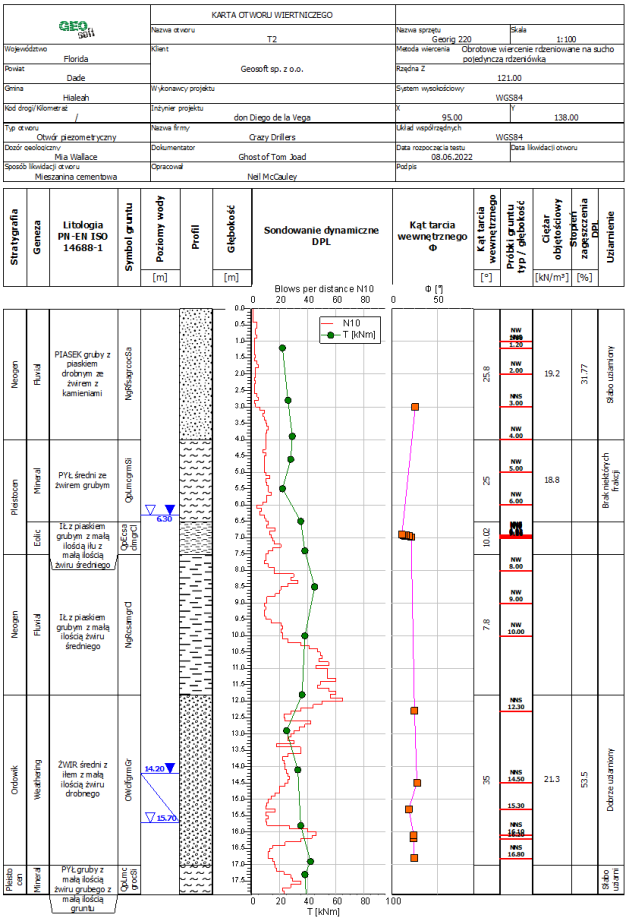
Geo DB - Geotechnical and Geological database

GEO DB is a program designed for

- **Registering** all geological and geotechnical information obtained from boreholes in a database
- Registering and **interpreting** laboratory test results for soil samples
- Registering and interpreting field test results (*in situ* pore pressure, **SPT**, **DPT**, **FVT**, etc.)
- Creating geological, hydrogeological, and geotechnical **documentation**



Key program features

- **User-friendly** licensing and updating
- **Security** of data stored in a local database
- **Efficient** and fast data entry
- **Automation** of a number of editing and calculation processes
- **Advanced** analytical and calculation methods
- **High-quality** graphics
- Reading and importing data stored in databases of **other programs**.

The **scope of data** that can be entered into the GEO DB database and the rules for creating documentation are fully compliant with:

- "***Guidelines for performing ground investigations for road construction purposes***" developed by the Polish Geological Institute for the General Directorate for National Roads and Motorways (GDDKiA)
- "**Guidelines for the identification and testing of ground for high-speed railway investments**" developed by the Polish Geological Institute in cooperation with the AGH University of Science and Technology and the Warsaw University of Technology for the CPK
- ISO 14688-1, ISO 14689-1, PN-B-02480, and USCS standards

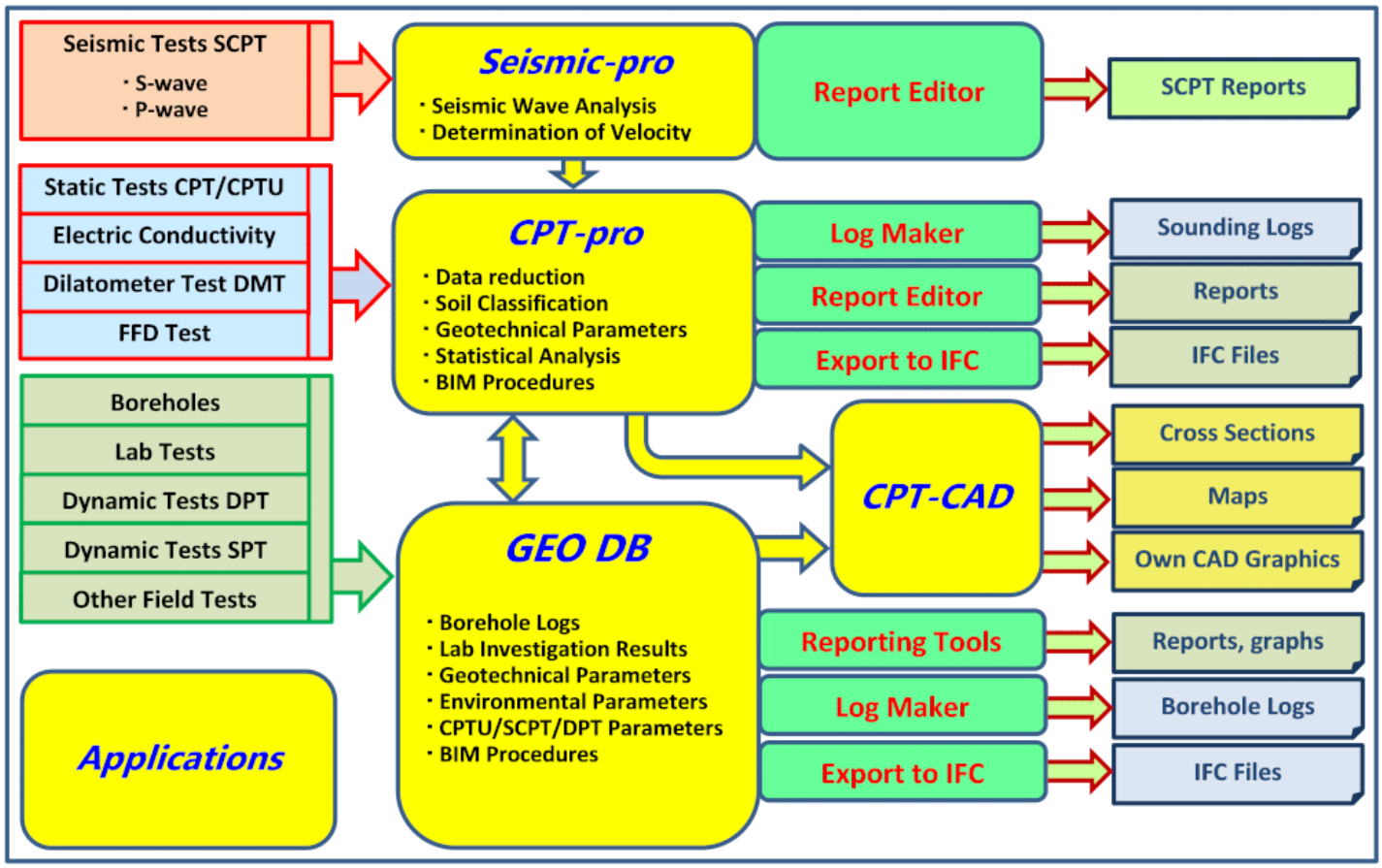
The GEO DB database structure and implemented procedures enable the export of data for a selected project to the **IFC** (Industry Foundation Classes) format, which is the primary tool for creating construction and infrastructure designs using **BIM** (Building Information Modeling) technology.

Advanced **statistical methods** allow for the estimation of **characteristic values** of geotechnical parameters.

All data stored in GEO DB can be used to automatically generate appropriate documentation, including:

- **Borehole data**
- **DPT sounding data with interpretation results**
- **Piezometer/well design**
- **Piezometric measurement report**
- **Sieve analysis report**
- **Graphs**

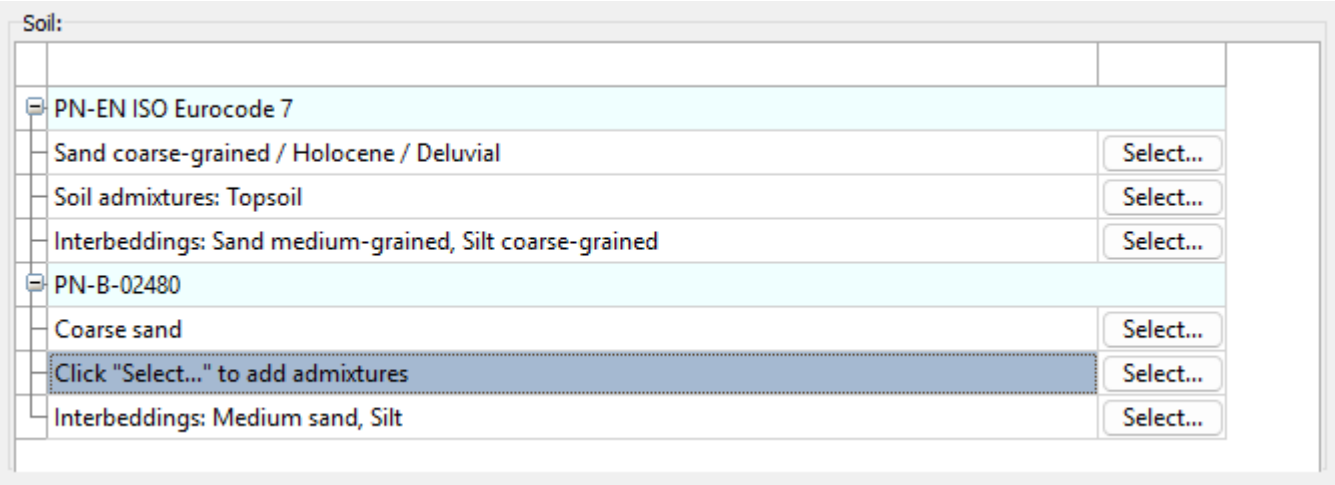
The **CPT-pro** and **CPT-CAD** applications, which are **compatible with GEO DB**, enable the creation of extensive documentation, including **geological/geotechnical cross-sections** and **maps**.

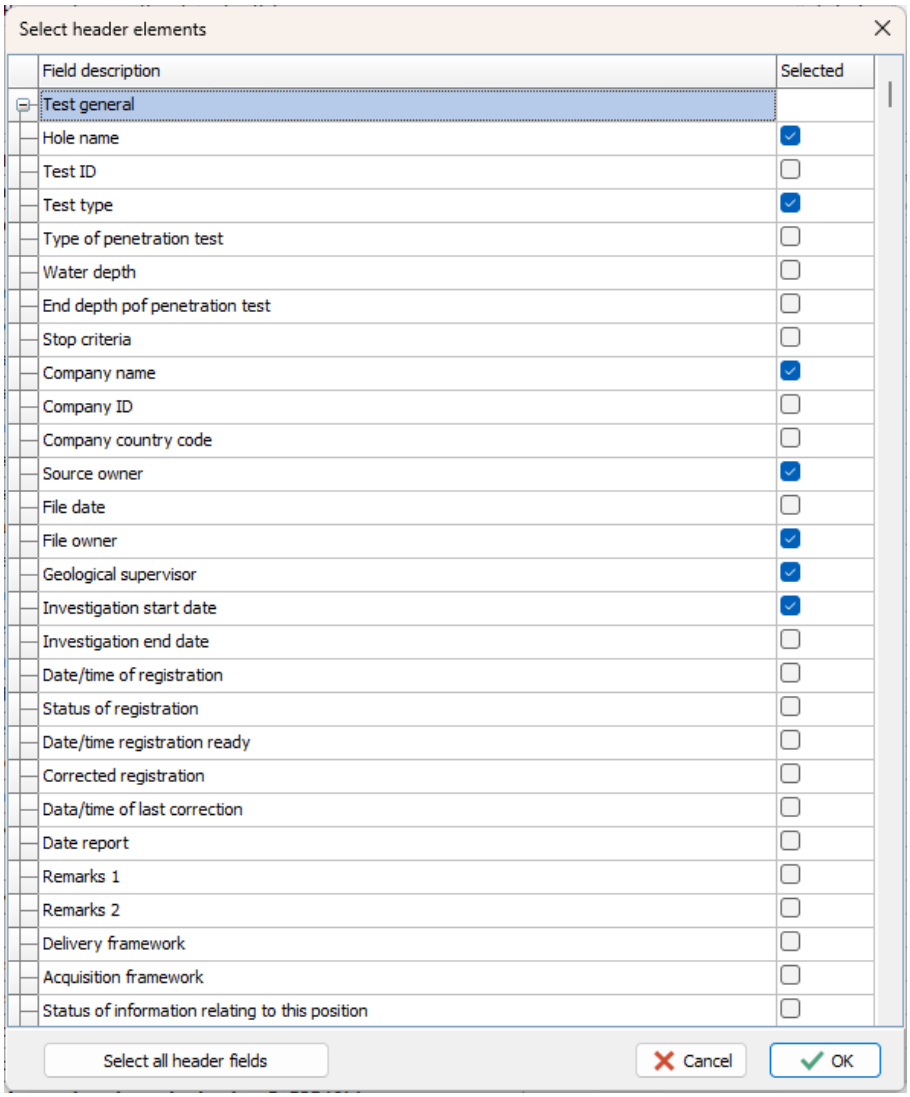


GEO DB is a multilingual program that allows you to generate borehole data and reports in any implemented language. Currently, Polish and English are supported. All dictionaries implemented in **GEO DB** already include appropriate translations.

A very extensive set of header data (over 200 items), including data required by **USCS** and **AGS** standards, allows you to record all necessary data.

A unique feature of GEO DB is the ability to simultaneously enter data according to multiple standards (e.g., PN-B-02480, PN-EN ISO 14689-1, USCS, etc.).





The **Favorites** mechanism, used extensively in the **GEO DB** program, involves selecting a limited subset of individual categories (soils, header data, parameters, etc.) and displaying only those selected. This limits the amount of information visible on the screen to only the most important information and significantly increases the efficiency of working with the program.

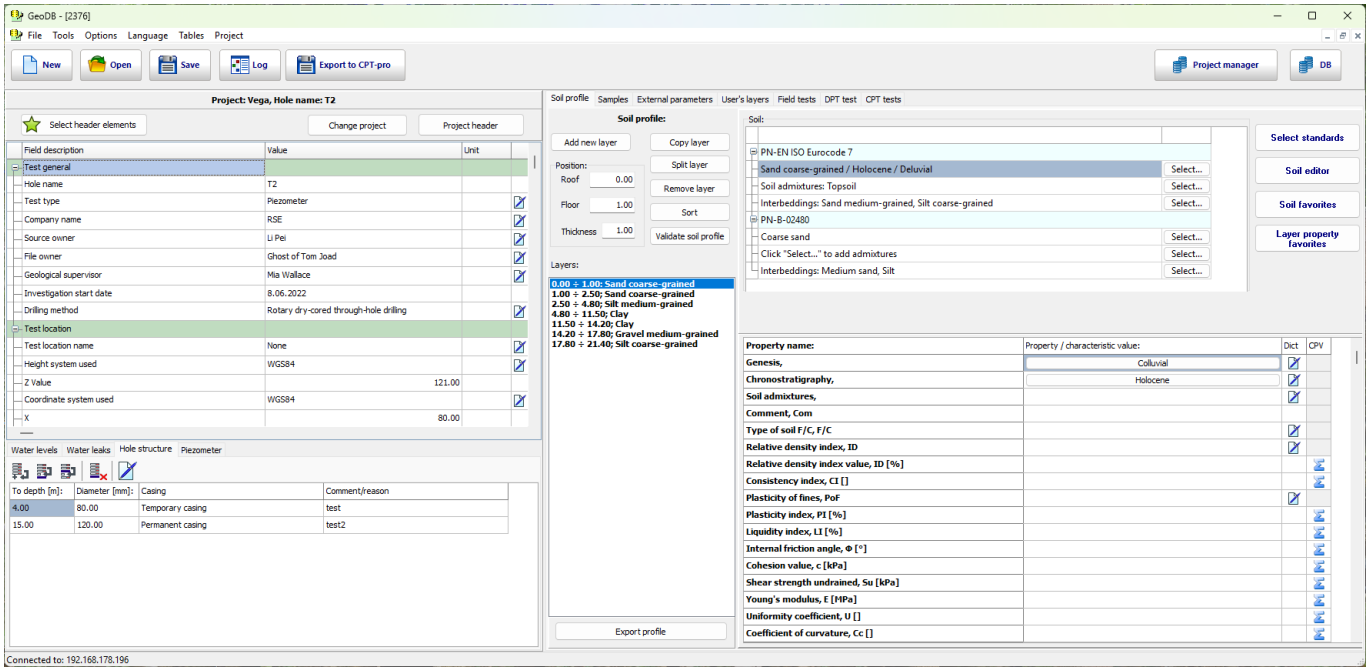
(Left) Example list of borehole header data selected as **Favorites**. The list can be changed at any time.

Regardless of the geological profile, the user can simultaneously enter profiles **based on other criteria**, including soil suitability for foundations and piling, the presence of contaminants, and so on.

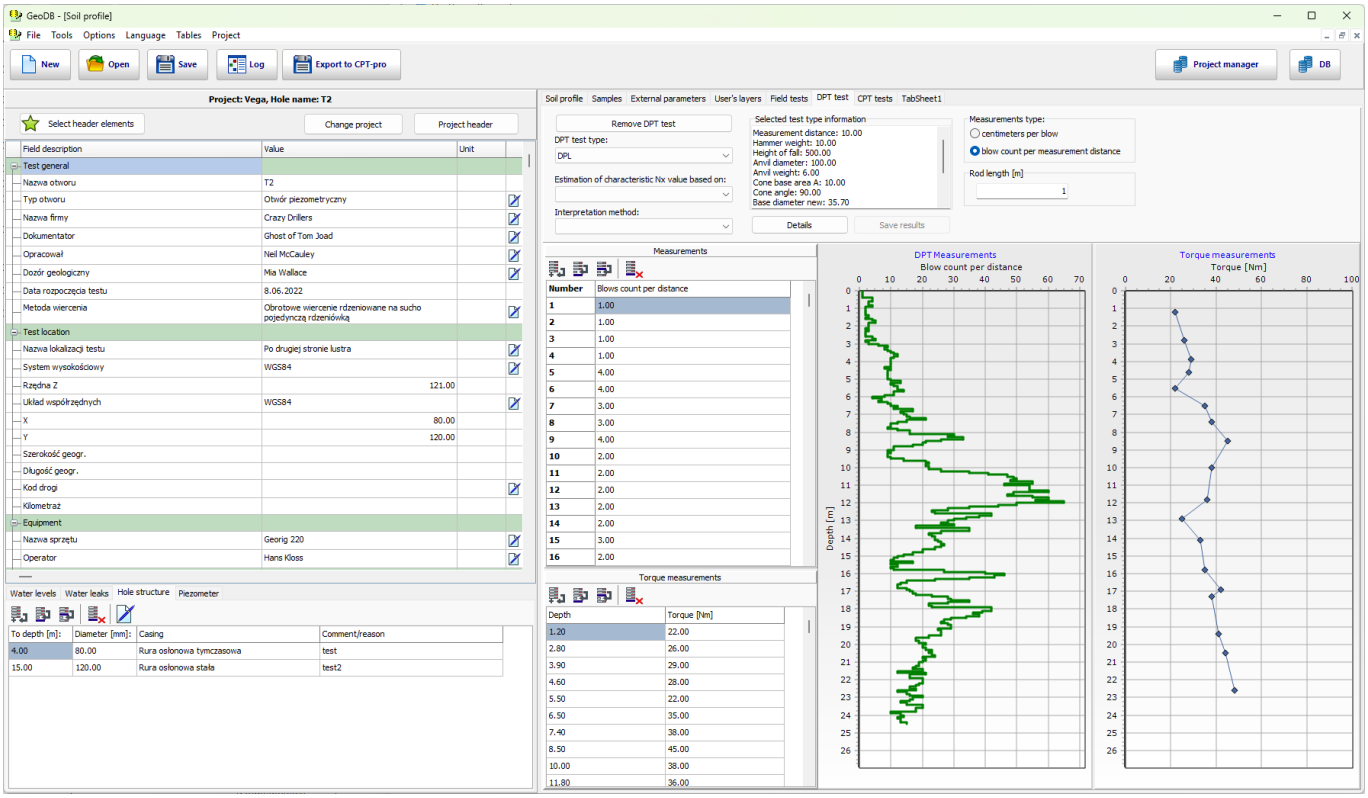
Soil characteristics, properties, and parameters obtained from field and/or laboratory sample testing are assigned to a point with X, Y, and Z coordinates. This allows for further spatial analysis.

Elements of the GEO DB program structure. Main windows.

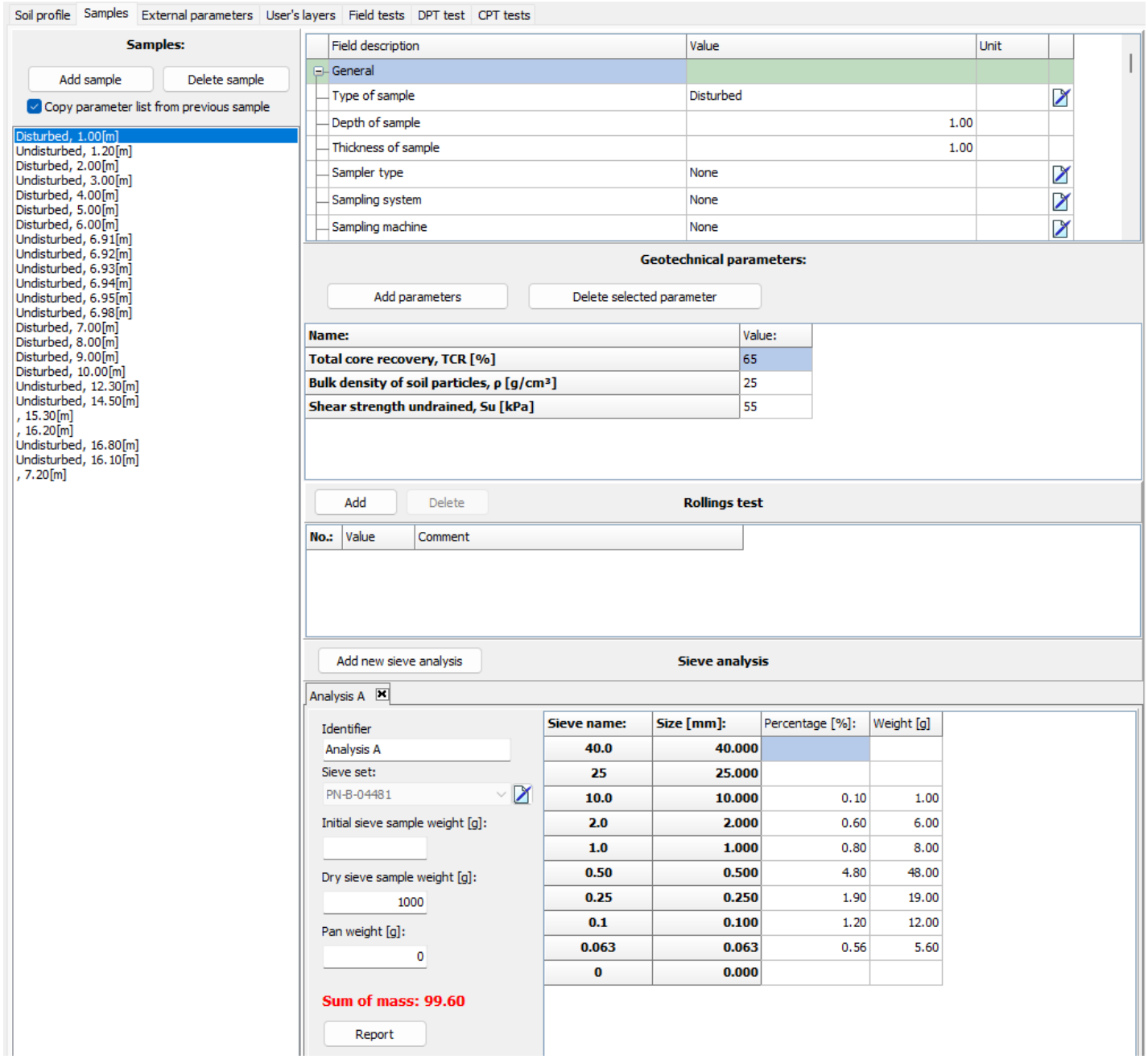
The **GEO DB main window**, **Soil profile tab**. The header and properties of the hole selected for **Favorites** are on the left side of the window, the new layer input panel and list of already entered layers are in the center of the window, and the **soil type**, **admixtures**, **interbedding**, and **layer properties** are on the right.



GEO DB main window. **DPT test tab**. The right panel contains complete information about the **DPT** test, including **measurement results** and **test standard** information.



The main GEO DB window. A tab for handling samples and their laboratory tests. The lower section displays sieve analysis data.

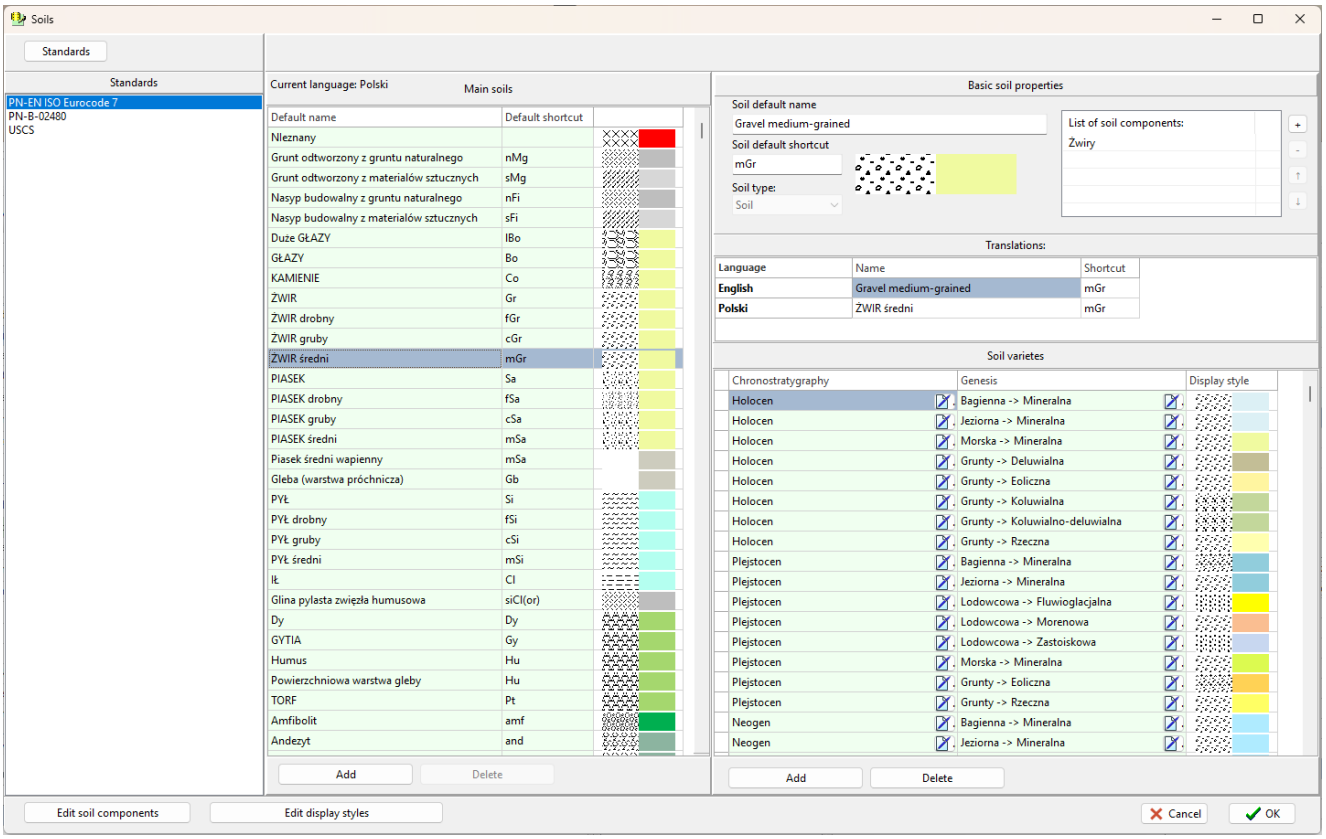


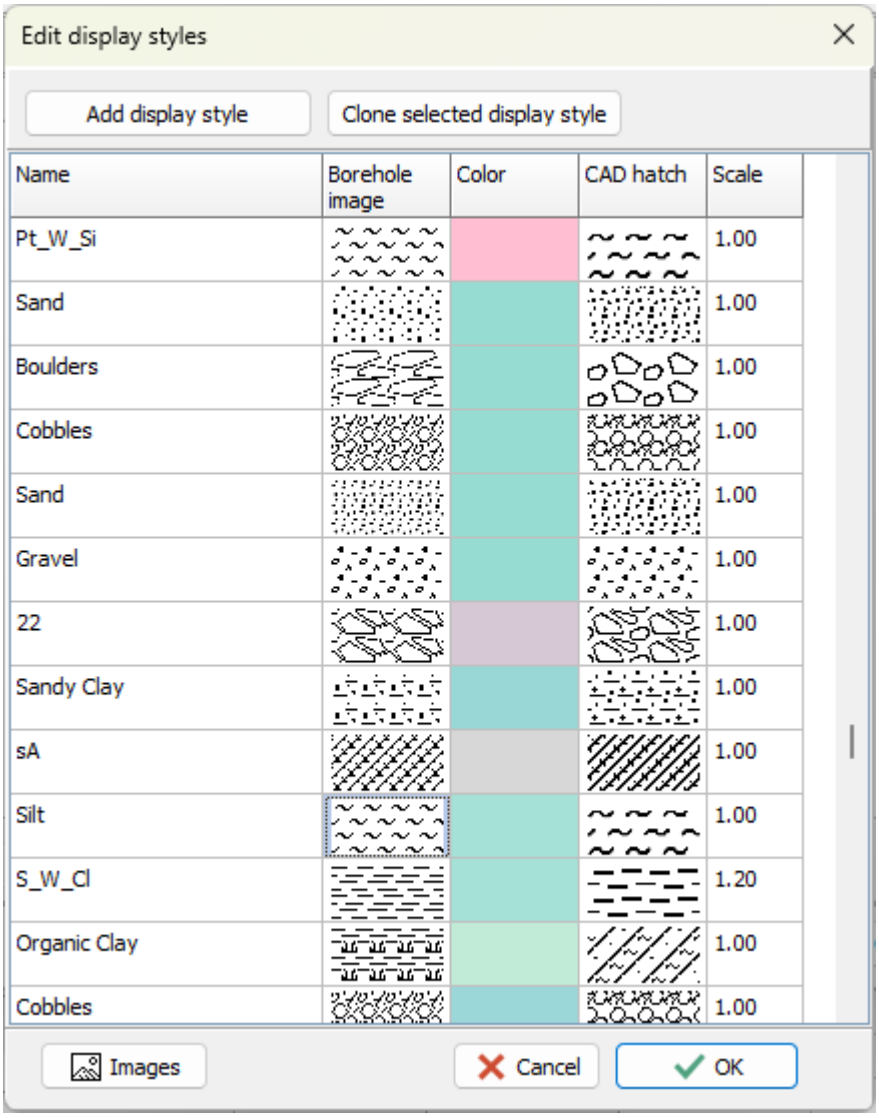
Field description	Value	Unit
Test general		
Test name	T2	
Test type	Piezometric hole	
Company name	Crazy Drillers	
Source owner	Ghost of Tom Joad	
File owner	Neil McCauley	
Geological supervisor	Hans Kloss	
Investigation start date	08.06.2022	
Drilling method	Rotary core drilling	
Test location		
Test location name	On the Other Side of the Mirror	
Height system used	None	
Z value	121.00	
Coordinate system used	None	
X coordinate	95.00	
Y coordinate	138.00	
Latitude		
Longitude		
Highway, railway or dike code		
Location in 'line coordinate'		
Equipment		
Equipment name	None	
Equipment operator	None	
Test circumstances		
Method of backfilling the hole	Cement mixture	

Borehole header data. Only those selected as **Favorites** are visible.

The symbol allows you to open and edit any dictionary at any stage of the program.

Soil Type Table (below). All soil types are represented in the database by **standard**, **name**, **main components**, **genesis**, **chronostratigraphy**, and **display style**.



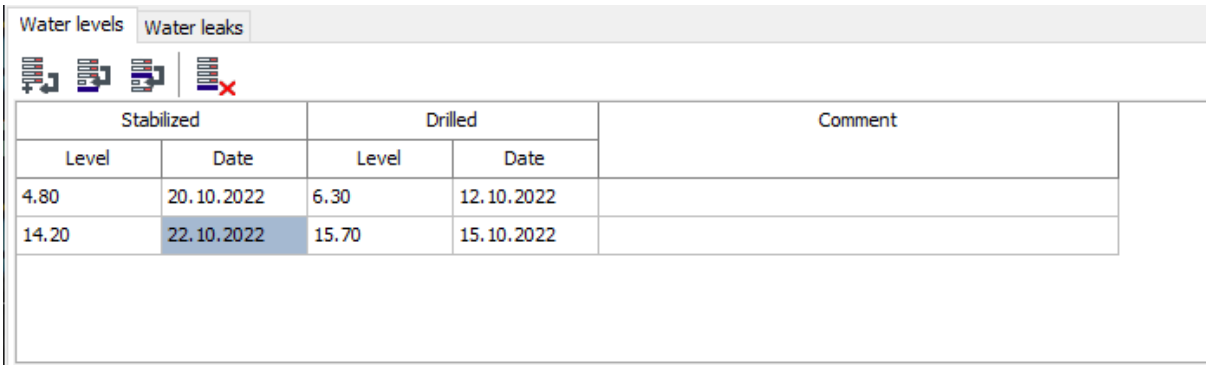


Display style i.e. representing color and pattern can be created by User for each soil type. Patterns can be generated by User due to local requirements.

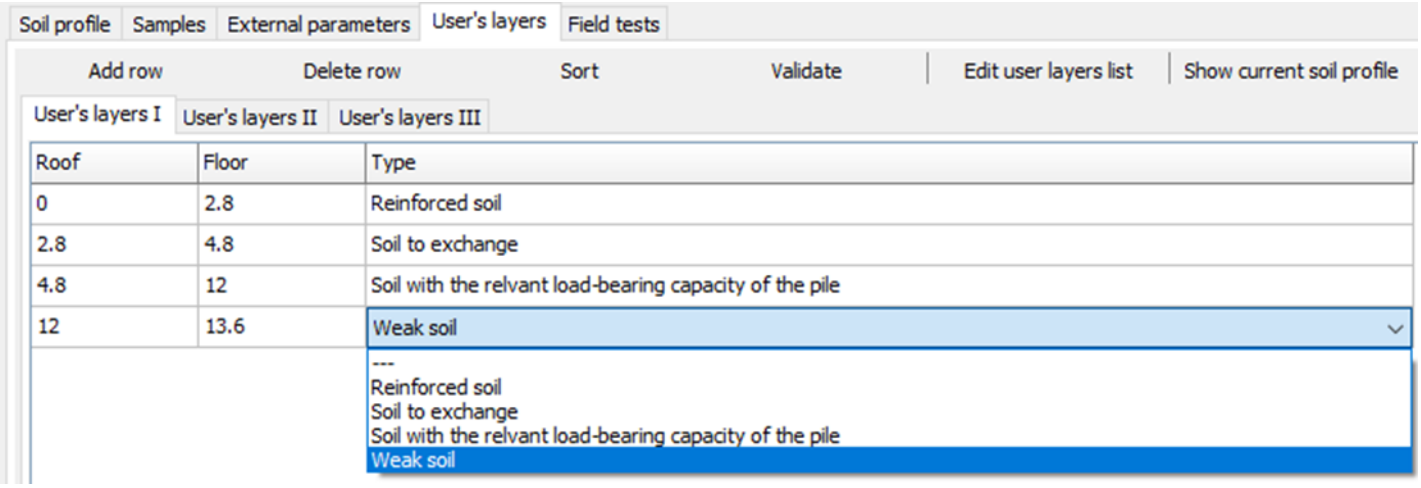
On the borehole log, the hole can be graphically represented using colors and / or patterns.

Hatch patterns are automatically loaded and applied in CPT-CAD module on geotechnical cross-sections.

The **GEO DB** program allows you to enter any amount of information on water levels (drilled and stabilized) and leakage levels into the database. This information can be automatically entered on the borehole log and on the cross-section made in the **CPT-CAD** module.

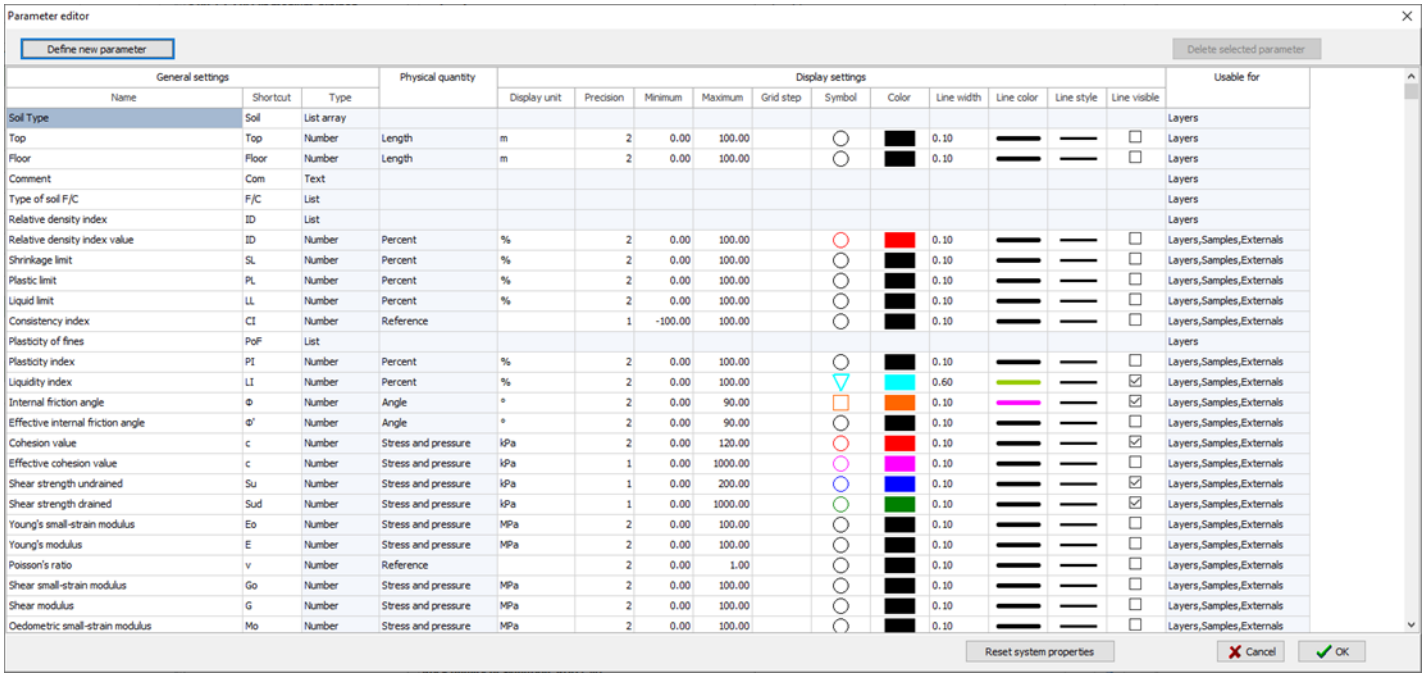


In addition to geological and geotechnical characteristics and the resulting division into layers, the GEO DB program enables the introduction of additional divisions according to other criteria, e.g. according to the criterion of the degree of contamination or the suitability of the soil for the foundation.



The GEO DB program allows you to enter all basic geotechnical and environmental characteristics of the soil into the database.

It was assumed that the parameter values may come from ***laboratory tests*** of soil samples, ***field tests*** and the so-called ***external sources***, including all types of standards, other studies, monographs, etc. The procedures included in the program enable automatic creation of appropriate reports and charts.

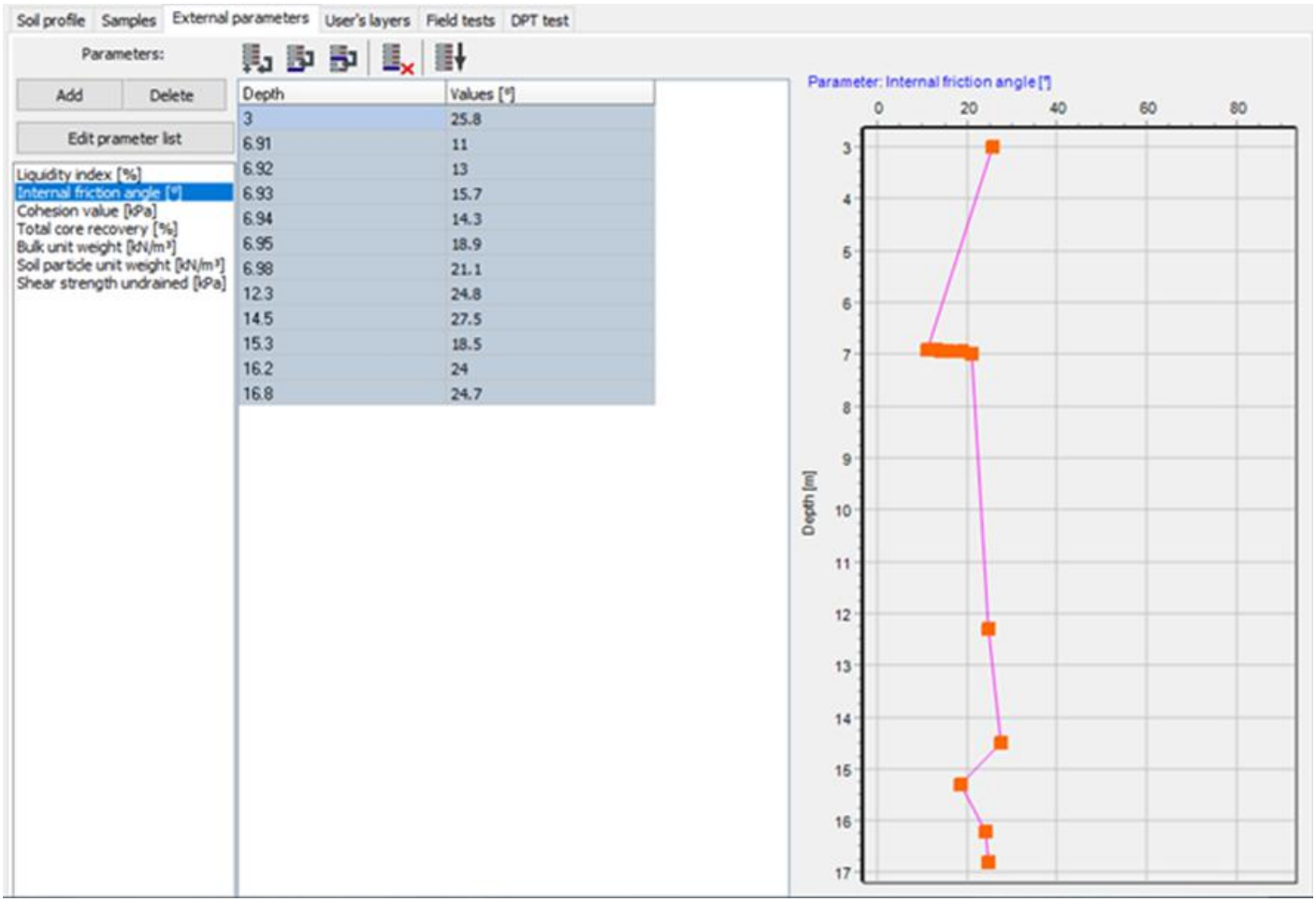


The ***Parameter Editor*** used in **GEO DB** allows you to add any additional parameters of the form [***depth vs. value***], saving their values in the database and generating an appropriate report. The **GEO DB** database allows you to enter information about collected soil samples, including: with basic characteristics of samples, such as type, dimensions, sampler type, date of collection, quality, etc., and assigning parameter values specified in laboratory tests to appropriate samples

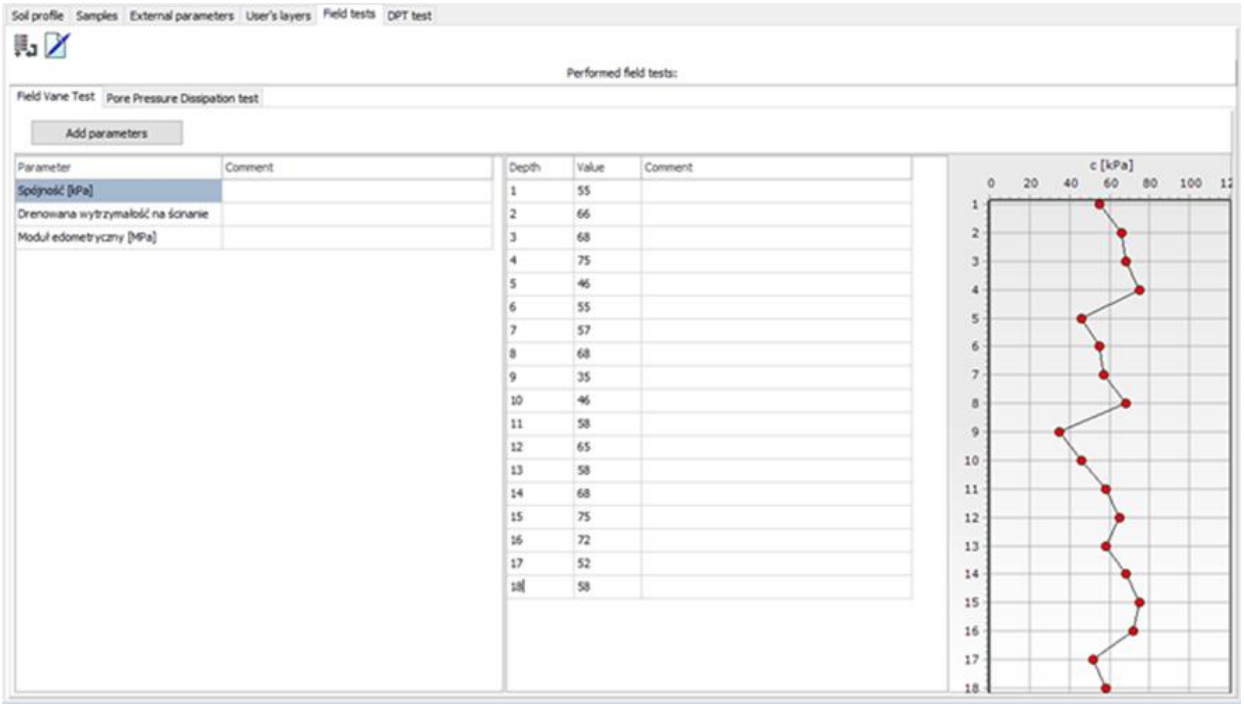
NOTE. By associating soil samples with boreholes, the values of each parameter are associated with a point in the field with coordinates X, Y and Z. X and Y are the rectangular coordinates of the borehole and the Z ordinate results from the ground level and the depth of sampling.

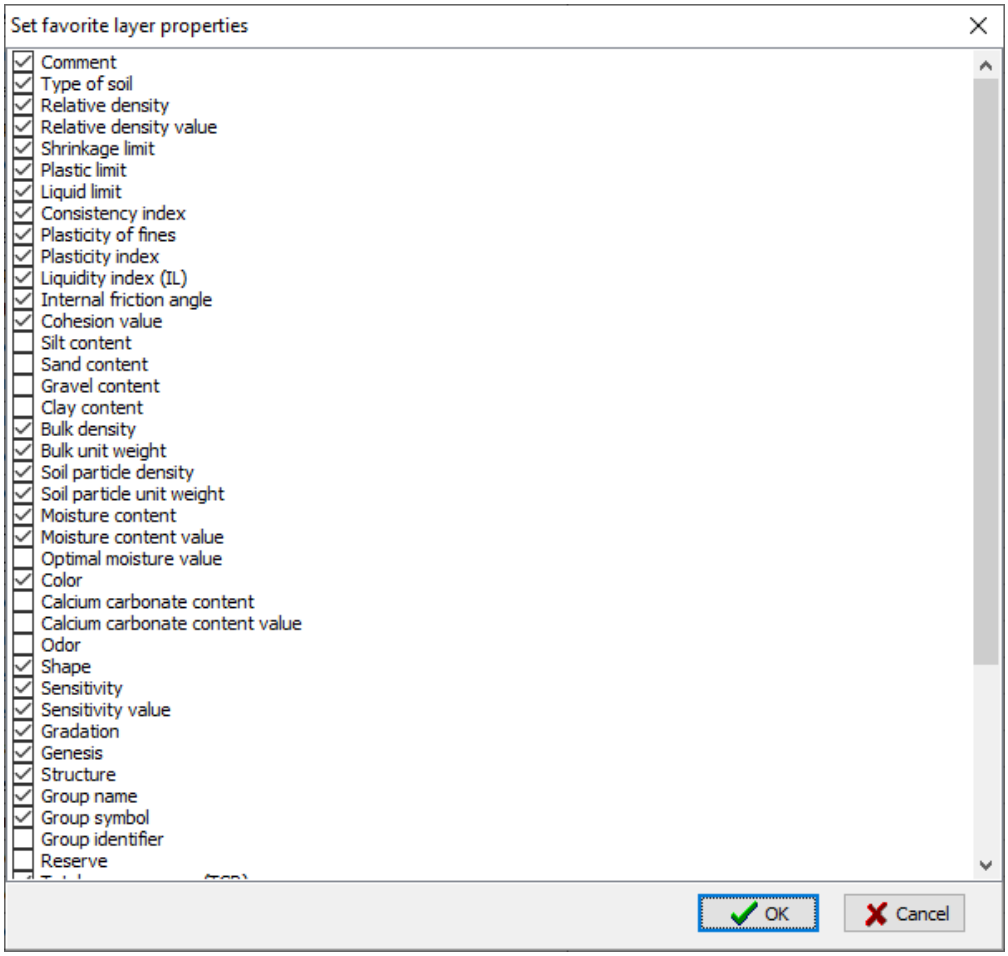
The built-in ***Parameter Editor*** allows you to add your own parameters by defining their name, symbol, type, unit, symbol and line type on the chart

Regardless of the parameters estimated in laboratory tests of samples, **GEO DB allows you to save parameter values from other sources, such as standards, studies, publications**, etc., in the database. Such parameters are called here as ***external parameters***.

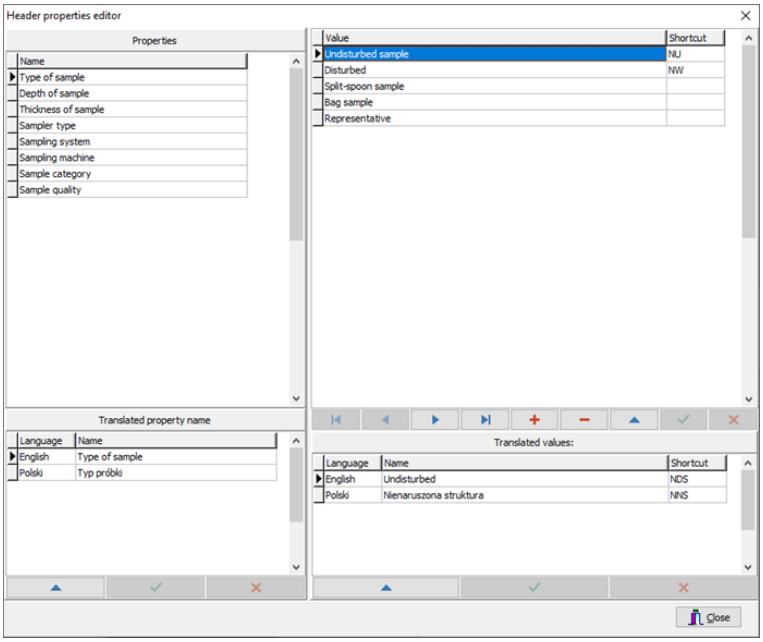


Additionally, the program allows you to enter native values and values interpreted from field tests (e.g. pore pressure measurement with a stationary sensor, pressiometric module, soil sensitivity determined in the FVT test, etc.).



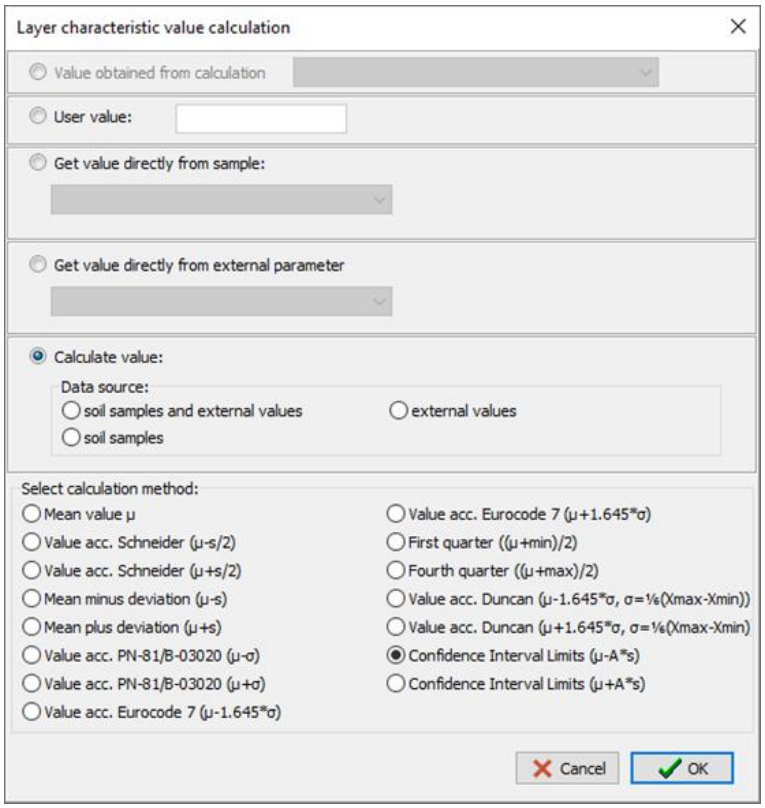


An example set of geotechnical parameters and other soil properties selected to ***Favorites***.



The **GEO DB** program allows you to enter into the database all the basic characteristics of soil samples taken in boreholes, including geotechnical parameters obtained in laboratory tests. The procedures included in the program enable the automatic creation of reports and charts.

CAUTION. By linking the soil samples to the boreholes, the values of each parameter are related to a point in the field with coordinates X, Y and Z. X and Y are the rectangular coordinates of the hole and Z is derived from the ground level and depth of the sample.



The Geo DB program includes procedures for automatic estimation of the *characteristic values of parameters* based on the results of laboratory tests according to. method selected by the User.
Advanced statistical methods are implemented:

- **Eurocode 7**
- **PN-81/B-03020**
- **acc. Schneider, 1997**
- **average value**
- **method I and IV quarters**
- **acc. Duncan, 2000**
- **t-Student's distribution and confidence limits for the estimator of the population mean**

and additionally - the possibility of indicating the value defined in standards or value from other studies.

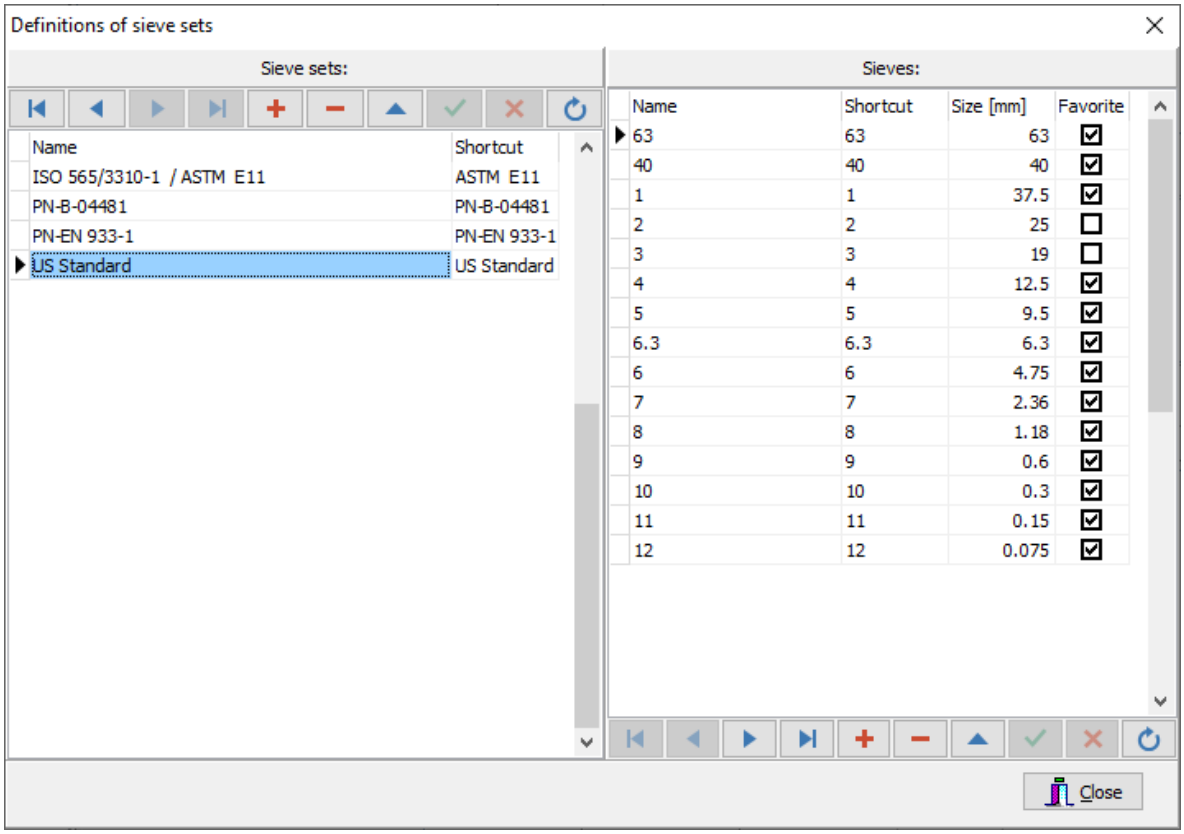
All statistical calculations are performed automatically according to method selected by the User.

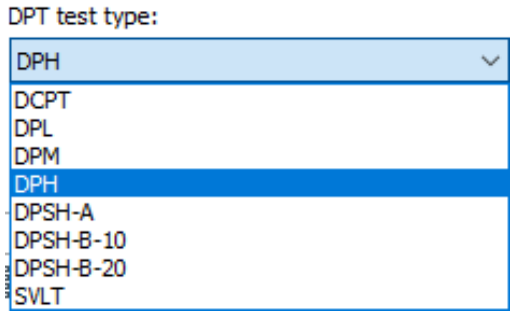
The characteristic value can be estimated for the indicated lithological layer or for the indicated geotechnical layer with a number specified by the User. In the latter case, the characteristic values can be calculated for a single hole or for a selected set of holes in total. The estimated characteristic values of the parameters are saved in the database as characteristics of the appropriate layers.

An important element of laboratory tests is ***sieve analysis***. The results of this analysis are related with the soil sample, and therefore with the hole having its defined place in space. Sieve sizes can be defined by the User depending on the standard used and laboratory equipment.

The sieve analysis report is generated after pressing the [***Report***] button in the appropriate tab. For each tab, the [***Report***] button generates a report specific to the ***sieve standard*** selected in the tab and the set of entered data. The report consists of three main panels:

- Header table
- Grain size chart
- Table containing
  - The content of individual fractions in numerical form
  - Histograms of fraction distribution
    - Detailed histogram for all subfractions
    - Common histogram for main fractions (clay, silt, sand, gravel)
  - Quantiles for individual grain sizes D10, D20…D90
  - Calculated grain size parameters
    - Grain uniformity index **Cu**
    - Grain curvature index **Cc**
  - Percentage of clay fraction **I** [%]

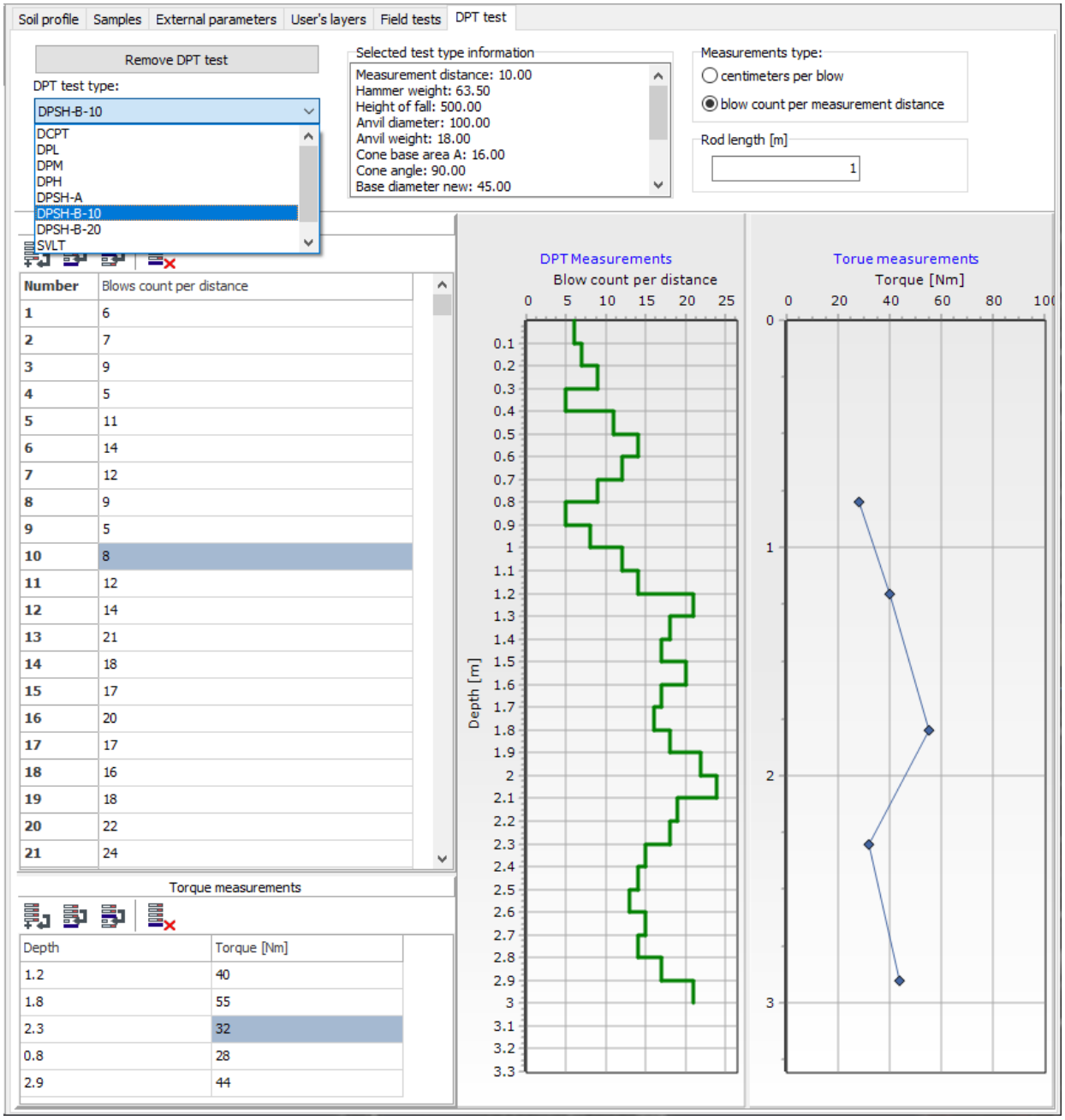




The GEO DB program allows you to enter and interpret the results of all commonly used DPT penetration tests, including **SLVT** tests, where the torque $\mathbf{T_{max}}$ related to the rotation of the vane wings is additionally measured.

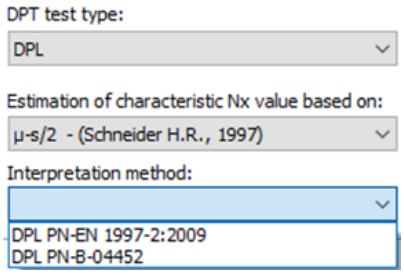
When performing the **DPT** test, it is recommended to rotate the rods with the measurement of the torque **T**. The **GEO DB** program also allows you to enter and present this data on the sounding log.

Dynamic tests (e.g. **SLVT**) are also performed, in which instead of a conical tip, a vane is driven into the ground and, in addition to the standard measurement of the number of blows per 10 cm of drive at selected depths, a torque measurement is performed in cohesive soils to assess shear strength.

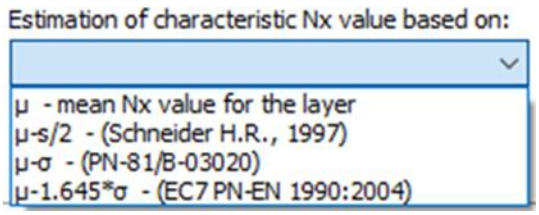


The **GEO DB** program allows you to enter, interpret and present this data on a sounding log. While entering the results of **DPT** soundings, graphs of dependence [***Number of beats per X cm***] and torque diagram (if such a measurement is introduced) are drawn on an ongoing basis in order to control the correctness of the entered data.

The **GEO DB** program allows you to enter measurement results presented as [***Number of beats per X cm***] (where ***X*** is defined by the **DPT** standard), and in the form [***Deep/[cm] per beat***]. The latter system is used in devices with automatic recording of results. [***Deep/[cm] per beat***] form data files can be imported into ***GEO DB***. The results entered in the latter way are automatically converted to the [***Number of beats per X cm***] format and interpreted according to standard methods.



The parameters of each test type are listed after the meaning of the type of **DPT** test being entered. For each interpretation method, the User can choose the method of determining the parameters representative for the separated layer, as described next to it. According to the selection of the DPT test type, a list of available interpretation methods is also created. While entering the results of DPT soundings, dependence graphs [Number of beats per X cm] and torque diagram (if such a measurement is introduced) are drawn on an ongoing basis in order to control the correctness of the entered data.



For each interpretation method appropriate for the selected DPT test type, a representative value of the parameter for the separated strata is calculated according to the statistical procedures presented on left. This value is entered into the appropriate field in the ***Layer properties*** table and can be automatically entered into the hole log and geotechnical sections

The **GEO DB** program enables the **automatic generation of a *borehole log*** containing any set of information related to the selected hole. The borehole log (see below) is fully editable by the User, including the ability to change the contents of the header fields as well as the width and content of individual columns. The geological profile can be represented by filling with patterns or colors assigned to specific soil types.

The **GEO DB** program contains a number of different patterns of hole logs, differing from each other in the number of cells in the header table and the number and type/content of columns.

Column types:

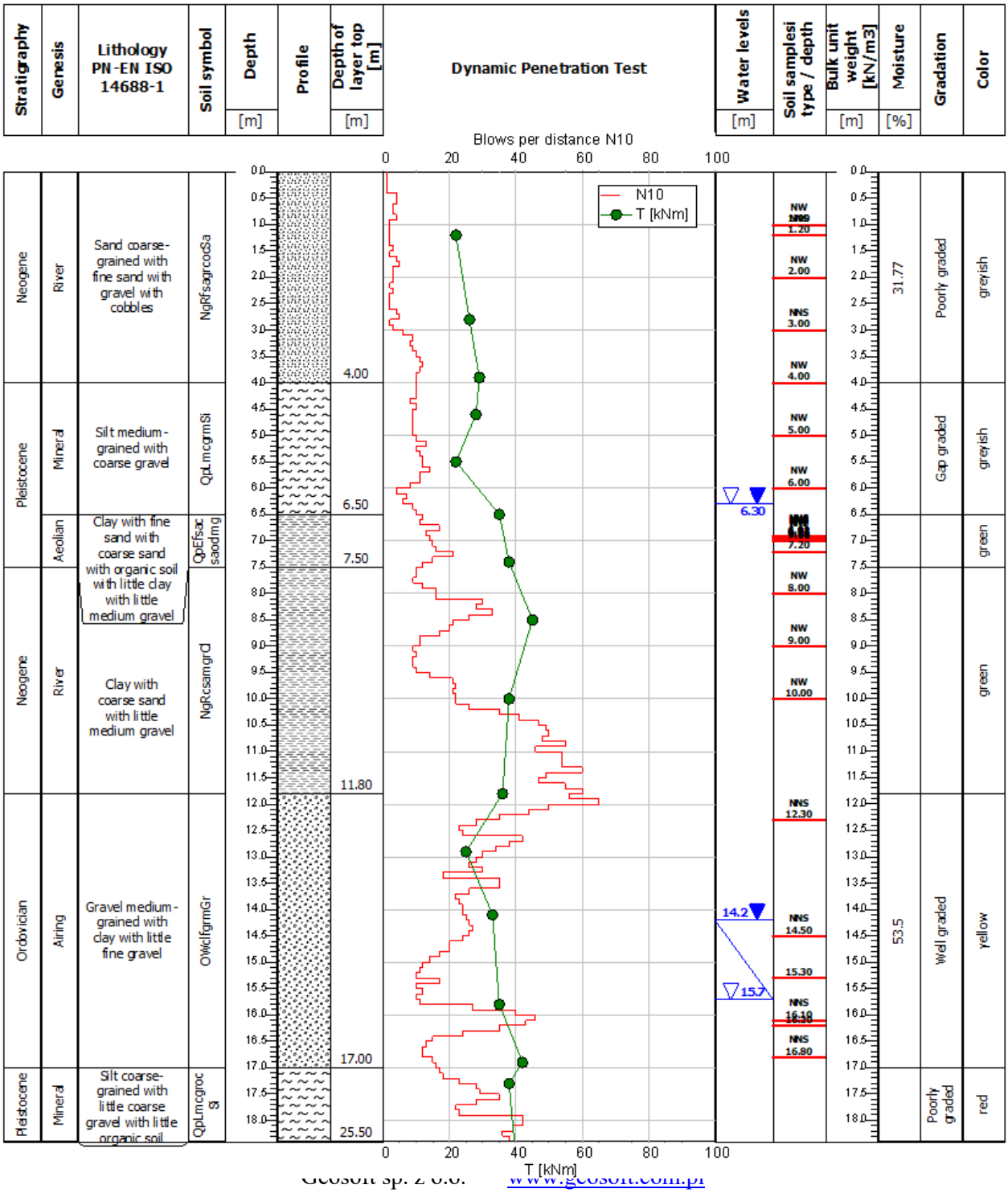
- depth axis
- axis of ordinates Z
- soil profile
- text (soil name, comment, descriptive and numerical parameters of layers, type of gradation, etc.)
- water levels
- water leaks
- hole structure (diameters, casings, filters, backfilling etc.)
- piezometers
- soil samples (type, location)
- graphs
    - parameters determined in laboratory tests of samples
    - dynamic sounding (native and interpreted)
    - field test
    - borehole-related CPT sounding parameters and their interpretation results

Cells in the header table may contain project and borehole header data selected by the User.

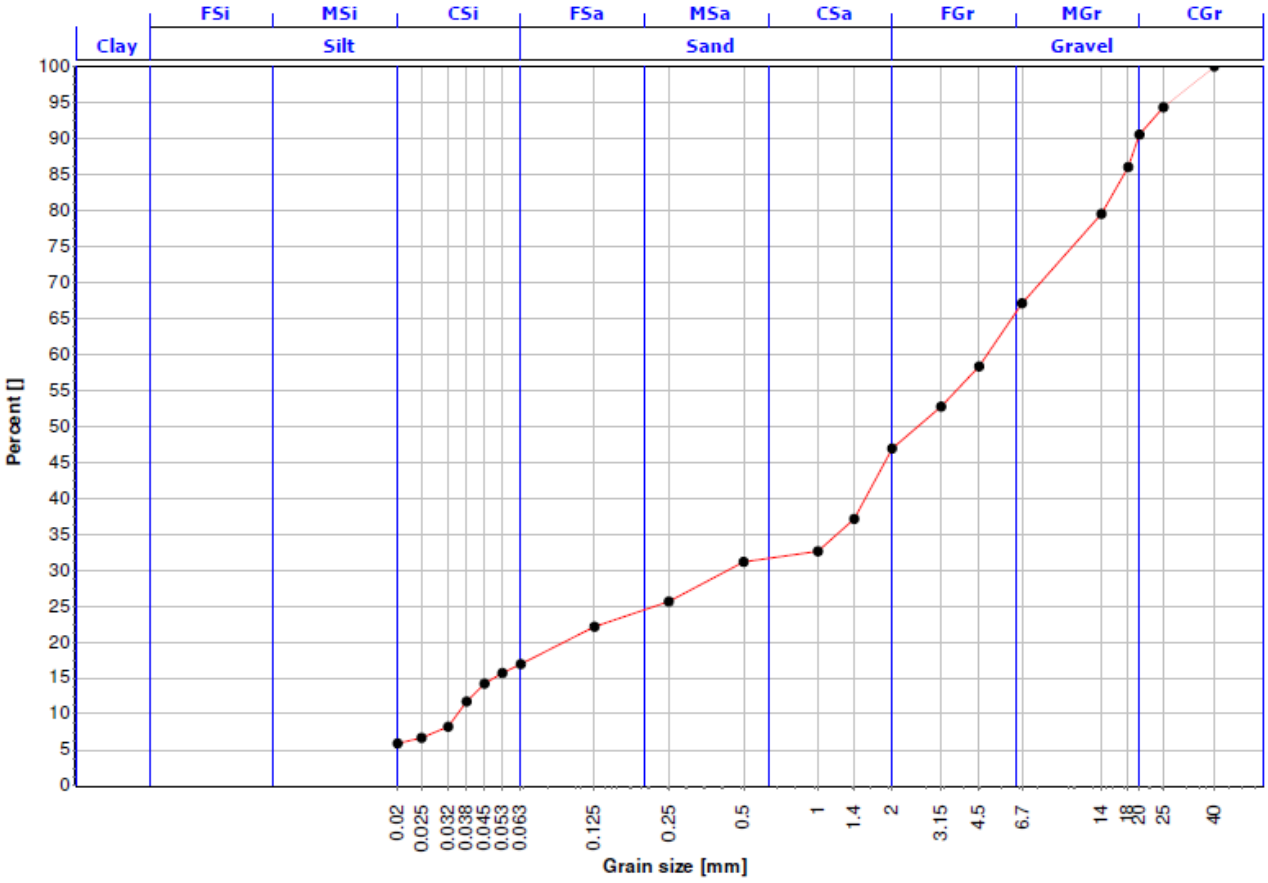
GEO soft	Drawing title: BOREHOLE LOG	Figure Name	
	Hole name: T2	Equipment name: Georig 220	Verical scale: 1:100
Land of project: Florida	Client: Geosoft sp. z o.o.	Drilling method: Rotary dry-cored through-hole drilling	
Province of project: Dade		Z Value: 121.00	
County of project: Hialeah	Project contractors: NASA Inc.	Height system used: WGS84	
Highway, railway or dike code/Mileage: /	Project engineer: don Diego de la Vega	X: 95.00	Y: 138.00
Equipment operator: Hans Kloss	Company name: Crazy Drillers	Coordinate system used	
Geological supervisor: Mia Wallace	Source owner: Ghost of Tom Joad	Investigation start date: 08.06.2022	Backfilling date
Method of backfilling the hole: Cement mixture	File owner: Neil McCauley	Signature	

Stratigraphy	Genesis	Lithology PN-EN ISO 14688-1	Soil symbol	Depth [m]	Depth of layer top [m]	Macroscopic description PN-EN ISO 14688-1	Water levels [m]	Soil samplesi type / depth	Bulk unit weight [kN/m3]	Moisture	Gradation	Color
Neogen	Fluvial	Sand coarse-grained with fine sand with gravel with cobbles	NgRfsagrcocSa	0.0–4.00	4.00	Yellow sands with gravel and cobbles, however but it could be anything else here as well		NM 1.20; NM 2.00; NDS 3.00; NM 4.00	19.2	little moisture	Poorly graded	greyish
Pleistocen	Mineral	Silt medium-grained with coarse gravel	QpLmcgrmSi	4.00–6.50	6.50	Mediuim silts and fine sands of glacial origin		NM 5.00; NM 6.00	18.8	hydrated	Well graded	greyish
Neogen	Fluvial	Clay with coarse sand with little medium gravel	NgRcsa mgrCl	6.50–7.50	7.50	Green clays with organic particles	6.30	NDS 7.00		wet		green
Neogen	Fluvial	Clay with coarse sand with little medium gravel	NgRcsamgrCl	7.50–11.80	11.80	Green clays with organic particles		NM 8.00; NM 9.00; NM 10.00		wet		green
Ordowik	Weathering	Gravel medium-grained with clay with little fine gravel	OWclfgrmGr	11.80–17.00	17.00	Glacial gravels with coarse red sands	14.2; 15.7	NDS 12.30; NDS 14.50; 15.30; NDS 16.10; 16.30; NDS 16.80	21.3	dry	Well graded	yellow
Pleistocen	Mineral	Silt coarse-grained with little coarse gravel with little organic soil	QpLmcgrocSi	17.00–25.50	25.50	Silt coarse-grained with yellow sand and unknown organic particles with a very nasty smell and disgusting color				little moisture	Well graded	red

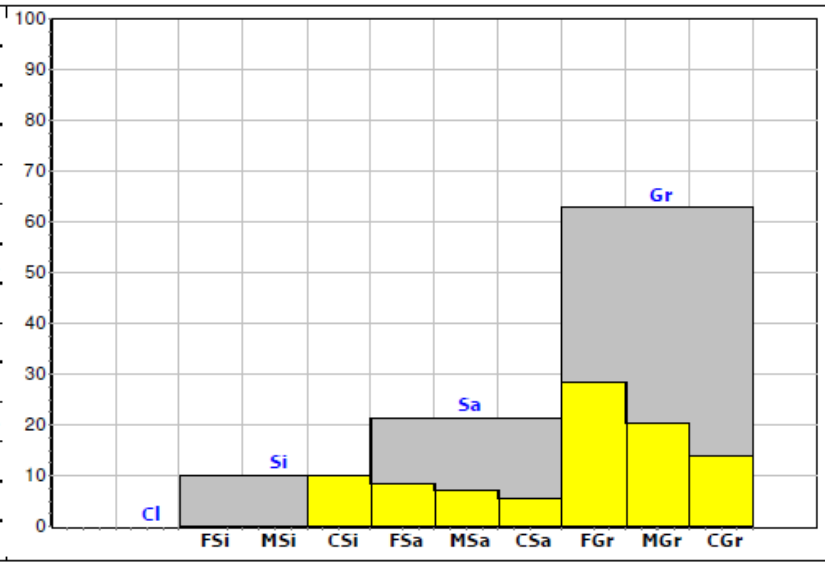
	Drawing title: BOREHOLE LOG	Figure Name	
	Hole name: T2	Equipment name: Georig 220	Verical scale: 1:100
Land of project: Florida	Client: Geosoft sp. z o.o.	Drilling method: Rotary dry-cored through-hole drilling	
Province of project: Dade		Z Value: 121.00	
County of project: Hialeah	Project contractors	Height system used: WGS84	
Highway, railway or dike code/Mileage: /	Project engineer: don Diego de la Vega	X: 95.00	Y: 138.00
Test type: Piezometric hole	Company name: Crazy Drillers	Coordinate system used: WGS84	
Geological supervisor: Mia Wallace	Source owner: Ghost of Tom Joad	Investigation start date: 08.06.2022	Backfilling date
Method of backfilling the hole: Cement mixture	File owner: Neil McCauley	Signature	



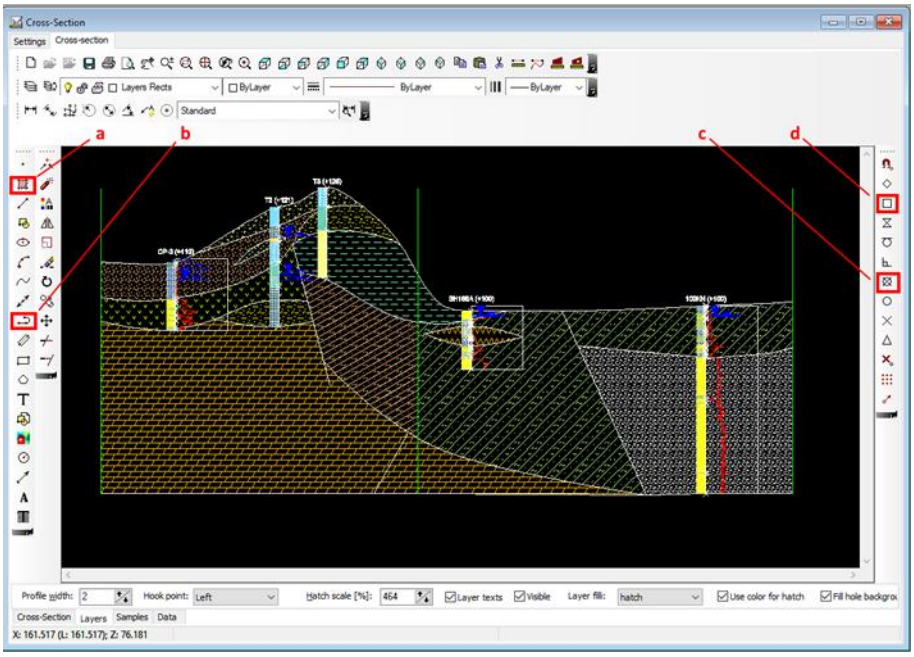
	SIEVE ANALYSIS REPORT/	Figure Name/ /
	Company name: Crazy Drillers	Drilling method: Rotary dry-cored through-hole drilling
Country of Project	Project name: Vega	Depth of sample: 6.91
Province of project: Dade	Project contractors: NASA Inc.	Weight of sample
Land of project: Florida	Hole name: T2	Sieve analysis name
City/Town of project: Miami Beach	Examination laboratory	Sieve sample weight: 1000.00
Date of sampling	Laboratory technician	Sieve set name: ISO 565/3310-1 / ASTM E11
Type of sample: Undisturbed	Date of sieve analysis	Pan weight



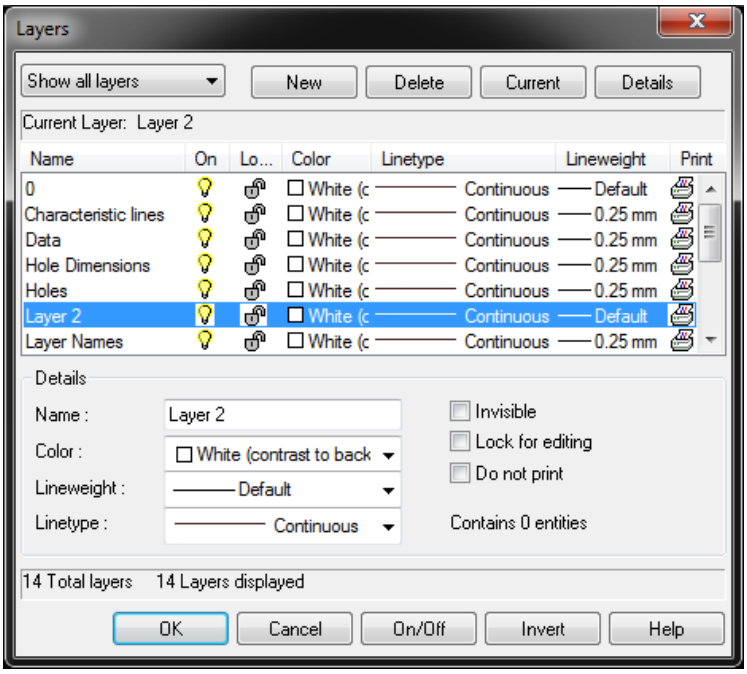
0-0.063	**Cl,Si**	**10.11**
0-0.002	**Cl**	
0.002-0.063	**Si**	**10.11**
0.002-0.0063	FSi	
0.0063-0.02	MSi	
0.02-0.063	CSi	10.11
0.063-2	**Sa**	**21.42**
0.063-0.2	FSa	8.51
0.2-0.63	MSa	7.30
0.63-2	CSa	5.62
2-63	**Gr**	**62.86**
2-6.3	FGr	28.43
6.3-20	MGr	20.52
20-63	CGr	13.91



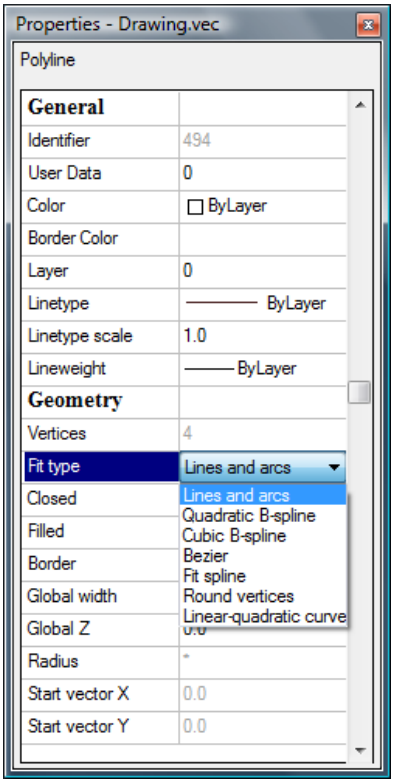
D10 [mm]	0.035
D15 [mm]	0.049
D20 [mm]	0.1
D30 [mm]	0.449
D40 [mm]	1.575
D50 [mm]	2.605
D60 [mm]	4.91
D70 [mm]	8.366
D80 [mm]	14.258
D85 [mm]	17.332
D90 [mm]	19.738
Cc []	1.17
Cu []	140.011
I [%]	



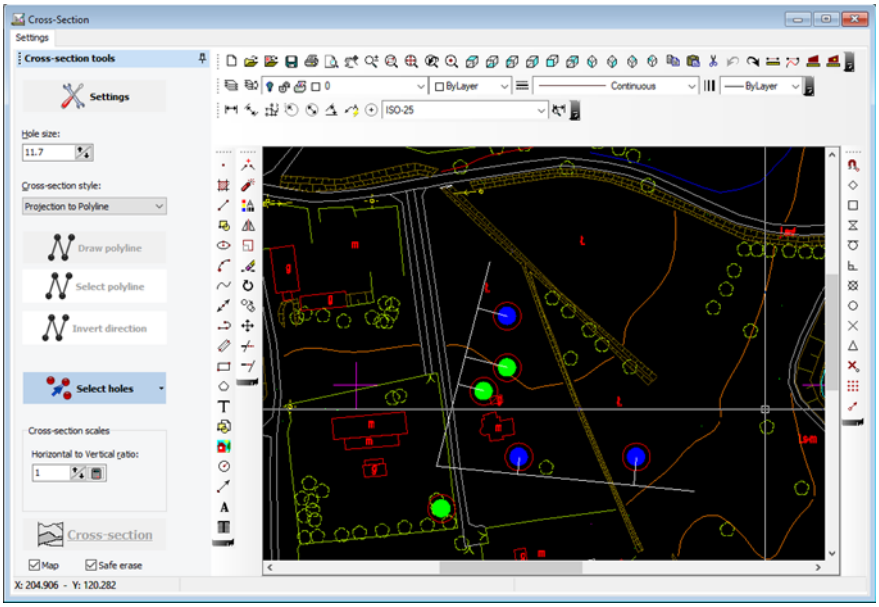
The **GEO DB** program cooperates with the **CPT-CAD** module, used to create geotechnical sections and maps. This module is equipped with CAD type graphics and allows you to create drawings in DXF and DWG formats. Unlike other CAD programs, the **CPT-CAD** module allows you to create cross-sections with different vertical and horizontal scales.



The structure of drawing layers is fully compliant with the structure implemented in CAD programs (eg AutoCAD). This option greatly facilitates the creation and edition of drawings, especially sections and maps.

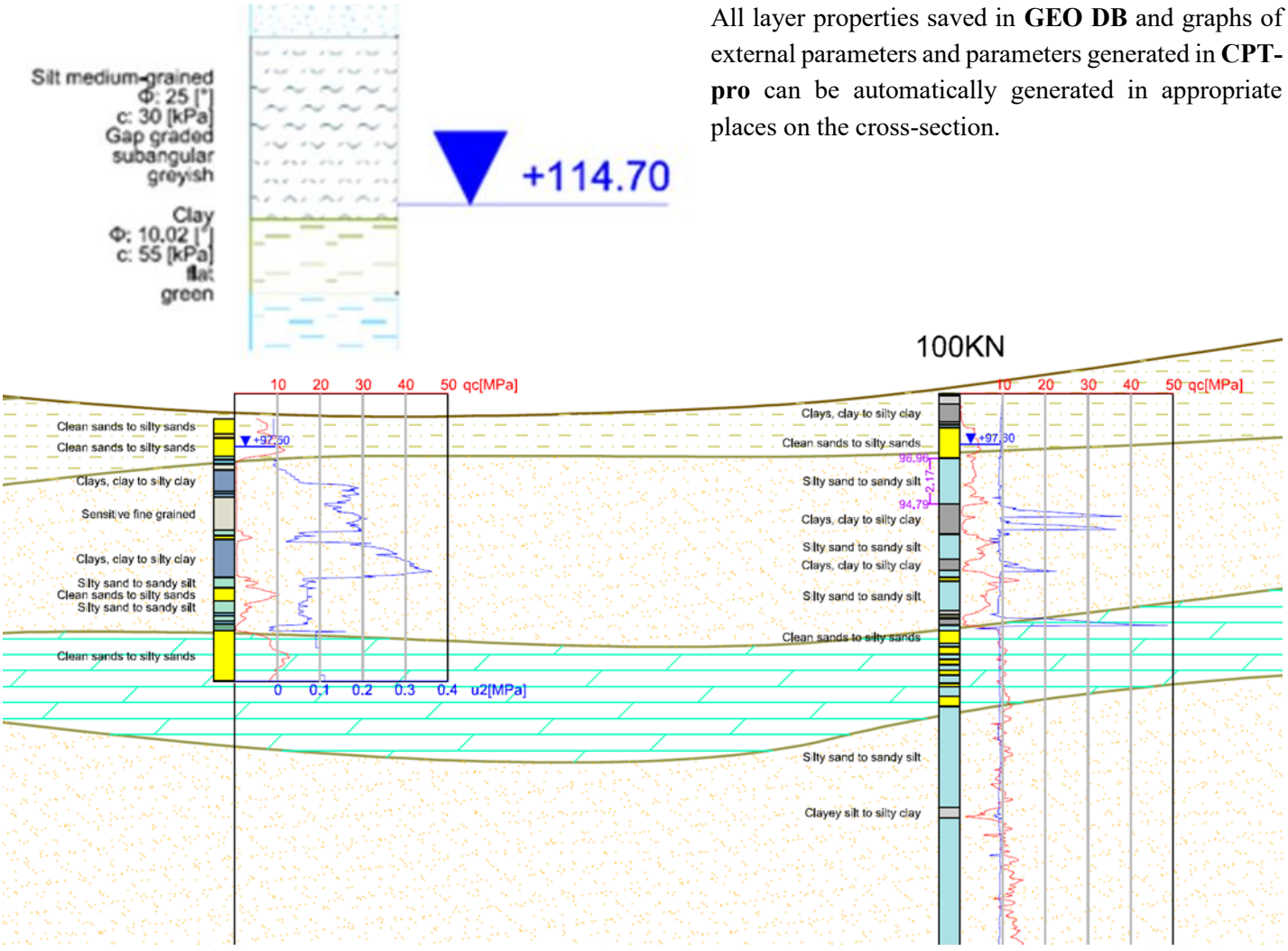


All graphic objects have a number of properties that they can be easily listed and edited. The list of properties is created individually depending on the type of object and contains only the characteristics relevant to that object.



CPT-CAD allows you to create cross-sections along the following lines:

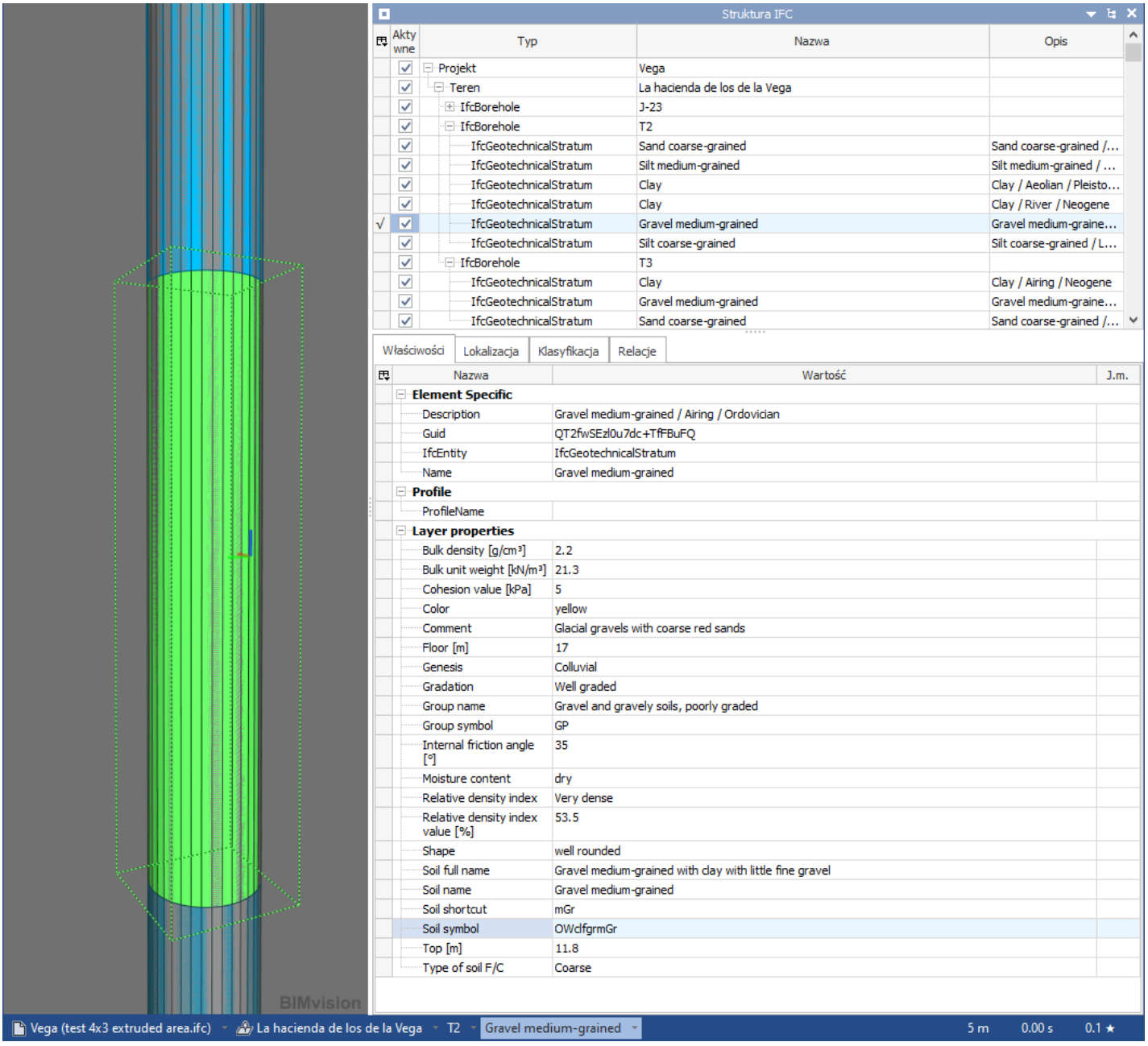
- Straight lines and polylines onto which the selected points are projected
- Polylines "over the holes" that run from hole to hole in the order of selection
- "Road" lines where the distances between the holes are consistent with road coordinates (mileage).



All layer properties saved in **GEO DB** and graphs of external parameters and parameters generated in **CPT-pro** can be automatically generated in appropriate places on the cross-section.

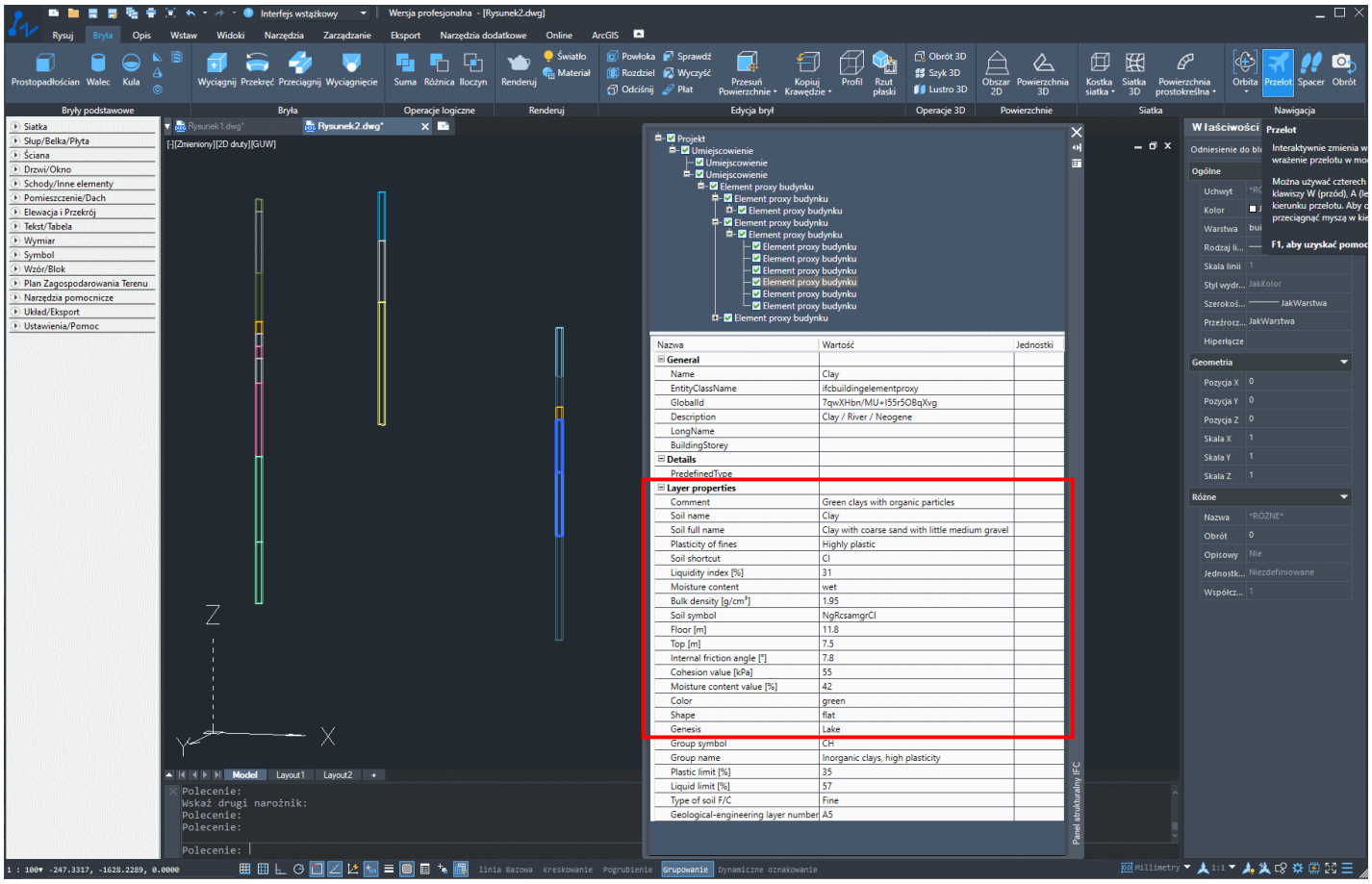
Exporting a single hole or a set of holes assigned to a ***Project*** to the ***IFC (Industry Foundation Classes)*** format ensures compatibility with ***BIM (Building Information Modeling)*** technology and allows for effective sharing[1] of information stored in the **GEO DB** database and archiving it.

IFC files can be opened[2] in some **CAD** type software, like **ZW CAD**



[1] To view **IFC** files, free tools such as ***BIMvision*** or ***BIMcollab*** are sufficient. Access to the **GEO DB** database is not required.
[2] Currently only IFC ver. 2x3, however IFC ver. 4x3 will be also added to next versions of ZW CAD.

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Layer properties		
Comment	Green clays with organic particles	
Soil name	Clay	
Soil full name	Clay with coarse sand with little medium gravel	
Plasticity of fines	Highly plastic	
Soil shortcut	Cl	
Liquidity index [%]	31	
Moisture content	wet	
Bulk density [g/cm^3]	1.95	
Soil symbol	NgRcsamgrCl	
Floor [m]	11.8	
Top [m]	7.5	
Internal friction angle [°]	7.8	
Cohesion value [kPa]	55	
Moisture content value [%]	42	
Color	green	
Shape	flat	
Genesis	Lake	

The **3D** graphic representation of all selected holes divided into lithological layers and the properties of all layers, including the values of geotechnical parameters, are exported to the **IFC** file.

After selecting any selected layer, a window with a list of properties of this layer appears in the graphical representation. After importing such a file into the program ZW CAD, it can be saved in DWG format and reopened with all properties.