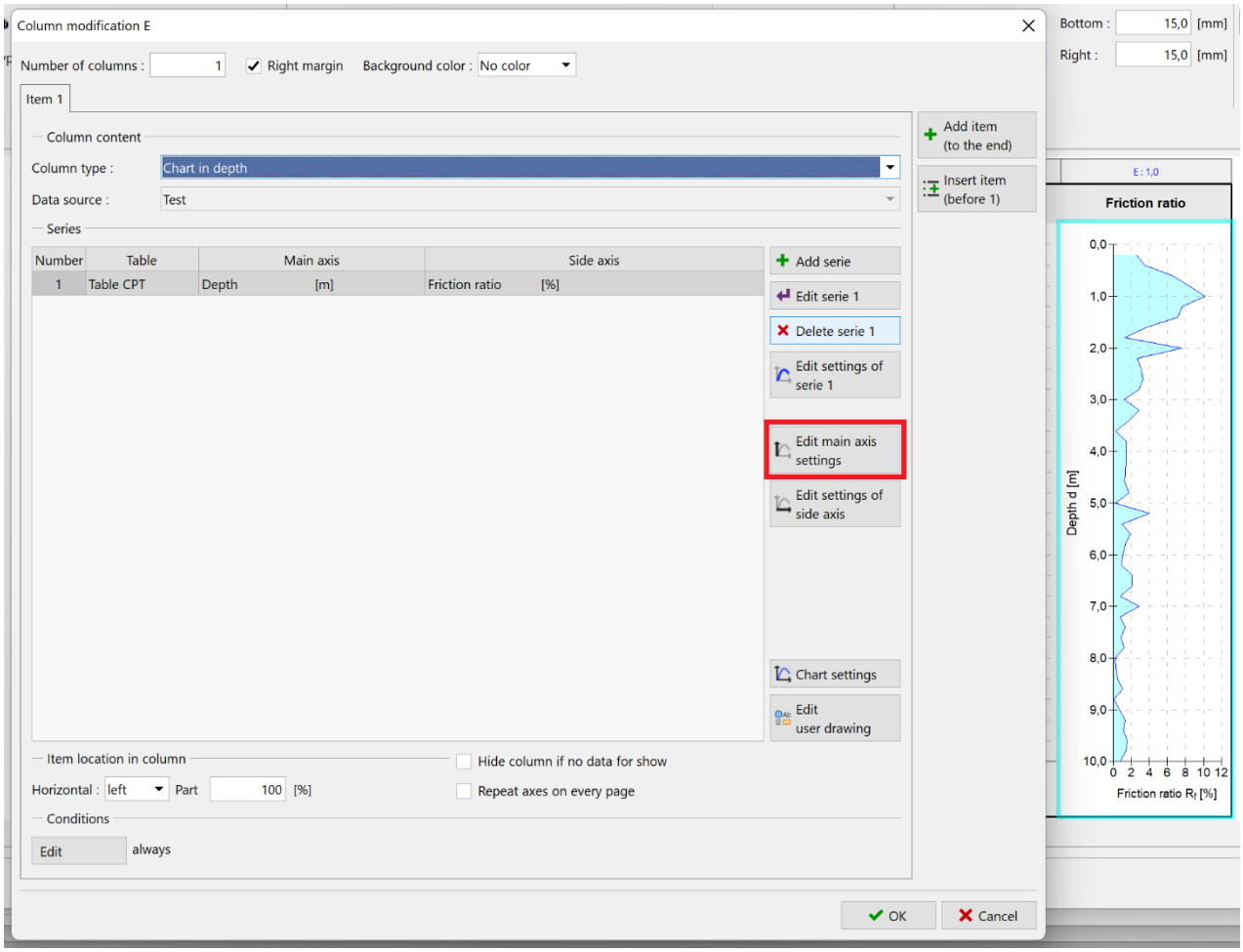
We select the corresponding data – “Friction ratio”.



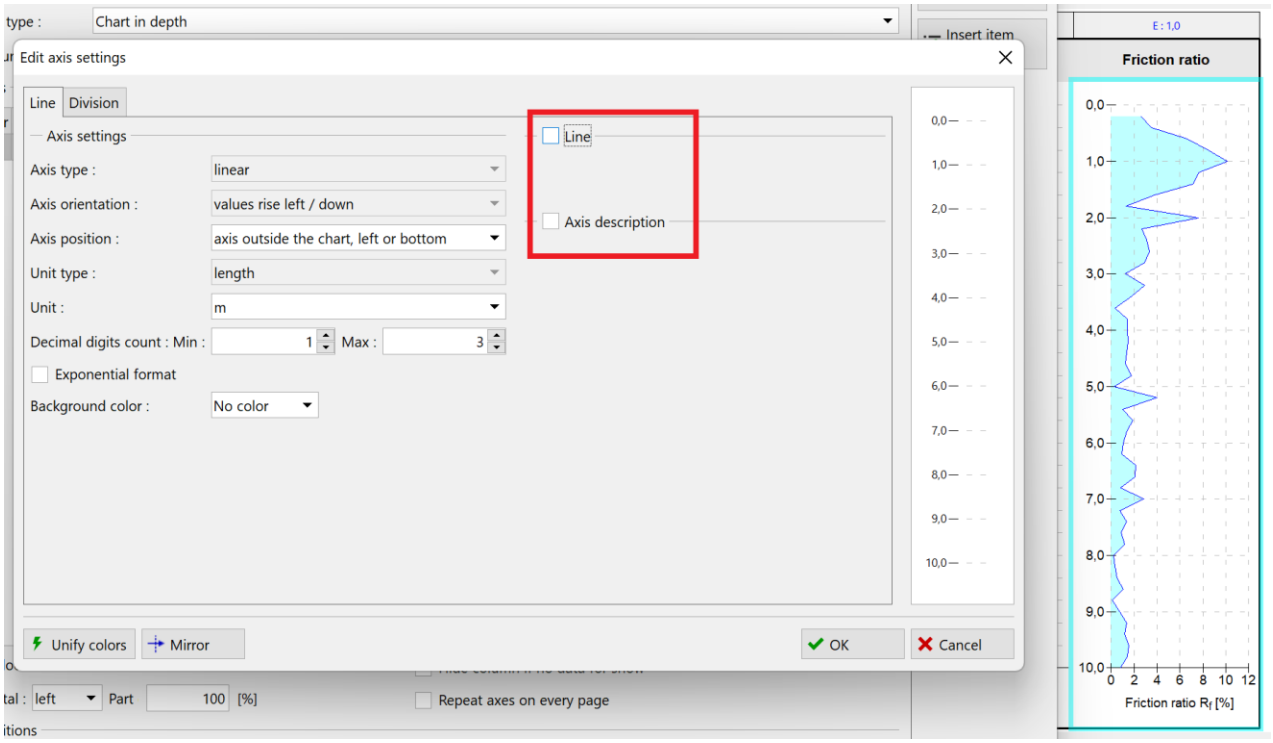
Now we can see the desired graph in the column. However, we still need to adjust its visual appearance to correspond with the other graphs.

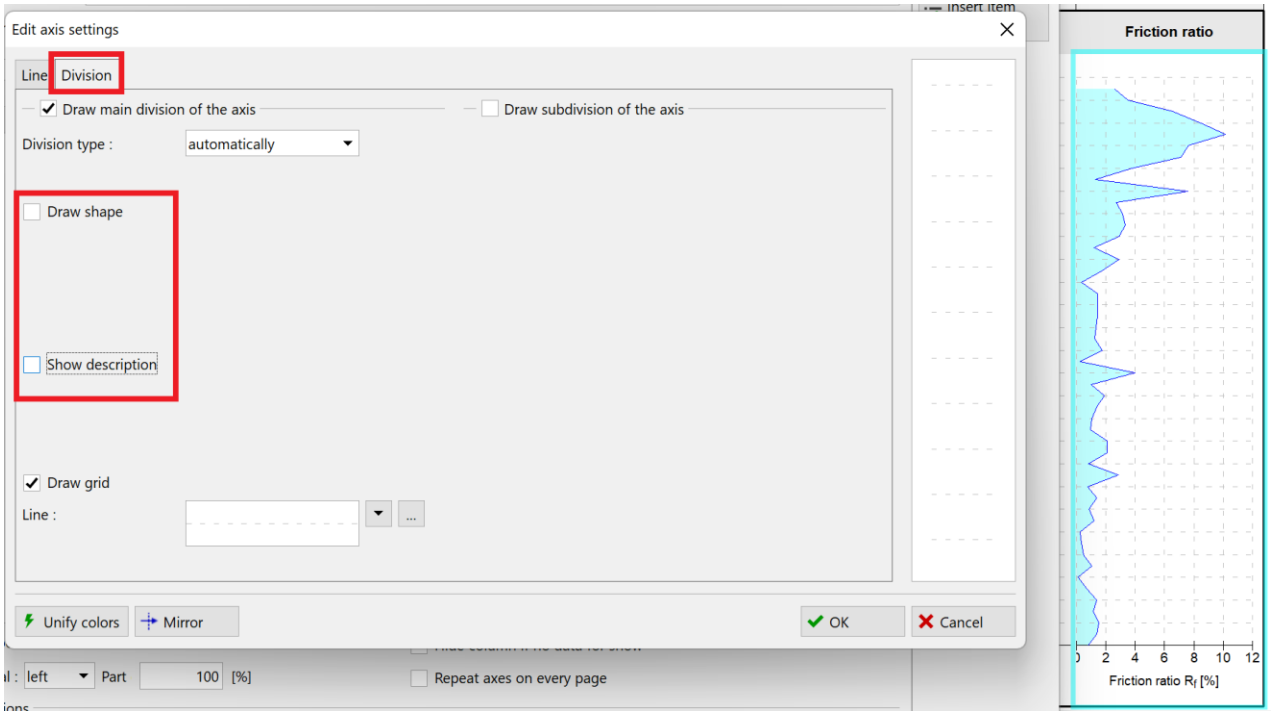


Let's start by editing the main axis (vertical). This is common to all graphs - we will not display it for the edited graph.

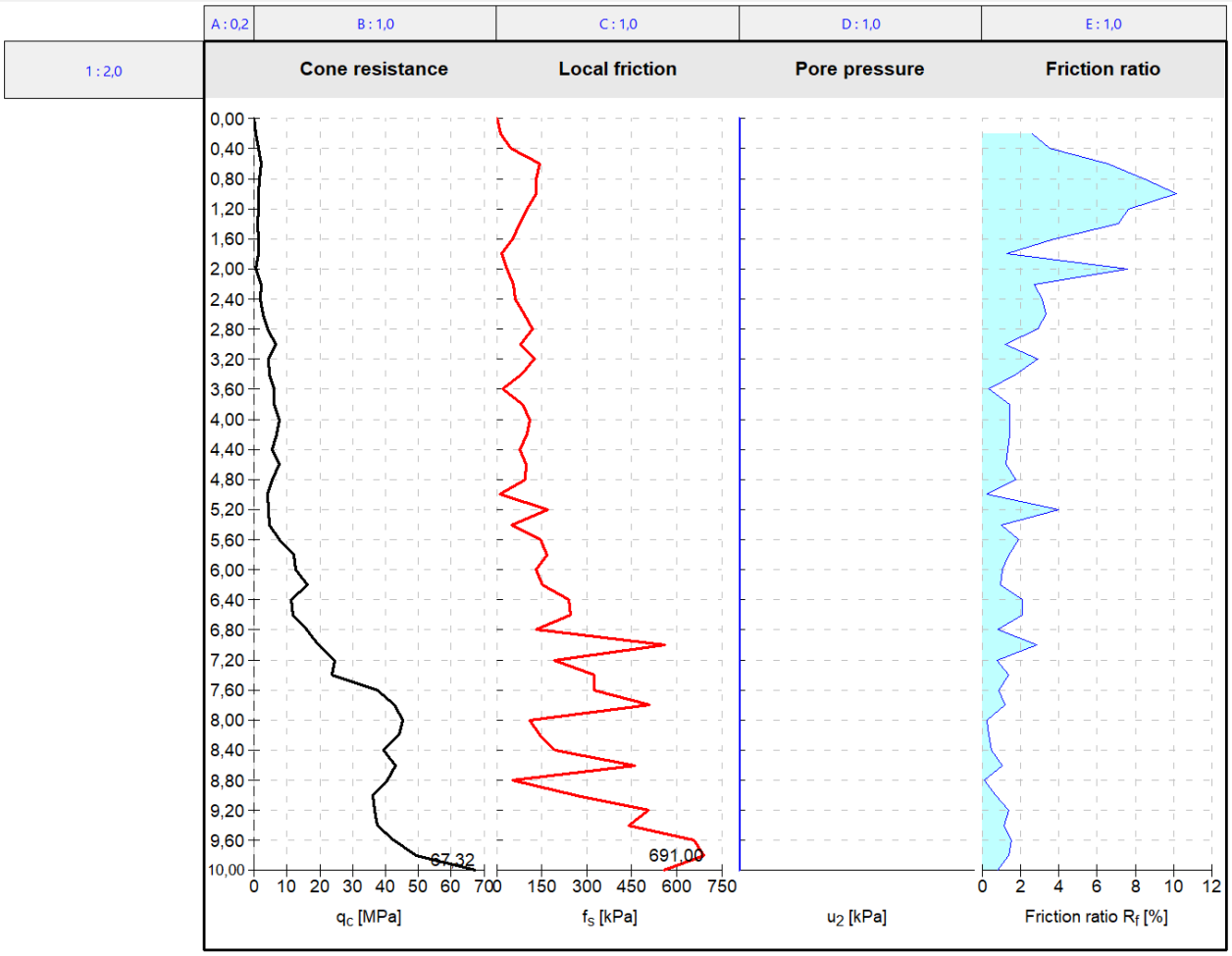


We will turn off the display of the line, the description of the axis, and in the “Division” tab, also the shape and description.

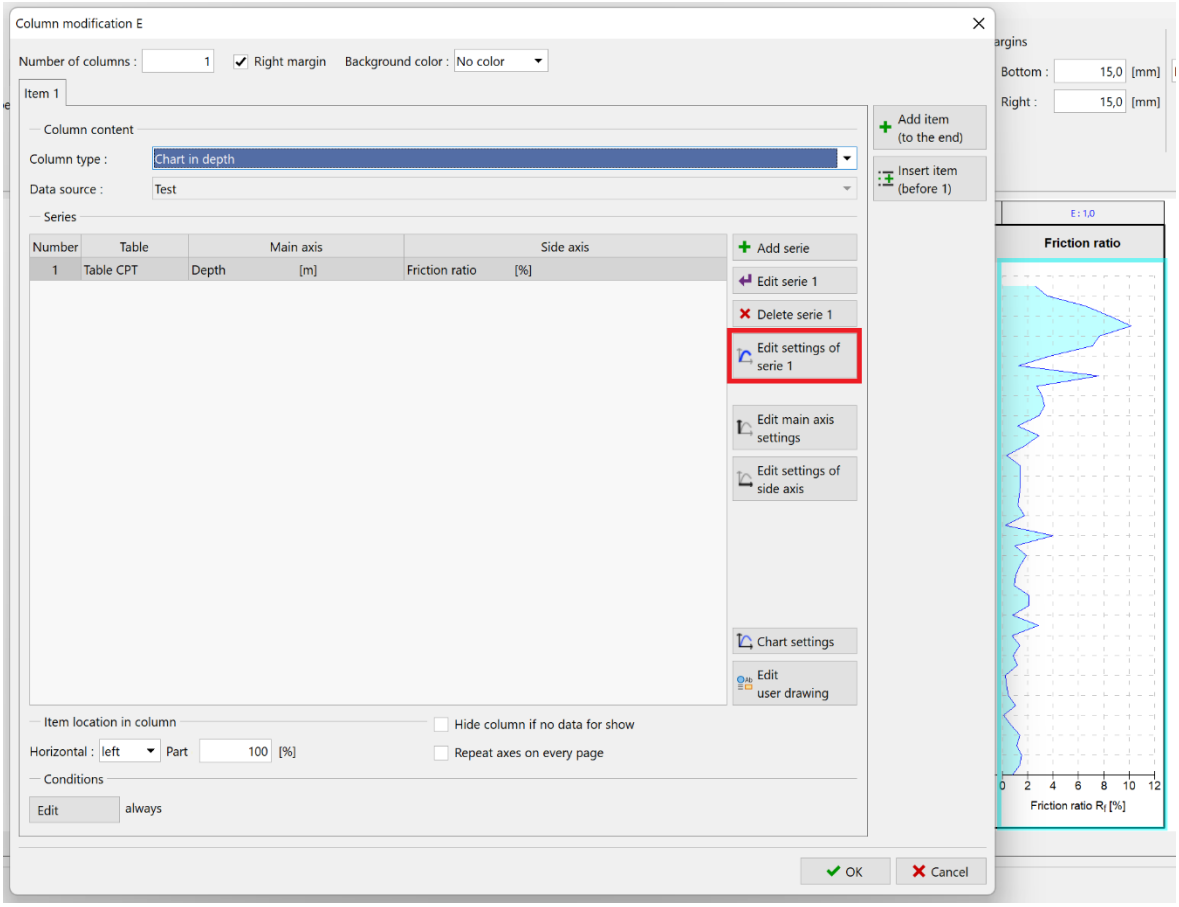




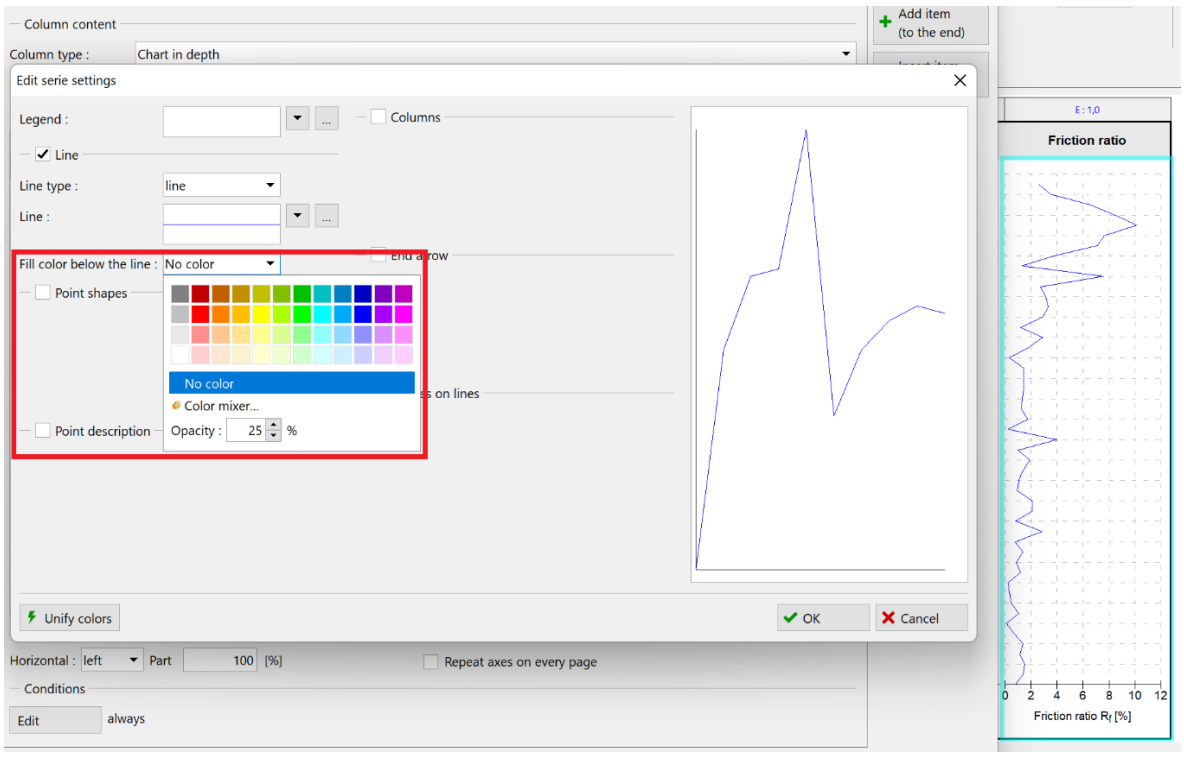
Now we will adjust the visualization of the series itself to match the other charts.



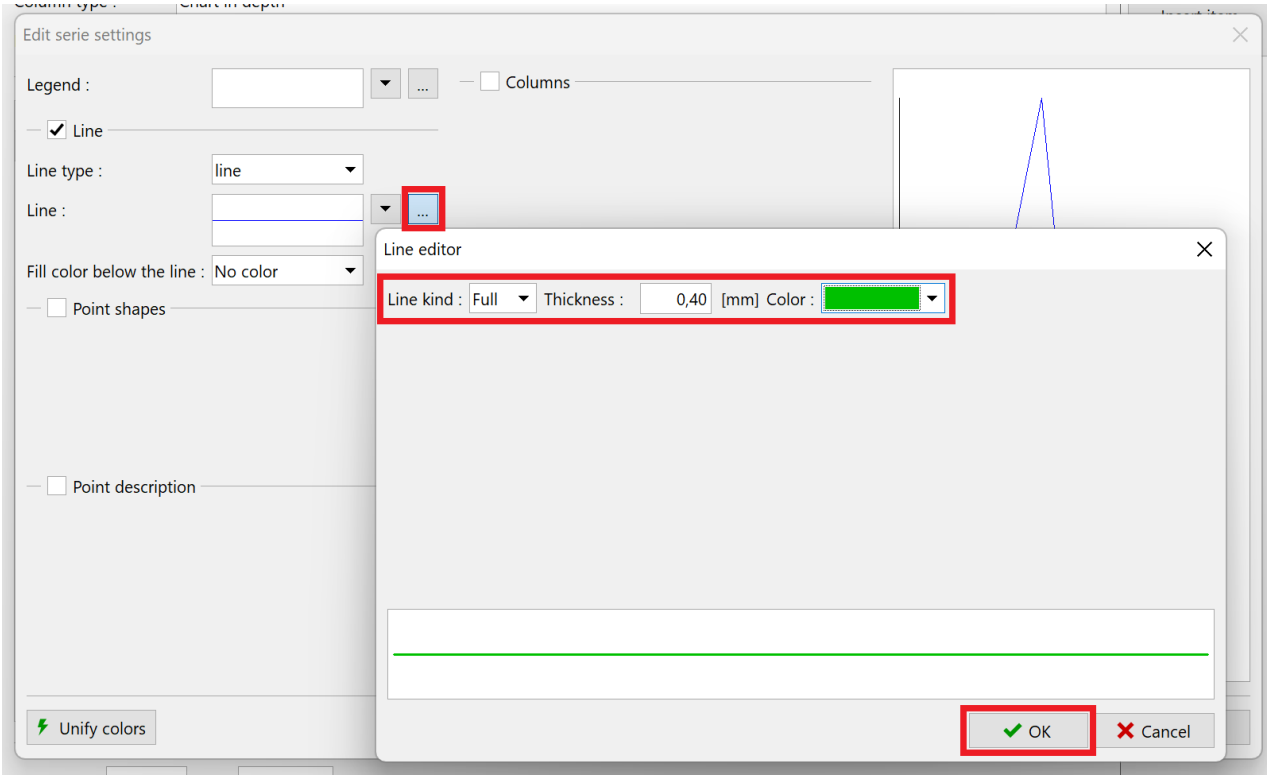
Press button “Edit settings of serie 1”.



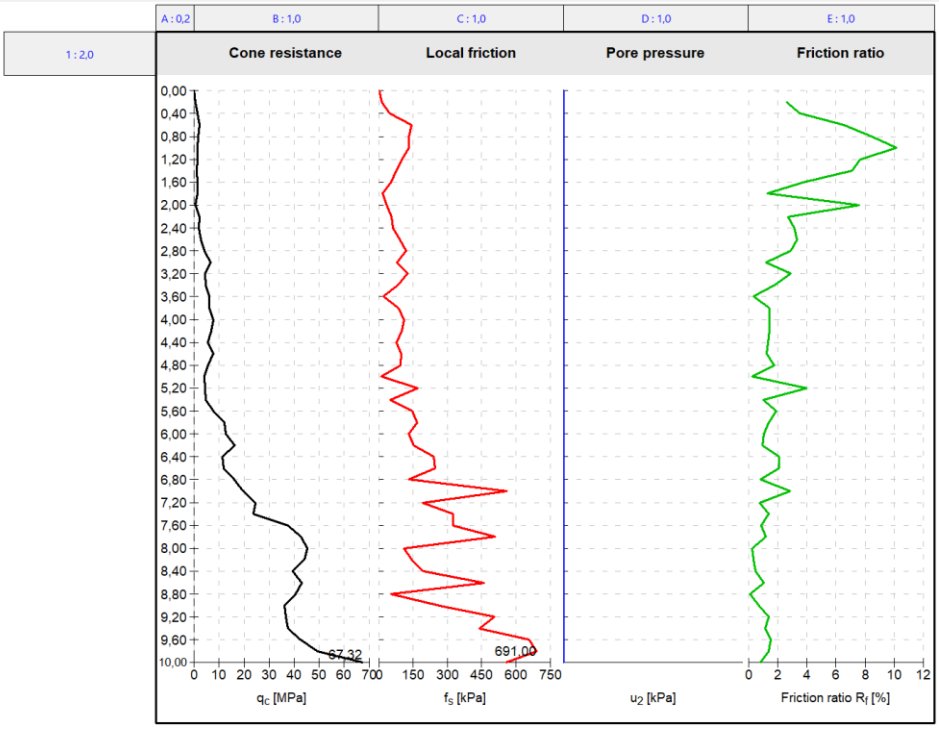
Here, we will do the necessary modifications – turn off the color fill below the line.



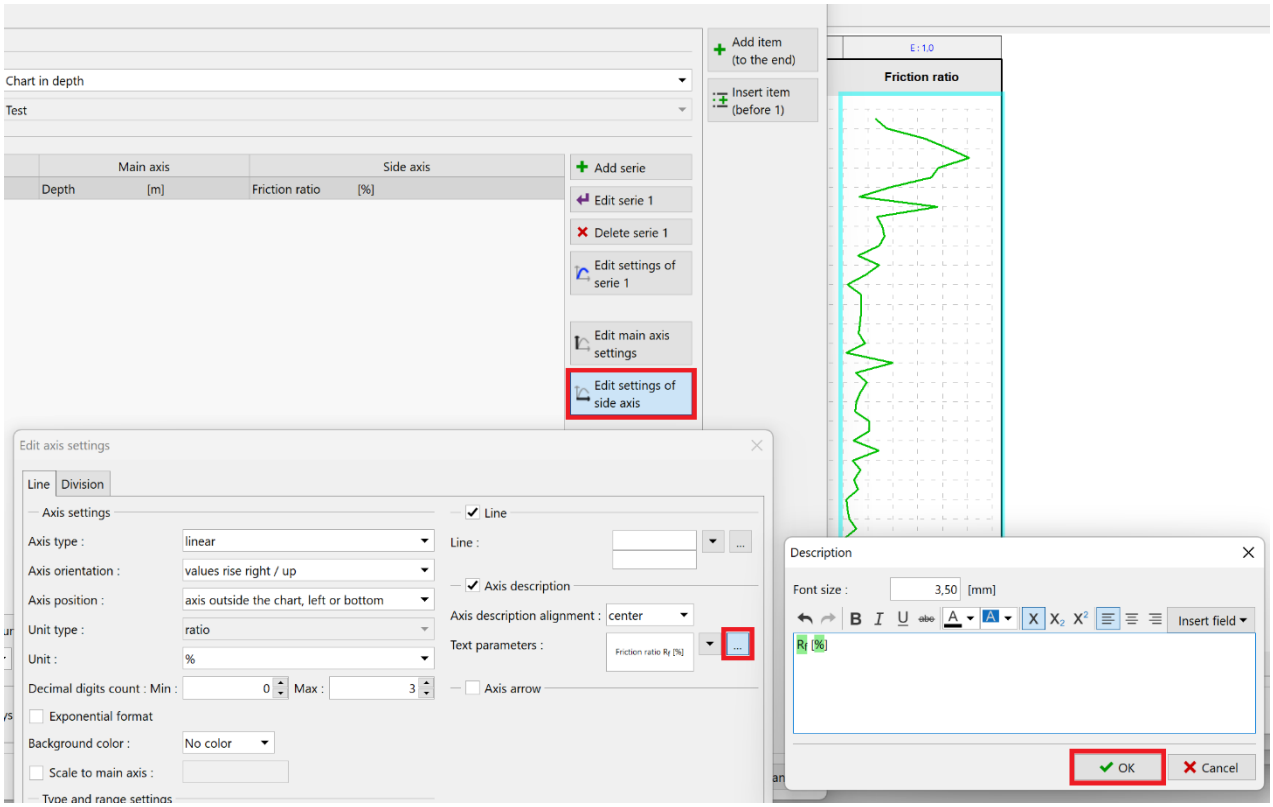
Next, by pressing the button with three dots, we will edit the line itself.
We will unify the thickness to 0.4 mm and select the green color, which is not yet used.



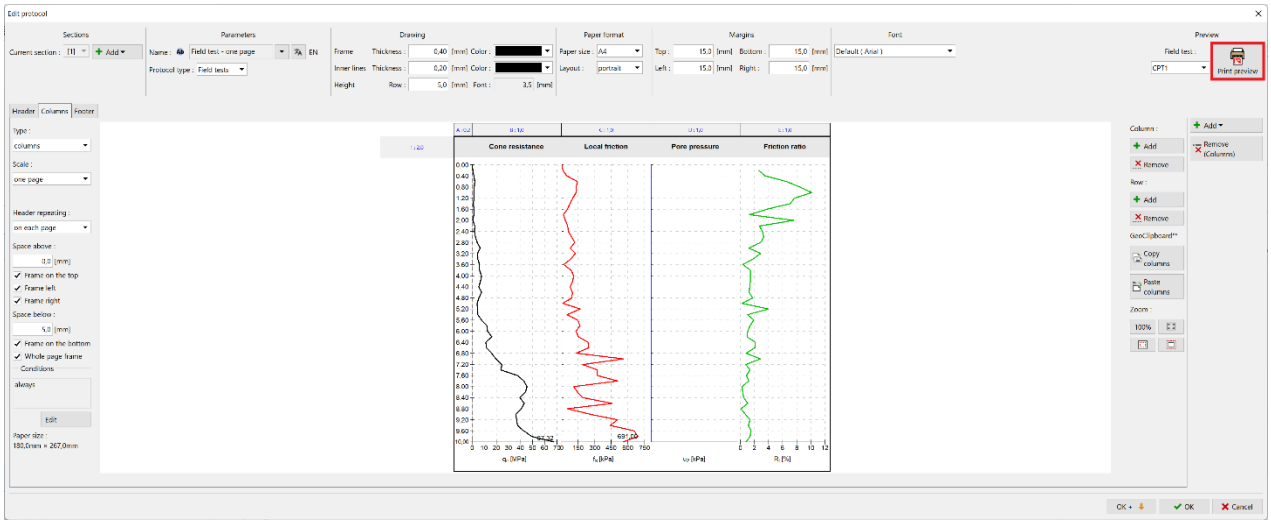
We will also adjust the description of the side axis to match the other graphs.

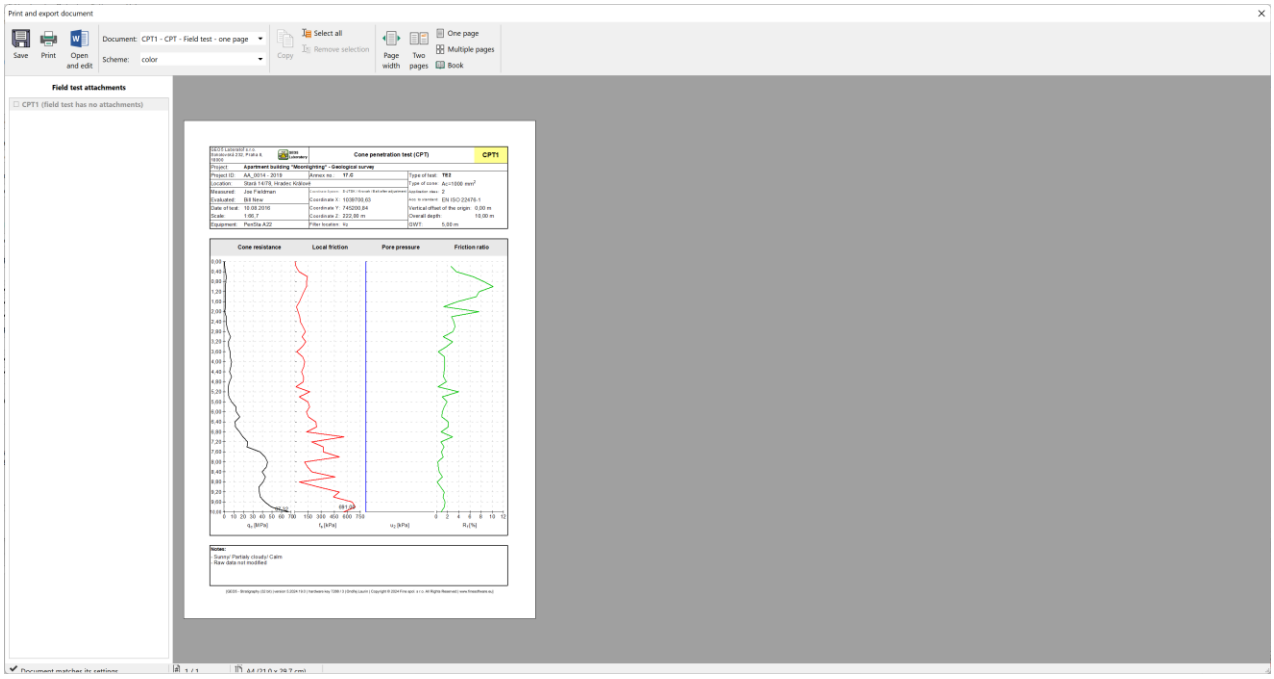


The procedure here is similar to other modifications – we open the side axis editor and modify the description of the axis so that it contains only the symbol.



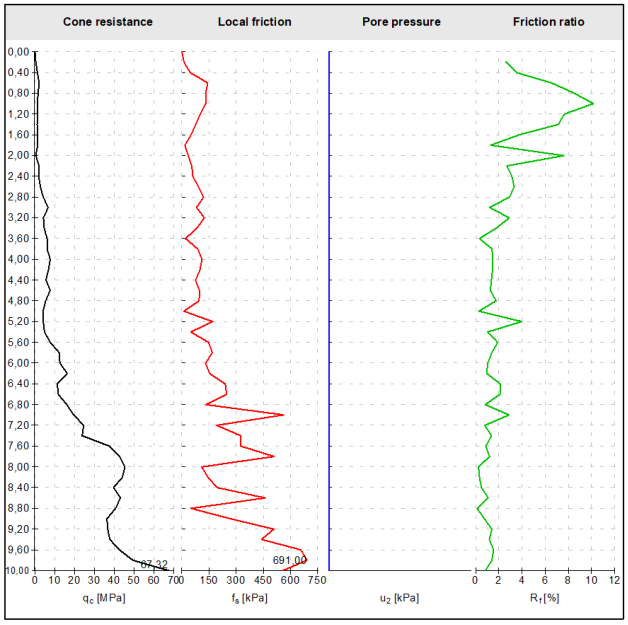
By pressing the “Print preview” button, we can check whether our log corresponds to the required assignment.





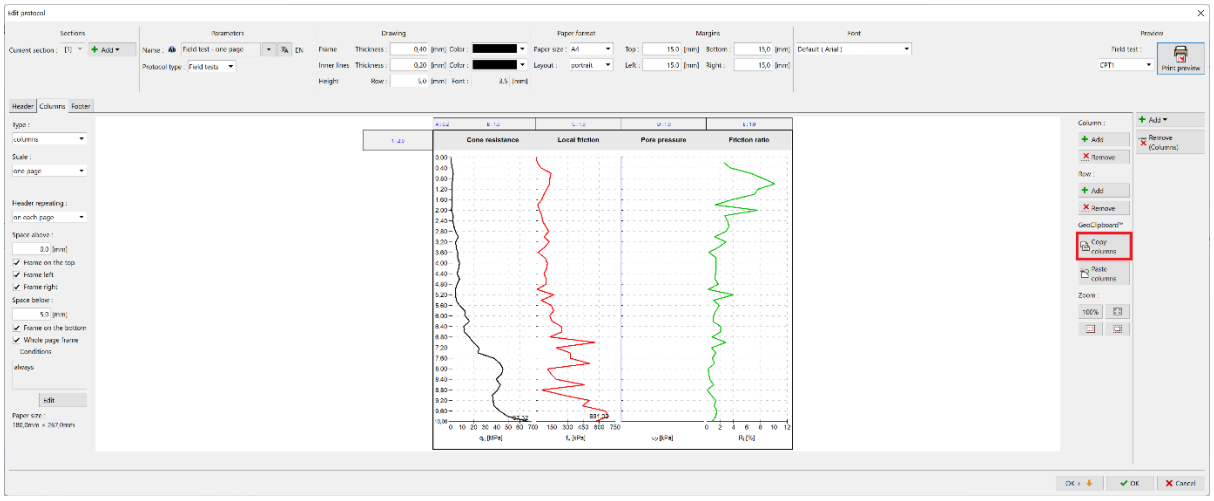
The created protocol corresponds to our assignment.

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

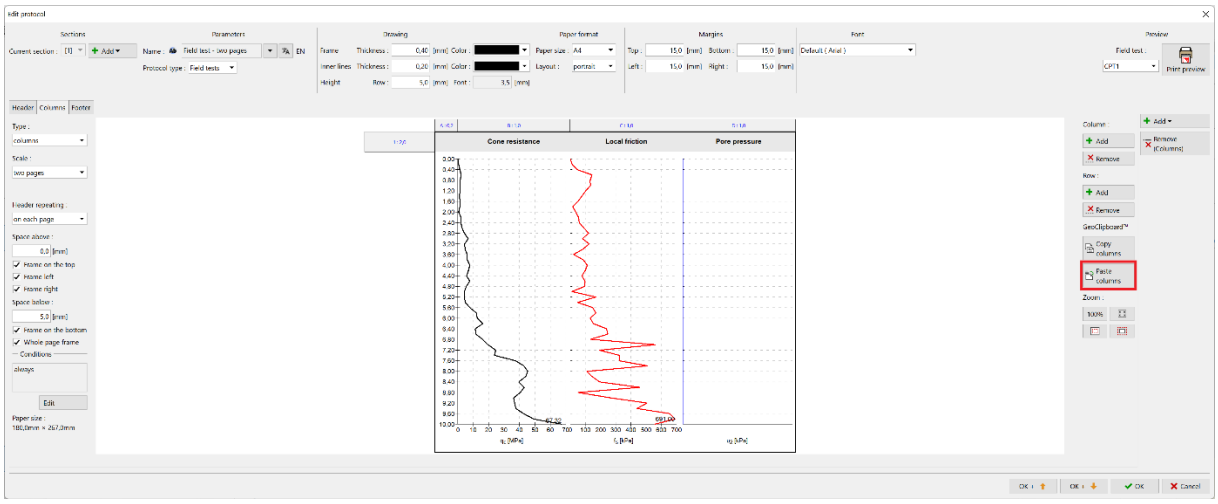


Notes:
- Sunny/ Partialy cloudy/ Calm
- Raw data not modified

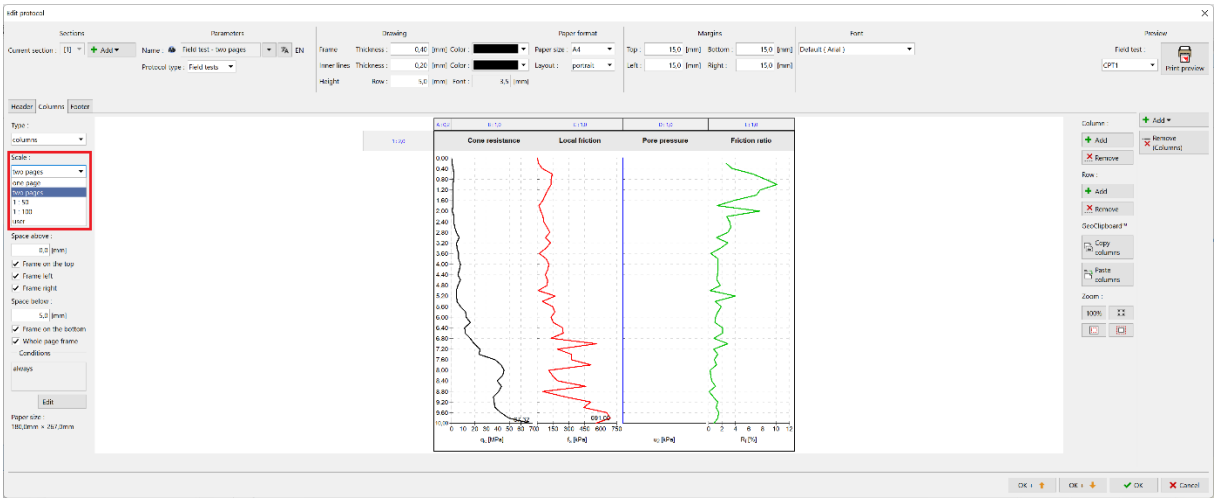
If we want to modify the graph in other protocols, it can be copied very quickly. In the edited log, click on the column tab and press “Copy columns”.



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.