

Interpretation of Field Tests into the Soil Profiles

Program:	Stratigraphy
File:	Demo_manual_43_1.gsg
	Demo_manual_43_2.gsg

Boreholes and some other field tests have to be simplified or interpreted for geotechnical design or the creation of a 3D subsoil model. It is necessary to create geotechnical types of soils, define the thicknesses of soil layers for each test.

Assignment: Interpret the field tests from Engineering Manual No. 42 into the soil profile.



Solution:

There are two ways we can proceed:

- Interpret the field tests separately in the "Soil Profile" frame
- Interpret the field tests when creating geological sections
- Combination of both ways

Approach 1 – Interpretation of field tests in "Soil Profile" frame

We will open the Demo_manual_42.gsg file and look at the entered tests – borehole "BH1" and CPT "CPT1".



First, we will look at the borehole protocol and think about which geotechnical soil types we want to create.

Edit	t field test p	properties (bore	ehole)									×
— Test p	parameters								s	oil profil	e	
Test nar	me:	BH1							0,0	$\langle \rangle \rangle$	\sim	
Coordin	nate : x =	0,0	0 [m])	/=	0,00 [m]				1,5- FW	\propto	\otimes	
Heigth	: [input	•	2 =	0,00 [m]				3,0-	$\times\!\!\times$	\bigotimes	
Depth c	of 1. point :		d	i =	0,00 [m]				4,5-	\bigotimes	$\langle X \rangle$	
Overall	depth :		d _{to}	t =	24,00 [m]				6,0-	\bigotimes	\boxtimes	
✓ Fiel	ld test gene	erates soil profil	le						San 7,5 - of	d with tr	ace 3	
Layers	Samples	Table GWT	Data - Protocol	Data - Test	Attachments				9.0 - GR	s ·		
No.*	Thickness t [m]	Hloubka d [m]	Soil	name	Soil pattern	Layer description		Add (to the end)	10,5	du	5-	~
1	4,9	0 0,00 4,90	Fill			fine grained SAND with some silt, dense, mixed with cobles of concrete and pieces of bricks partly the size is larger than the borehole diameter, black colour of the soil			E 341 #12,0- 13,5-Wea 15,0- Sha	le, fully thered	17	
2	1,5	0 4,90 6,40	Fill			coarse GRAVEL with some silt (clayey shale) and fresh angular cobles up to 15 cm, dark grey colour			16,5 - Shá moc 18,0 - Wea	le, Jerately ithered	9	
3	2,2	0 6,40 8,60	Sand with trac	e of fines		medium grained with some fine soil, dense, rust-brown			19,5-	+	10	
4	1,0	0 8,60 9,60	Gravelly clay			hard, gravel particles up to 10 mm (weathered shale), brown			21,0- Sha	le, slight	ly	
5	0,9	0 9,60 10,50	Sandy clay			hard, with some pieces of gravel (quartz) up to 50 mm dia., brown	•		22,5-			
Pr	rint log	🔒 Import							OK		🗙 Ca	ncel

The solution is never exactly clear; there are always different ways of simplification – for example:

- GT1 Landfill, GT2 Sand, GT3 Clay, GT4 Weathered Slate, GT5 Slate
- GT1 Landfill, GT2 Fine-grained soils, GT3 Slate

In our example, we will choose a significant degree of simplification, and we will continue to work with three geotechnical types only. We will switch to the "Soils" frame. So that we do not have to input the names, samples, and colours of the soil again, we will take them from the tests. We will change the individual names of the soils and delete the other soils.

		⊕] Ad	lopt from field tests	Add									
		No	Soil name	1 8-0		e 11.		-					
		1	Fill	(C)	adopt fron	n field tes	S PER Add	Edit No. 1	× Remove	NO. 1			
		2	Sand with trace of fines	No.	A	So	il name	GT1 - Fil					$\propto \propto $
1000		3	Gravelly clay	1				Unit weig	ht :	$\gamma = kN$	l/m ³		\sim
$ \rightarrow $		4	Sandy clay	2	Sanc			I Strecc-cta	te '	effective	10		
		5	Shale, fully weathered	3	Grav	Ad	opt from field tests	🕂 🖬 Add	- / Edit No. 2	-X Remove No.	2		
		6	Shal	4	Sanc	No +	Soil	name	CT2 Char				
		7	Shale, moderately weathe	5	Shal	1	GT1 - Fill	indiffe	Unit weigh	t:	Y =	kN/m3	
	Sile .	8	Shale, slightly weathered	6	Shali	2	GT2 - Clay		Stress-state	e ;	effective	1	
	S			-		3	GT3 - Shale		Angle of in	ternal friction :	φ _{ef} =	*	-
			-	S 0	anali				Cohesion d	of soil :	Cef =	кРа	
			5	× –	_				Deformatio	on modulus :	Enter =	MPa	
									Oedometri	c modulus :	Eoed =	MPa	
									Saturated u	unit weight :	Yeat =	kN/m ³	· · · · · · · · · · · · · · · · · · ·

Note: New soils can also be added when creating a Soil profile or Geological section; it is not necessary to return to this frame.

We will select the borehole BH1 – we see, that the interface of layers and partly even the soils were copied from the specified borehole.





We will open the soil profile and edit it.

Edit soil profile										2
Identification					Parameters					
Nome:	BHI				GWT depth : h _{QWT} =	12,50 [m]				
Coordinate : x -	0,00 (m) y =	0.00 [m]			🛃 Suil profile is active for ge	ological model	generation			
	0,00 [m]									
Depth of the 1st	point from original terrain : d ₁ =	0,00 [m]								
View field tes					Layers of soil profile					
7 GWT bored	1: GWL = 15.00 m					No Th	ickness [m]	Depth [m]	Soil name	Add
T GWT stead	v: GWT. = 12.50 m			from field test	2 NOV XXXX	1	4,90	0,004,90	GTI - Fill	(to the end)
			2,00- 10-	Tel Astronomia	en Avar	2	1,50	4,906,40	GTI - Fill	
			4.00-	Acid solis	1 CXXXX	3	2,20	6,408,60	(not assigned)	
						4	2,00	8,609,60	(not assigned)	
			6,90	Depth by field test	******	5	0,90	9,60 10,50	GT2 - Clay	
			8,00		and a	6	5,50	10,5012,00	GT2 - Clay	
			000		9	7	2,80	12,00 14,80	(not assigned)	
			10,007			8	1,00	14,8015,80	(not assigned)	
			12,00 - Sugar Son A . 4	-	12	⊽ 9	3,50	15,8019,50	(not assigned)	
			14.00- Wegthered	•	assigned	10	4.70	19,3024,00	G13 - Shale	
				7	15					
			10.007 Shale moderately		and 0					
			10,00 Weathered		13 assignedi					
					71115					
			Shale, slightly		21 GT3-////					
			22,00-		Shaw					
			24,00		24					
A 21212	D.								04.1	4 OF

We will assign the soils to all layers.



Finally, we will remove the redundant interfaces – the easiest way is to merge the same layers into one by using the "Merge layers with the same soil" option in context menu (available using right mouse button).





The result is a three-layer soil profile.

a profile					
ntficebon	Parameters				
/s BHI	GWT depth : h _{GWT} =	12,50 [m]			
Jinate x = 0,00 (m) y = 0,00 (m)	🖌 Soil profile is active for get	ological model generation			
z - 0,00 [m]					
of the 1st point from original terrain : d ₁ = 0,00 [m]					
w field test	Layers of soil profile				
aWT bored : GWT ₆ = 15,80 m - 5.50	Copy profile	No. + Thickness [m]	Depth [m]	Soil name	Add (milliound)
3WT steady (GWT, = 12,50 m	from field test	2 560	6.40 12.00	GTI - Fill GT2 - Clar	(to the end)
	Add soils 3-	3 12,00	12,0024,00	GT3 - Shale	
Sarres,	Depth by field test 9				
8,00	9 GI2				
10,00-					
12,00 -	ar to 12 1/1/32	7			
14,00- Wegtt	N ///				
16,00- Share	ccetately /////				
10,00	10 Share				
20,00-					
22.00-	21 21				
24.00	24				
	 A state of the second se			-	



Next, we will interpret the CPT. When the dialog box opens, the program evaluates the CPT test by the Robertson method and will design the soil layers.



We can assign soil types, according to Robertson, to our geotechnical types. Press the "Table of soils Robertson 2010" button and try to assign the soils.

Table of soils (Robertson 2010) X								
Soil descriptio	n		Assigned soil					
Sensitive fine grained		(not assigned)		Add soil				
Organic soils - clay		GT2 - Clay 🔻	· · ·	Add soil				
Clay - silty clay to clay		GT2 - Clay 🔻	· · ·	Add soil				
Silt mixtures - clayey silt to silty clay		GT2 - Clay 👻	· · · ·	Add soil				
Sand mixtures - silty sand to sandy silt		(not assigned)		Add soil				
Sands - clean sand to silty sand		(not assigned)		Add soil				
Gravelly sand to dense sand		(not assigned)		Add soil				
Very stiff sand to clayey sand		GT1 - Fill 🛛 👻		Add soil				
Very stiff fine grained		GT1 - Fill 🛛 🔫		Add soil				
			✓ ОК 🗙	Cancel				

We will change the size of the minimal layer to 0.5 m to reduce the number of layers and assign the created layers to the profile.

Edit soil profile									×
Identification		Classification			Parameters				
Nome:	CPTI	Classification type :	Robertson 2010 👻		GWT depth : h _{GWT} =	under) [m]			
Coordinate : x =	10,00 (m) y = 20,00 (m)	Penetrometer net area ratio :	α = 0.75 [-]		🛃 Soë profile is active for get	logical model generation			
z -	0,00 [m]	Unitweight: input -	7 - 19,00 [kN/m ³	1					
Depth of the 1st	point from original terrain : d ₁ = 0,00 [m	Minimum thickness of layer :	h = 0.50 [m]						
View field test					Layers of soil profile				
Silt in Sand Sand Very	Clusivillation type : Robertson 2010 indures - clayey sit to dify Clay matters - villy sure to sendy sit - class shard to ally sand toti line grained	Concretis	Une a. Very still fine grined It soulars - cayes at 5 and Sends - chen sand Sends - chen sand	Copy profile from field test Add soils Depth by field and Table of only Koberbon 2010	0 1 2 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5	No. = Thickness[m] 2 0,00 2 3,00 4 4,20	Depth [m] 0,00-0,60 0,66-2,20 2,26-5,80 5,86-10,00	Solaans (not ssigned) (11-Fil) (12-Clay) (not exigned)	∲ 644 (to the sent)
合 Print log	Re copy soil profile into clipboard						CK	+ 🛊	🖌 OK 🛛 🗶 Cancel

We will then modify the profile by assigning a layer of Slate and merging a layer of landfill.



Now the profile is created.



Approach 2 – creation of soil profiles using Geological Sections

This method has the advantage that we can create our idea for multiple profiles at the same time. We can also leave the decision of which geotechnical types to create until the creation of the section.

Again, we open *Demo_manual_42.gsg* file.

We will go to the "Geological Sections" frame.





Enter the geological section from the BH1 to CPT1 and go to the "Creation of Geological Section" tab.

We see selected field tests. Soil profiles display on the axis of test, but they aren't created yet.



New geological sect	tion				- D X
Name :					
Topology Creation of	Geological Section Drawing				
0 + 0					
Interfaces of Layers	Water Structures Descriptions				- Drawing
德	Interfaces of Layers	Assigned tests	Assignments in point	its	Soil hatches
Generate	n Add line	7 Edit soil profile (number 1)	🕂 🝼 Add graphically	Add textually	Soi names
5 Adopt from 3D model	No. + Line type Closed Border Line type Interface Description	No. + Field test Type of test Soil profile Draw tests 1 BH1 Borehole Yes Yes	No. + s[m]	z(m) Soil	Draw borders No areas created.
		CPTI CPT Yes Yes			
					Draw all tests

We will input our idea of the geological section.



We input assignment points to the areas and assign soils, resp. geotechnical types. If the type is not created already, we can do it now.



Rev geological section		
polony Creation of Geological Section Drawing		
Cratical of Geological Section Baxing	Add new sold Add new sold Herms: G11 - F8 — Bacic data Unit weight: 7 = [D4/m ³] Stess-state: effective Angle of news (ficcion: 4 ₆ /4 * [] ¹] Cohesion of add: 4 ₆ /4 * [] ¹] Defension modulos: 4 ₆ /4 * []] Defension	X Draw Pattern category : GEPRODO Subcategory : Superficial depotes (1 = 8) • Pattern : I Made up ground Cater : Badageound : enter color •
	Clessify Clear	네는 Add = Close X Cancel
terfaces of Layers Water Structures Descriptions Interfaces of Layers Interfaces of Layers	Assigned tests Assignments in points	Soil hatches
No. List type Closed Rode Description 1 Polyline ✓ ✓ Ord safected) 2 Polyline ✓ ✓ ✓	No. Field Not Type of test Solution Not. Implementation Solution	Constantia No areas created
		Draw all tests
	The assignment takes precedence over the soil profiles.	Do not draw ter

Using "Generate" button we generate area of fill.





The same way we assign soils to other areas.

New geological section		D ×
Name :		
Topology Creation of Geological Section Drawing		
		Drawing
- Interfaces of Layers	Assigned tests Assignments in points	Soil hatches
		Soil names
No. + Line type Closed Border Line type Interface Description 1 Polylime - - - (not solected) 2 Polylime - - V/V/V (not solected)	No. * Field test Type freets Soli profile Draw tests No. * s(m) s(m) Soli 1 BH1 Borefole Yes 1 10,00 -2,246 (T1 - Fill) Soli 2 CPT CPT Yes 2 10,00 -2,246 (T2 - Fill) Soli	Draw borders reas created.
	3 11.78 -149/GT3-Sare 22222	raw all tests
	The assignment takes precedence over the soil profiles.	o not draw tests
	🎪 Add + Close	X Cancel

We will open soil profile (borehole BH1) and edit it. We can see dialog window for soil profile input.

Ldit soil profile		
Identification	Parameters	
Name : DFtt	GWT depth: h _{gW} = 12.50 (m)	
Coordinate x = 0,00 [m] y = 0,00 [m]	 Sell profile is active for geological model generation 	
z= 0.00 (m)		
Depth of the 1st point from original terrain : d ₅ = 0,00 (m)		
- View field test	- Layars of sell profile	
2 GWI bored: GWIs = 15,82 m	Concomelle No. * Thickness [m] Depth [m] Soil name	Add
	200- Vent (vint fract off) 000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0 1000- 0	
Annt log 🚱 copy soil profile into clipboard		CK X Cancel

Using "Adopt profile from geol. section" button all data from geological section are transferred into the soil profile.





We will assign to the individual layers the corresponding geotechnical type - soil.

Ecit soil profile						×
Identification		Parameters				
Name: BHI		GWT depth : h _{OWT} =	12,50 [m]			
Coordinate x = 0,00 [m] y = 0,00 [m]		📝 Suil profile is active for geo	logical model generation			
z = 0,00 [m]						
Depth of the 1st point from original terrain : d+ - 0,00 [m]						
View field test		Leyers of soil profile				
w GWT bored : GWT, * 15.00 m	Converted Converted		No. + Thickness [m]	Depth [m]	Soil name	Add
GWT steady : GWT, = 12,50 m	from field to	et Plante	1 6,50	0,006,50	GTI - Fill	* (to the end)
	2,00- Add soils		3,77	6,50 12,27	GT2 - Clay	
	4,00-		3 10,73	12,27 23,00	GT3 - Slate	
	630 D		6			
	Sand with trace of					
	8,00	9- 612				
	10,00-	_ Clay	8			
	12,00 - Sector Andrew Street	12	7			
	14.00- Wegthered	1////				
		13- / / / / /				
	To UT Shale moderately	m.////				
	10,00 Weathered	13 Shits				
	20,00-	1111				
	anale, sigrat	21				
		23				
	24,00		1			
Print log Recopy soil profile into clipboard					0K+ 🔸	🖌 OK 🛛 🗙 Cancel

We will repeat the process for the CPT as well. It can be done to the depth of the model (below) or only to the depth of the field test.



After return into the section we see that soil profiles have been created.

10 11							×
Name :							
Topology Creation (of Geological Section Drawing						
				TI-FE			
	1 1						
Interfaces of Layers	Water Structures Descriptions						Drawing Coll business
Interfaces of Layers	Water Structures Descriptions		Assigned tests		Assignments in point	ti	Drawing ✔ Soil hatches ✔ Soil backgroun
Interfaces of Layers	Water Structures Descriptions	K Remove No. 2	Assigned tests Z Edit soil profile (number 2)	1	Assignments in point	ts 李韶 Add tectually	Drawing ✓ Soil brickes ✓ Soil brickground ✓ Soil and sport
Interfaces of Layers Generate	Water Structures Descriptions Interfaces of Layers Image: Add line Image: Add line No Line type Closed Border: Line type 1 Polyine ✓ (Image: Add line)	Remove No. 2	Assigned tests Assigned tests Z Edit soil profile (number 2) No. + Field test T Benchole	Soil profile Draw tests Yes Yes	Assignments in point	ts (*) (*) (*) (*) (*) (*) (*) (*) (*) (*)	Drawing Sail batches Sail batches Sail batches Sail batches Sail anese Draw bodres Bane bodres 3 areas created
Interfaces of Layers Generate Adopt from 3D mod	Water Structures Descriptions Interfaces of Layers Image: Structures Image: Structures Image: Add line Image: Structures Image: Structures </td <td>Interface Description of selected)</td> <td>Assigned tests Z Edit soil profile (number 2) No. + Field test J Birl. Borehole 2. CPT1 CPT</td> <td>Soil profile Draw tests Yes Yes Yes Yes</td> <td>Assignments in point Assignments in point Add graphically No. + s[m] 1 10,00 2 10,81 2 10,81</td> <td>ts ★ (m) Add testually z(m) - 2.54 (17) - 560 -2.43 (17) - 71 (20) - 277 (20)</td> <td>Densing Solih haches Soli haches Soli hanes Soli hanes Javes created.</td>	Interface Description of selected)	Assigned tests Z Edit soil profile (number 2) No. + Field test J Birl. Borehole 2. CPT1 CPT	Soil profile Draw tests Yes Yes Yes Yes	Assignments in point Assignments in point Add graphically No. + s[m] 1 10,00 2 10,81 2 10,81	ts ★ (m) Add testually z(m) - 2.54 (17) - 560 -2.43 (17) - 71 (20) - 277 (20)	Densing Solih haches Soli haches Soli hanes Soli hanes Javes created.
Interfaces of Layers Elemenate Adopt from 3D mod	Water Structures Descriptions Instructions Image: structure Image: structure Image: structure Image: structure Image: structure	Marrove No. 2 Interfere selected)	Assigned tests 7 Edit soil profile (number 2) No. + Field test 1 BH1 Berehole 2 CPT1 CPT	Soil profile Draw tests Ves Ves Ves Ves	Assignments in point	ti ∰ ∰ Add textually 1 m/ 500 -2.24 (11 - fm -2.24 (12 - Chy 2.2.2) -1.4(4) (12 - Sarw 2/2/2)	Dansing Sol hackey Sol hackey Sol hackey Sol hackey Sol remet Sol remet Dans hadders J areas created.
Interfaces of Layers Scienceste Adopt from 3D mod	Water Sourciptions Interfaces of Layers	K Remove No. 2 Interface Description out selected)	Assigned tests Z Edit soli profile (number 2) No. • Field test 1 Eff. Biochoice 2 CPT1 CPT	Soil profile Draw tests Yes Ves Yes Yes	Assignments in poin (*) CAd graphically No. + s(m) 1 10.00 2 10.81 3 11.76	t ∰∰Ådi tetudiy 1/m 500 -2,41 (07164 -4,28 (075ke 2/2/2)	Draving Solh hatche Solh hatche Soli hatche Soli hance Javes created. Dass ell texts



Working with Soil Profiles

The program, resp. the selected template contains protocols for printing the soil profiles – as a field test report and its interpretation.



Next, we can generate a 3D model of the subsoil from the created soil profiles.

