

Using standards and analysis settings

Program: Gravity wall

File: Demo_manual_01.gtz

This chapter explains how to use the Settings administrator, which serves to select the standards, partial factors and verification methodology. It is a basic step that all GEO5 programs have in common.

Introduction:

GEO5 software is currently used in more than 100 countries worldwide. Engineering tasks are the same everywhere – to prove that the construction is safe and well-designed.

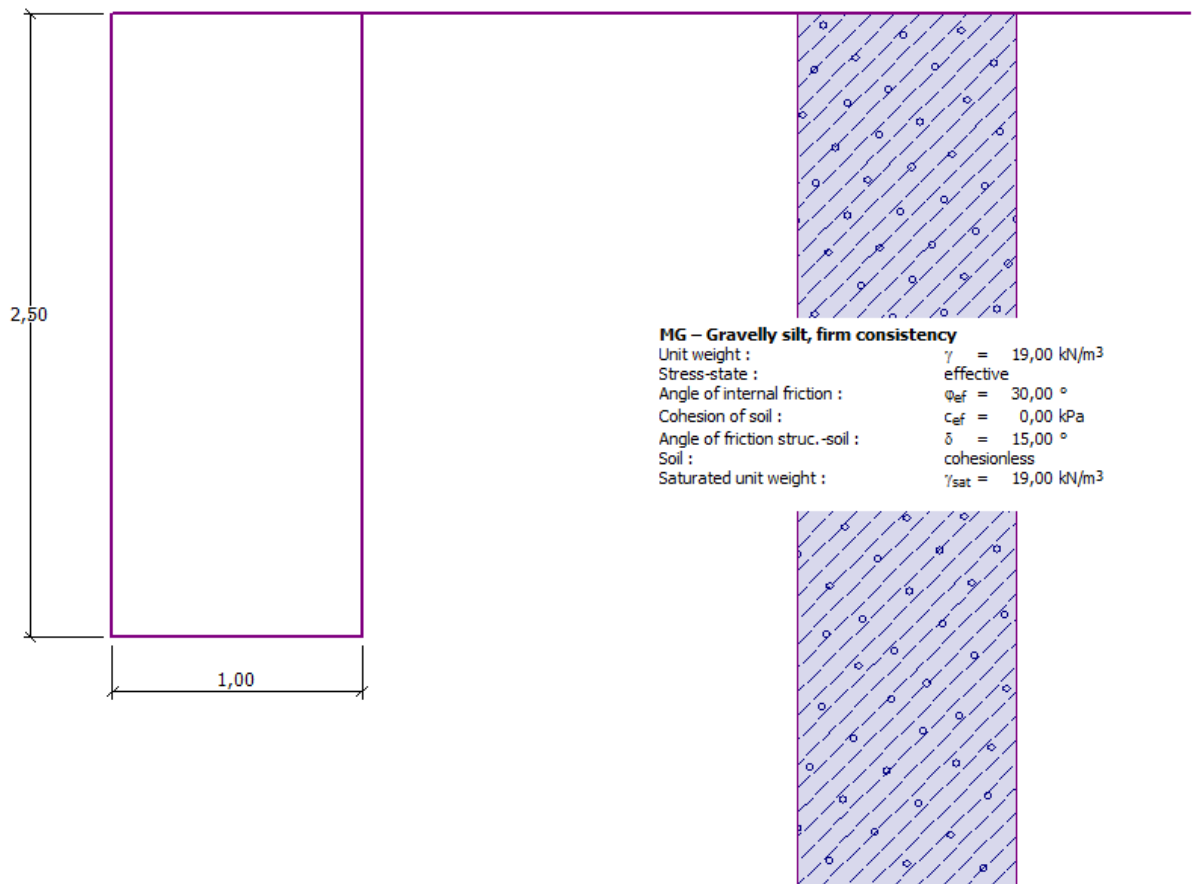
The basic characteristics of structures (e.g. dimensions of the wall, terrain, localization of anchors etc.) are the same all over the world, however the ways of proving that the construction is safe and the theories of analysis differ. The large number of new theories and partial factors of analysis lead to the need to input large amounts of data and complicate programs. The Settings administrator was created to simplify this process.

In the Settings administrator all input parameters are defined, including standards, methods and coefficients for the current country. The idea is that each user will understand the settings defined in the program (or will define new settings for the analysis) and then use them in their work. The user then goes to the Settings administrator and Settings editor only occasionally.

Assignment:

Perform an analysis of a gravity wall as shown on the picture below for overturning and slip according to these standards and procedures:

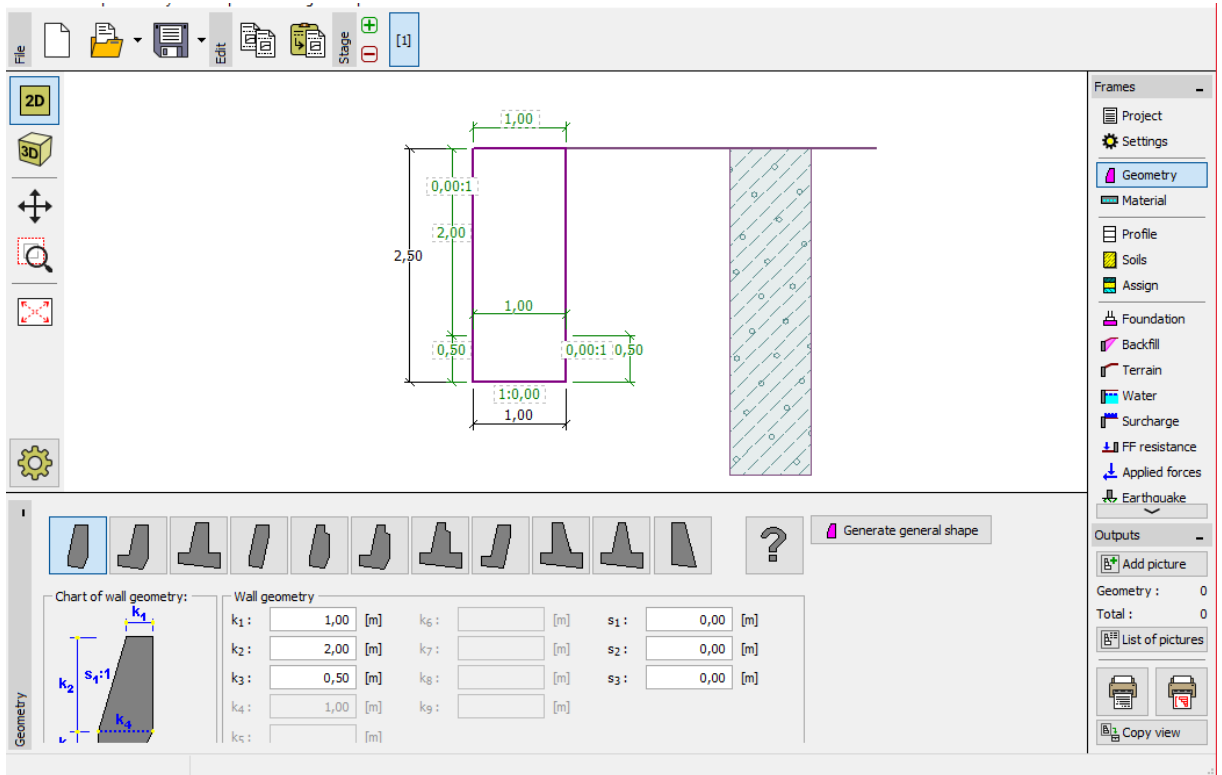
- 1) CSN 73 0037
- 2) EN 1997 – DA1
- 3) EN 1997 – DA2
- 4) EN 1997 – DA3
- 5) Safety factor on SF=1.6



Scheme of the gravity wall

Solution:

Firstly, we will input some basic data regarding the construction and the geological conditions in the frames: "Geometry", "Soils" and "Assign". The other frames will not be used because they are not important in this simple example. We will input the geometry of the wall in the frame "Geometry" according to the following picture. The value k_1 will be changed to 1 m, k_2 will be set to 2 m and k_3 will be set to 0,5 m. The values s_1 , s_2 and s_3 will be set to 0 m.



Frame “Geometry” – gravity wall dimensions input

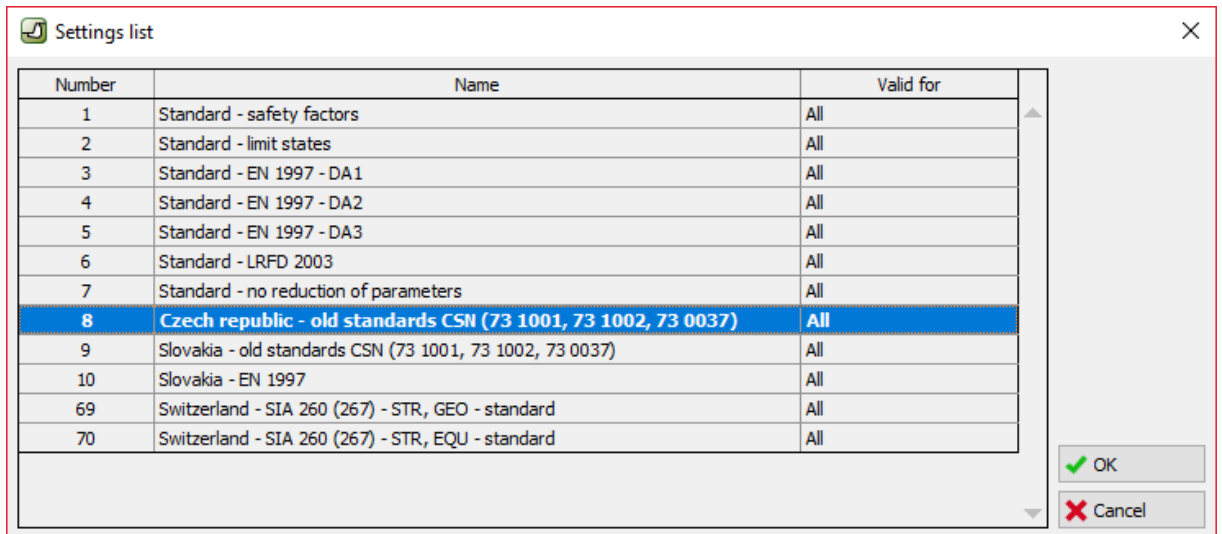
Then we will move on to the frame “Soils”, where we will add a new soil of class MG according to the table below.

Soil (Soil classification)	Unit weight γ [kN/m ³]	Angle of internal friction φ_{ef} [°]	Cohesion of soil c_{ef} [kPa]	Angle of friction structure – soil $\delta =$ [°]
MG – Gravelly silt, firm consistency	19,0	30,0	0	15,0

Table with the soil parameters

In the frame “Assign”, the first soil will be assigned automatically to the layer or layers. This can be changed if necessary. Now that the basic input of the construction is done, we can choose the standards we want to use, and then finally run the analysis of the gravity wall.

In the frame “Settings” click the button “Select settings” and choose number 8 – “Czech Republic – old standards CSN (73 1001, 73 1002, 73 0037)”.



Dialog window “Settings list”

Note: The look of this window depends on what standards are currently active in the Settings administrator – more information about this can be found in the help of the program (press F1). If the setting you want to use isn’t on the list in the dialog window “Settings list”, you can activate it in Settings administrator.

Now, open the frame “Verification” and note that the utilization of the construction has been calculated as 53,1% for overturning and 66,5% for slip.

Verification

No. of force	Force	F _x [kN/m]	F _z [kN/m]	Application point x [m] z [m]		Coeff. [-]
1	Weight - wall	0,00	57,50	0,50	-1,25	1,000
2	Active pressure	-19,38	4,70	1,00	-0,83	1,000

Verification

OVERTURNING : SATISFACTORY (53,1%)

SLIP : SATISFACTORY (66,5%)

Frame “Verification” – results of the analysis using the CSN 73 0037 standard

Then return to the frame “Settings” and choose number 3 – “Standard – EN 1997 – DA1”.

Settings list

Number	Name	Valid for
1	Standard - safety factors	All
2	Standard - limit states	All
3	Standard - EN 1997 - DA1	All
4	Standard - EN 1997 - DA2	All
5	Standard - EN 1997 - DA3	All
6	Standard - LRFD 2003	All
7	Standard - no reduction of parameters	All
8	Czech republic - old standards CSN (73 1001, 73 1002, 73 0037)	All
9	Slovakia - old standards CSN (73 1001, 73 1002, 73 0037)	All
10	Slovakia - EN 1997	All
69	Switzerland - SIA 260 (267) - STR, GEO - standard	All
70	Switzerland - SIA 260 (267) - STR, EQU - standard	All

OK Cancel

Dialog window “Settings list”

Again, open the frame “Verification” and note the results (55,6% and 74,7%) for EN 1997, DA1.

Verification

No. of force	Force	F _x [kN/m]	F _z [kN/m]	Application point		Minor load
				x [m]	z [m]	
1	Weight - wall	0,00	57,50	0,50	-1,25	
2	Active pressure	-17,29	4,63	1,00	-0,83	

Verification

OVERTURNING : SATISFACTORY (55,6%)

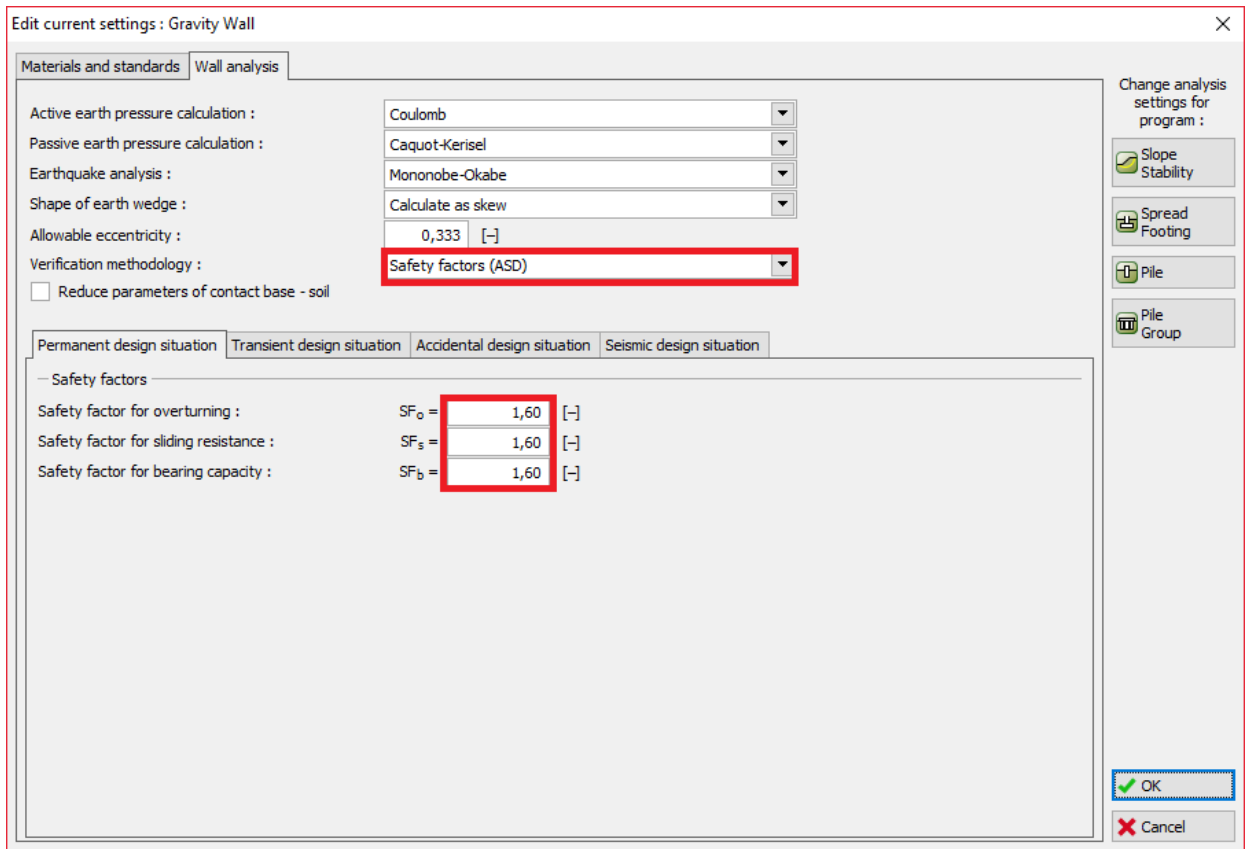
SLIP : SATISFACTORY (74,7%)

Frame "Verification" – results of the analysis for EN 1997, DA1

Repeat this procedure for Setting number 4 – "Standard – EN 1997 – DA2" and number 5 – "Standard – EN 1997 – DA3".

The analyzed utilization of the construction is 77,8% and 69,7% for EN 1997, DA2 and 53,5% and 74,7% for EN 1997, DA3.

Option 5 (analysis using Safety factors) is not as simple. In the frame “Settings” click on “Edit”. This will show you the current analysis settings. Change the verification methodology to “Safety factors (ASD)” and then set the safety factor for overturning and sliding resistance to 1.6.



Dialog window “Edit current settings: Gravity Wall”

Press OK and run the analysis. The resulting utilization in the “Verification” frame is 69,0% for overturning and 77,1% for slip.

The screenshot displays the 'Verification' frame in GEO5. On the left, a 2D diagram of a wall is shown with dimensions: height 2,50 and width 1,00. A vertical force of 57,50 is applied downwards at the top center, and a horizontal force of 17,90 is applied to the right at the bottom center. A red arrow labeled '+z' points downwards from the base. To the right of the wall is a soil mass with a blue hatched pattern. The right sidebar contains a 'Frames' list with 'Verification' selected, and an 'Outputs' section with 'Add picture' and 'Copy view' buttons.

No. of force	Force	F _x [kN/m]	F _z [kN/m]	Application point		Coeff. [-]
				x [m]	z [m]	
1	Weight - wall	0,00	57,50	0,50	-1,25	1,000
2	Active pressure	-17,29	4,63	1,00	-0,83	1,000

Verification		
OVERTURNING:	SATISFACTORY	(69,0%)
SLIP:	SATISFACTORY	(77,1%)

Frame "Verification" – analysis results for SF = 1.6

If you would like to use this setting more often, it is useful to save it by going back to the "Settings" frame and clicking the "Add to administrator" button. Rename the new setting as shown below. Then save the setting by clicking the "Add + Close" button and next time use it as a standard setting.

Add current settings to the Administrator

Name : Valid for :

Materials and standards | Wall analysis

Active earth pressure calculation :

Passive earth pressure calculation :

Earthquake analysis :

Shape of earth wedge :

Allowable eccentricity : [-]

Verification methodology :

Reduce parameters of contact base - soil

Permanent design situation | **Transient design situation** | Accidental design situation | Seismic design situation

— Safety factors —

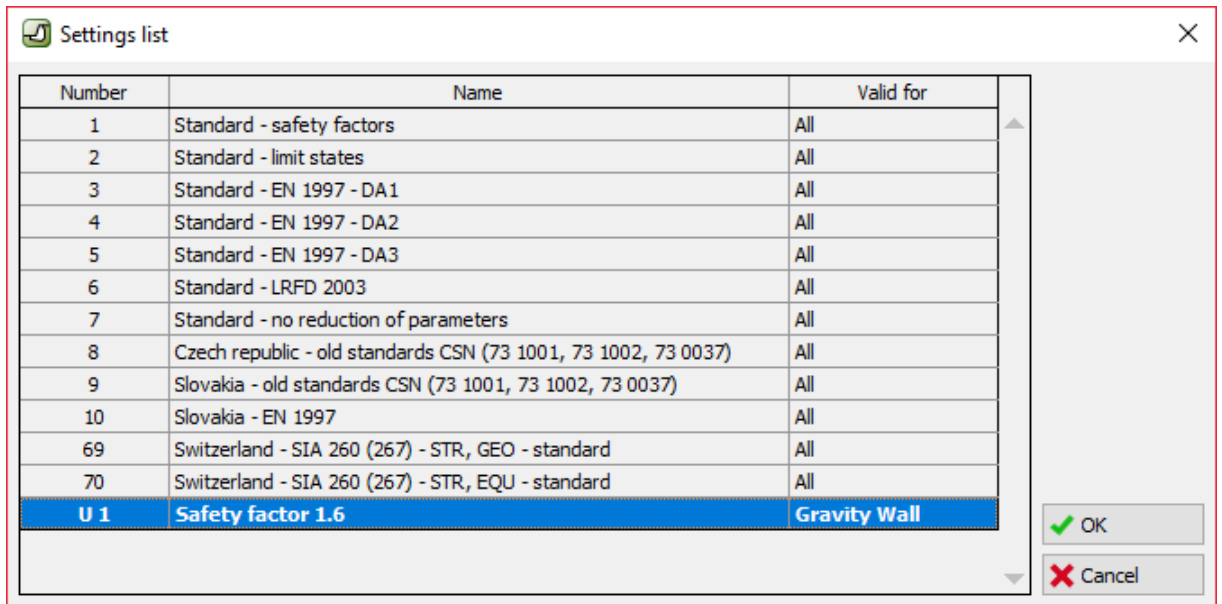
Safety factor for overturning : $SF_o =$ [-]

Safety factor for sliding resistance : $SF_s =$ [-]

Safety factor for bearing capacity : $SF_b =$ [-]

Dialog window “Add current settings to the Administrator”

The “Settings list” dialog window then looks like this:



Dialog window "Settings list"

Verification

The utilization percentage using each standard is:

	Overturning	Slip
1) CSN 73 0037	53,1	66,5
2) EN 1997 – DA1	55,6	74,7
3) EN 1997 – DA2	77,8	69,7
4) EN 1997 – DA3	53,3	74,7
5) Safety factor on SF=1.6	69,0	77,1

Using all selected analysis standards, the results are satisfactory.

Note: This simple method can be used to compare retaining structures or stability analyses. When analyzing foundations, the load (basic input data) must be computed according to relevant standards. That is why it doesn't make sense to compare foundation design according to various standards with the same values of load (nominal values).