

User Guide

PRO

Projected Properties on a Profile View

Version 8.09



Pro – Projected Properties on a Profile View – Version 8.09
User Guide

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PRO - PROJECTED PROPERTIES ON A PROFILE VIEW

1. INTRODUCTION

The **Pro** module is mainly used to display profile views along axes. These profile views show the borings projected on a given axis and their geotechnical properties, as well as the stratigraphic profiles with their respective seismic velocity. Pro is also used to display a plan view and / or a 3D view corresponding to the location plan of the borings and axes.

Pro uses a Graphical User Interface (i.e. with windowing) that is compatible with Microsoft Windows 7, 8 and 10.

Pro uses the Geo, X3D and SM2 libraries created by Sobek Technologies Inc. for data editing, the definition of the presentation style, and viewing and editing graphic results. Please refer to the Geo, X3D and SM2 guides for all details.

2. LAUNCHING THE PRO MODULE



To open **Pro**, double-click on the icon shown here.

The connection to the database can be done directly when calling Pro by entering the following string as target. The string will be:

C:\Geotec80\Bin\Pro.exe username/password@odbc:connection_alias

See paragraph 2 of chapter 2 of the X3D guide for all the details about the connection to a database. Once the connection to a database is done, the user can execute a data query to produce profile views.

When **Pro** is first launched, the following files are loaded from **C:\Geotec80\Style:**

- the markers file **geotec8.mrk**;
- the patterns file **geotec8.ptn**;
- the style file **Pro_Letter_plan-section.sty** which is a classic presentation model showing a plan view and profile view in Letter printing format.

The user can begin working with this initial presentation, or open another style file included with the software. He can modify the style file and save it in a new presentation. In subsequent loadings, Pro opens the style, markers and patterns files that were in use when Pro was closed.

3. FILE, EDIT, INSERT AND VIEW MENUS

None of the options of the **File**, **Edit**, **Insert** and **View** menus is specific to Pro. The detailed description of each option of these menus is done in chapters 2, 3, 4 and 5 of the X3D library guide.

4. TOOLS MENU

The options of the **Tools** menu are used to define the utilisation parameters of Pro and to edit the graphic components produced by Pro: the characteristics of the graphic page, of the graphs and curves, legends, axes, markers and patterns used. All these options are described in details in chapter 6 of the X3D library guide.

Options is specific to Pro. It is presented in paragraph 4.3. The definitions of the graphs and curves are presented succinctly in the following paragraphs.

4.1. Definition of the graphs



The list of graphs is established and updated in the graph editing window opened by selecting the **Graphs...** option of the **Tools** menu or by clicking the button shown on the left. More details about the graph editing are available in paragraph 4 of chapter 6 of the X3D guide. Figure 1 shows the graph editing window in Pro.

The table in this window contains all the graphs defined in the style file used. Each graph is identified by a unique number in the **#** column. The first graph is always **Page** with **# 0**. This graph represents the graphic page and cannot be deleted.

Among the graphs, there are the **primary graphs** whose **#P cell is 0**, the **sub-graphs** whose **#P cell is a negative value**, and the **secondary graphs** whose **#P cell is a positive value**.

4.1.1. The primary graphs

The primary graphs include a plan view, a tridimensional view and one or several profile views:

- **PLAN_VIEW** corresponds to the plan view.

The graph #1 is necessarily **PLAN_VIEW**. The plan view shows with markers the location of the borings. The axes can also be displayed, markers showing their turning points and their ends. Paragraph 10.1 presents this graph. A topographic background can be displayed in the plan view.

- **3D_VIEW** corresponds to the tridimensional view.

The tridimensional view shows as columns the borings and their properties defined as sub-graphs. Paragraph 10.3 presents this graph. A topographic background can be display in the tridimensional view.

- **PROFILE_n** corresponds to a profile view.

The style file can contain several graphs of profile views named **PROFILE_1**, **PROFILE_2**, etc. The **PROFILE_1** graph represents the profiles associated to the first axis retrieved from the query; the **PROFILE_2** graph, the profiles associated to the second axis; etc. If the style file contains only one graph of profile view, **PROFILE_1**, and 2 axes are retrieved in the query, there will be two graphic pages generated; the first showing the profiles associated to the first axis; the second, the profiles associated to the second axis. Paragraph 10.4 presents this graph.

If two graphs have the same name, **PROFILE_1** for example, the user can display the total length of the profiles associated to the axis in two sections by adjusting the limits of the X-axes of the graphs.

Each profile view can show several profiles. Most of the time, the profiles of the natural ground and of the rock are drawn. The seismic velocities can also be displayed along the profiles.

For the primary graphs, the **Left, Width, Right, Bottom, Height** and **Top** fields define their position and dimension; the user can modify these values.

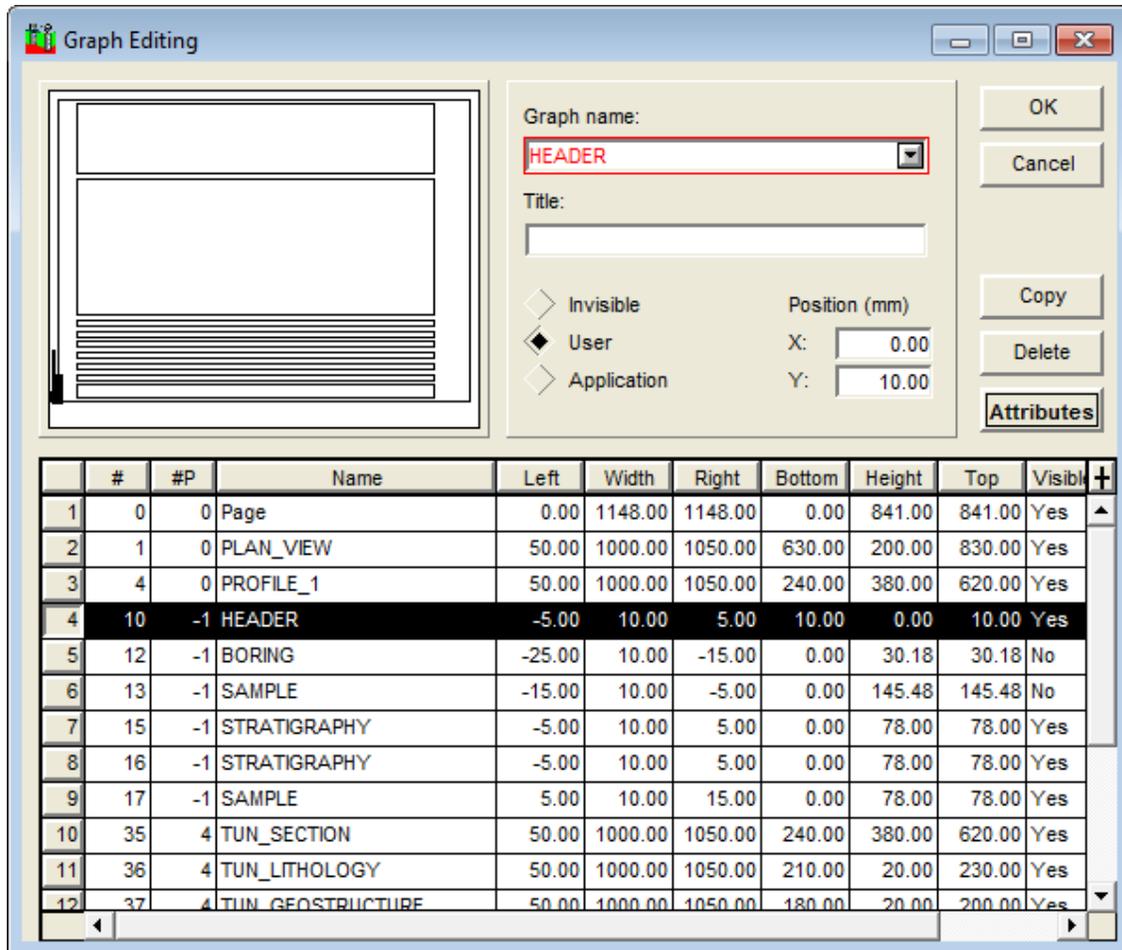


Figure 1 - Graph editing window

4.1.2. The sub-graphs

Among the sub-graphs (negative value in their **#P** cell), **HEADER** is different from the other sub-graphs because it is always present. It defines the boxes that include the identifiers of the borings in the profile(s) and tridimensional view.

The display of this sub-graph and the size of the elements represented (rectangles, squares, circles or ellipses) are defined in the options window. See paragraph 4.3 for the details.

The other sub-graphs define the presence and the size of the property columns of the borings represented on the profile(s) and tridimensional view. The content of these graphs is defined in the legend and curves editing window. See paragraph 4.2 for details.

For the **HEADER** sub-graph, the **Left, Width, Right, Bottom, Height** and **Top** fields reflect the position and size of the eventual identification boxes of the borings as defined in the options window. See paragraph 11.4 for the details.

For the other sub-graphs, the **Left, Width** and **Right** fields define the layout of the property columns with respect to the axis of the boring and the width of these columns. The **Bottom, Height** and **Top** fields are not used.

4.1.3. The secondary graphs

The secondary graphs are dependent on the primary graph whose number appears in the **#P** column; in our example, PROFILE_1. The secondary graphs have the same X-axis as the profile, i.e. the chainage.

For the secondary graphs, the **Left, Width, Right, Bottom, Height** and **Top** fields define their position and dimension in the page; the user can modify these values.

4.1.4. Addition and substitution of graphs

The user can add a graph or replace a graph with another. **Pro** automatically manages the numbering of the graphs; however the user decides if the new graph is a primary graph, a sub-graph or a secondary graph. The user selects the graph name in the scrolling list displayed by clicking on the button to the right of the **Name** cell.

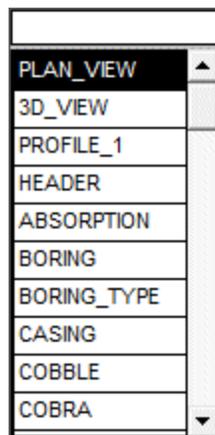


Figure 2 - Scrolling list of graphs

The scrolling list of graphs presented in figure 2 shows the **PLAN_VIEW, 3D_VIEW, PROFILE_1** and **HEADER** graphs, which are presented at paragraphs 10.1, 10.3, 10.4 and 11.4 respectively. These graphs are followed by the list of tables and views in the database that contain a depth field and / or a sample number, as well as the tunnel tables starting with **TUN_**, if they exist in the database. To create one or several additional profiles, the user will replace the "1" with the number of the profile view.

After selecting in the scrolling list a table or view name, the user will be able to create a sub-graph or a secondary graph. Details are presented in paragraphs 11 and 12.

After creating a new graph or replacing a graph with another, the user must execute a new query for the data associated to the new graph to be read in the database and the graph filled with information.

The user can also define a graph whose name is not in the scrolling list to add objects in the space occupied by this graph. These objects are usually general information such as the site number, the company logo, etc. Chapter 4 of the X3D library guide describes object editing.

4.2. Definition of the curves



The list of curves of a graph is established and updated in the legend and curves editing window opened by selecting the **Legend** option of the **Tools** menu or by clicking on the button shown here. More details about the legend and curves editing are available in paragraph 5 of chapter 6 of the X3D guide. Figure 3 shows the curves editing window for a STRATIGRAPHY sub-graph.

The **PLAN_VIEW** and **3D_VIEW** primary graphs only have predefined curves; **PROFILE_n** can also have curves inserted by the user. These graphs are described in paragraphs 10.1, 10.3 and 10.4.

If the selected graph has predefined curves, they will be displayed in the table at the bottom of the window with a number greater or equal to **100**. If the user deletes the predefined curves, they will be regenerated when he opens the window again.

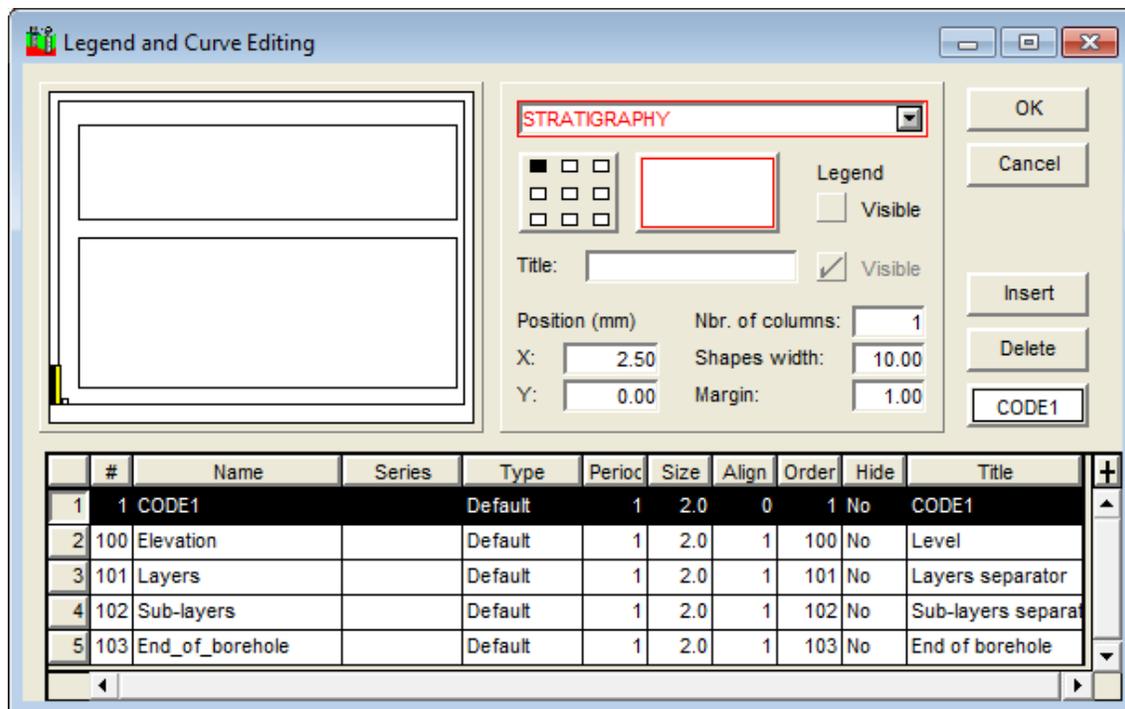


Figure 3 - Curves editing window

Except for the **PIEZOMETER** sub-graph which only contains predefined curves (see paragraph 11.7), the user can define one or several curves per sub-graph or secondary graph. For this, the user inserts a curve whose number is automatically generated and chooses the name of the curve from the scrolling list associated to the **Name** field. The scrolling list is the list of the fields from the table to which the sub-graph or secondary graph is associated.

If the user replaced a sub-graph or secondary graph with another one, the curves are not automatically modified. The user will delete the curves from the previous sub-graph or secondary graph or choose the new curves from the scrolling list of the **Name** column.

4.3. Options



The **Options** item of the **Tools** menu or the button shown here opens the window of options for geotechnical properties display, shown in figure 4 and figure 5.

4.3.1. Selection of axes and borings

In the rectangle labelled “**Selection of axes and borings**”, the user manages several parameters to refine the selection of borings and axes from his query, which are then displayed on the play view and the profile(s).

- **Display profile:**

The user can choose to display the profile of the **current axis** or of **all selected axes**.

When we display the profile of the **current axis**, only the PROFILE_1 graph is used, and the user can navigate between all axes retrieved.

When the profiles of **all selected axes** are displayed, PROFILE_1 will display the data of the 1st axis retrieved, PROFILE_2 of the 2nd axis, etc.

The plan view will display, respectively, only the current axis or all selected axes.

- **Display borings:**

The user can choose to display the borings of the **current site** or of **all nearby sites**. With the 1st option, only the borings of the site to which the axis belongs will be displayed; with the 2nd option, the borings located near the axis will be displayed, no matter their site. This applies for the profile(s) and plan views.

- **Limit around the axis:**

The box ‘**retrieve only borings close to current axis**’ is used to retrieve a rectangular limit around the axis, of a distance specified in the following field. If the option ‘display borings of all nearby sites’ is selected, Pro retrieves only the borings around the current axis, otherwise a very large number of data could be returned. In this case, the box cannot be unchecked.

Please note: The borings with a zone number different than the zone of the axis’s site are not retrieved. If the zones are not specified, Pro does not apply any restriction.

- **Distance for projection:**

Pro projects on the profiles the borings located within a given distance on both sides of an axis. The field “**Distance to the axis beyond which a boring is not displayed on a profile**” is used to enter the maximum offset beyond which the borings are no longer represented on the profiles. A boring located at a distance smaller or equal to the maximum distance from an axis will be represented on the profile of said axis. However, if a value is

indicated as range in the field **DISTANCE** of the **AXIS** table, it has precedence over the value described above.

- **Distance for offset to axis:**

In the field “**Distance to the axis beyond which the offset to the axis is indicated**”, the user defines the distance within which the borings are considered to be on the axis; then, the offset with respect to the axis is not indicated.

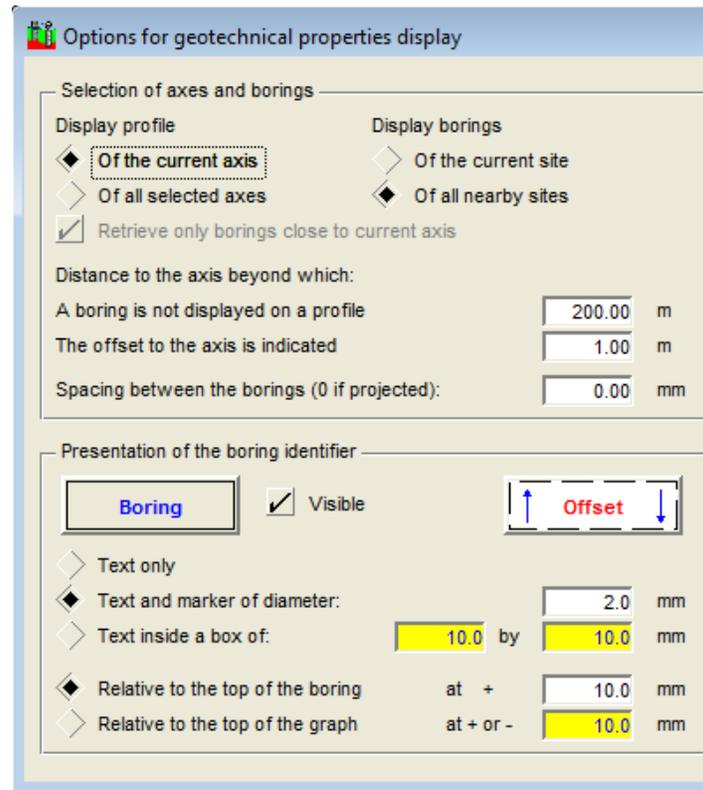


Figure 4 - Options for geotechnical properties display (left side of window)

- **Spacing between the borings:**

With Pro, the user can also display the borings on the profiles not at their real distance along the profiles but at an equal distance from each other. The field “**Spacing between the borings**” is used to define the fixed spacing, in millimeters, between the borings in the profiles. The borings remain distributed in the order in which they would be if they were projected.

If this spacing is **0**, the borings are projected at their exact position. With a spacing different than **0**, the profiles and seismic velocities are not displayed, and the borings are represented vertically, independently of their dip. Also, all options of the rectangle **Presentation of axis points and seismic lines** are deactivated.

If the user wants to represent borings in a profile without knowing their coordinates, their chainage and their offset along the profile, he can associate each boring to the desired axis and enter, as the chainage, the sequence number in which each boring is to be displayed.

To avoid borings from overlapping, the user must use a spacing greater than the sum of the widths of the property columns displayed.

4.3.2. Presentation of the boring identifier

In the rectangle labelled “**Presentation of the boring identifier**”, the user defines the presentation parameters for the profile(s) and 3D view.

- **Button Boring:**

The button labelled **Boring** opens the drawing attributes window, where the user can define how the boring numbers, the boxes and / or the markers (color) will be drawn. These attributes correspond to those of the **Boring** curve of the HEADER sub-graph (see paragraph 11.4).

- **Box Visible:**

The user can show or hide the boring identifiers in the profile(s) and 3D view, by checking or unchecking the box **Visible**.

- **Choice of the boring identifier:**

The user can choose the boring identifiers for the profile(s) and 3D view:

- their number only;
- their **number above a marker** characteristic of the type and state of the boring; the user defines the diameter of the marker, in millimeters.

the marker used for each boring is the one in the current markers file whose name is the concatenation of the type and state of the boring, for example TP_R for a realized test pit. If no corresponding marker is found, the one defined in the button Boring will be used.

- their **number inside a box** whose dimensions in millimeters are defined by the user; the test pits and trenches have rectangular or square boxes; the other borings, elliptical or circular boxes.

the boxes are separated horizontally in two parts. The top part shows the boring number, before the first dash -, underscore _ or space. The bottom part shows the rest of the boring number. If no dash, underscore or space is found, the top will indicate the boring type, and the bottom will indicate the entire boring number.

- **Position of the boring identifiers:**

The user can define the position of the boring identifiers, in millimeters:

- relative to the **top of the boring**, and necessarily above; or,
- relative to the **top of the graph**; if the distance is negative, the identifiers are displayed inside the graph; if the distance is positive, the identifiers are displayed outside the graph.

- **Button Offset:**

For a boring displayed on a profile view, when its offset to the axis is greater than the minimum specified distance (see paragraph 4.3.1), some drawing attributes can be defined.

The offset value can be displayed between the top of the boring and its identifier, next to an arrow (marker) indicating on which side of the axis the boring is located. An up-arrow indicates that the boring is left of the axis. A down-arrow indicates that the boring is right of the axis. The right and the left of the axis are determined from the point of view of an observer located on the axis point with smallest index, and facing towards the other end.

In addition, the border of the CODE1 column of Stratigraphy can be set with different attributes, i.e. another color and/or with dotted or dashed lines, to highlight the borings far from the axis. By default, a dashed line is used.

The button labelled **Offset** opens the drawing attributes window, where the user can define how the offset values, the marker and the border around the CODE1 column of Stratigraphy will be displayed. These attributes correspond to those of the **Offset** curve of the HEADER sub-graph (see paragraph 11.4).

The marker used by default for the offset is the one in the current markers file whose name is **Offset**. If no marker with this name is found, the one defined in the Offset button will be used. The marker is always displayed right of the line linking the identifier to the top of the boring. The user can modify the color and dimension of the marker, and choose another than the one named Offset.

- For the plan view, the attributes of the markers are modified in the legend and curves editing window for the PLAN_VIEW (see paragraph 10.1).

4.3.3. Presentation of axis points and sismic lines

All the following options can be activated except for profiles with equidistant borings.

- **End points of the axis:**

By checking this option, a vertical line is displayed in the profile view at the position of the 1st point and last point of the axis. The marker **pnt_axe** is used by default to identify the end points. If no marker with this name is found, the one defined in the attributes button will be used. This marker is displayed at the distance above the graph specified by the user. The vertical line stops at the position of the projection of the axis line at the bottom of the graph (see its description below).

The end point is identified as follows: if there is not dash in the axis number, the rank of the axis point is added at the end (example: axis A, end points A-1 and A-4 if the axis has 4 points). If there are dashes in the axis number, the rank of the axis point is added before the last dash (example: axis LS-150-15, end points LS-150-1-15 and LS-150-4-15 if the axis has 4 points).

The button on the right is used to define the attributes of the vertical line, the marker and the text.

- **Intermediate points of the axis:**

By checking this option, a vertical line is displayed in the profile view at the position of each intermediate point of the axis. The marker **pnt_int** is used by default to identify the intermediate points. If no marker with this name is found, the one defined in the attributes button will be used. This marker is displayed at the distance above the graph specified by the user. The vertical line stops at the upper surface of the sismic profiles. If there is no sismic profile, the vertical line stops at the intersection of the imaginary line joining the top of each boring.

The intermediate points are identified as follows: if there is not dash in the axis number, the rank of the axis point is added at the end (example: axis A, points A-2 and A-3 if the axis has 4 points). If there are dashes in the axis number, the rank of the axis point is added before the last dash (example: axis LS-150-15, points LS-150-2-15 and LS-150-3-15 if the axis has 4 points).

The button on the right is used to define the attributes of the vertical line, the marker and the text.

- **Intersection of sismic lines:**

By checking this option, a vertical line is displayed in the profile view at the position of the intersection of any sismic line (axis of type LS). The marker **hor_bar** is used by default to identify the intersections. If no marker with this name is found, the one defined in the attributes button will be used. This marker is displayed at the distance above the graph specified by the user. The vertical line stops at the upper surface of the sismic profiles. If there is no sismic profile, the vertical line stops at the intersection of the imaginary line joining the top of each boring.

By default, the intersections are identified with INT. above the number of the intersected sismic line. This format can be modified. The button on the right is used to define the attributes of the vertical line, the marker and the text.

When this option is checked, the sismic lines (axes of type LS) are also displayed in the plan view as information, with the same line color as the one defined by the user. The sismic lines displayed are either the ones of the current site or of the nearby sites (see paragraph 4.3.1).

- **Projection of the axis line:**

By checking this option, a horizontal line showing the projection of the axis line is displayed in the profile view at the distance below the graph specified by the user. It joins the end points of the axis, if they are displayed. The axis number is indicated in the center of the projection line.

In case of sismic lines, a marker is displayed at the position of the 1st and last geophone. By default, the marker LS_R (realized sismic line) is used. If it is not a sismic line (ex: a surveyed or implementation line), the marker named TYPE_STATE (ex: LA_R, LI_P) will be used and the markers will be displayed at the position of the axis end points. If the marker is not found, the one defined in the attributes button will be used.

The button on the right is used to define the attributes of the horizontal line, the marker and the text.

- **Sismic velocity:**

Except for the profile of the natural ground which is often surveyed, the profiles of the various horizons are very often the result of the interpretation of seismic tests. A series of uniformly spaced geophones record the velocity of seismic waves moving across the different layers. The elevations of the top of the layers under each geophone are inferred from these velocities.

In the **AXIS_PROFILE** table, each record of a profile point is identified by the axis number to which the profile is associated, the material defining the profile, the chainage of the geophone, the elevation of the top of the layer at this geophone's location and the seismic velocity for the layer.

By checking this option, the seismic velocity and a marker limiting each range of seismic velocities along the profiles are displayed. Otherwise, only the seismic profiles are displayed. By default, the marker **Velocity** (vertical bar) is used but can be modified using the attributes button. If the period of the marker is 1, the seismic velocity is displayed at the location of each geophone for all the profiles, and the marker limiting the ranges of velocities is not

displayed. If the period x of the marker is greater than 1, the seismic velocity is displayed at each x geophone for each range where the seismic velocity is the same. The marker limiting the ranges of velocities is also displayed.

The **spacing between the geophones** is used to define the maximum distance between 2 points of a profile, otherwise the profile and the display of the ranges of seismic velocities are interrupted between these points. If a value is indicated as spacing between the geophones in the field **SPACING** of the **AXIS** table, it has precedence over the value described above.

The option **Use strata color for the text and velocity marker** can be checked to distinguish more easily the velocities and ranges associated to each profile. The color of the profile material is then used for each element (see paragraph 10.4).

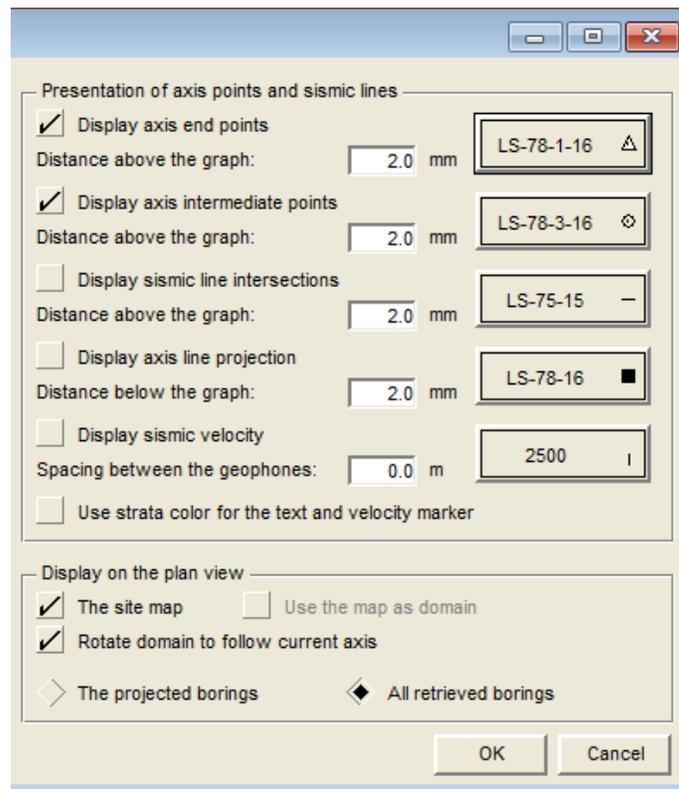


Figure 5 - Options for geotechnical properties display (right side of window)

4.3.4. Display on the plan view

In the rectangle labelled “**Display on the plan view**”, the user defines presentation parameters.

- **Site map:**

The user can display the **site map** in the plan view by checking the corresponding box. This map, whose name is entered in the **FILE_NAME** field of the **SITE** table, must be located in the input files directory or have its path specified with the file name, and be of cartographic type (.sit, .dxf)

- **Use the map as domain:**

By checking the box “**use the map as domain**”, Pro will use the domain of the site map as the current domain. If this box is not checked, the current domain will either be the one

defined in the SITE table with the fields EASTING, NORTHING, WIDTH and HEIGHT, or, if these fields don't all have a value, the current domain will be the domain around the axes and borings displayed.

- **Rotate domain to follow current axis:**

By checking the box “**rotate domain to follow current axis**”, Pro adjusts the orientation of the plan view for the axis to follow the profile view. If the box isn't checked, the plan view is oriented with the North towards the top.



The marker named **North** of the markers file can be added to the style file as a polyline with one point. The user can adjust the marker diameter. When the option **rotate domain to follow current axis** is checked, the marker **North** is automatically rotated to point towards the North. When the option is not checked, the marker is not displayed.

- **Display of borings:**

With the radio buttons **projected borings** and **all retrieved borings**, the user chooses to display in the plan view only the borings that are projected, or all the borings retrieved by the query. In the case of equidistant borings, only those within the distance to the axis specified, or inside the limit around the current axis (see paragraph 4.3.1) are displayed in the plan view if the option **projected borings** is checked.

5. DATA MENU

The options of the **Data** menu are detailed in chapter 7 of the X3D guide. The options are mainly used to retrieve data in the tables of the **Geotec** database. In Pro, the default retrieval (**simple query**) is done on the **Axis** table.

In Pro, the data entry options available in the **Data** menu (**Entry** option) and with the buttons of the application toolbar () are those of **Site**, **Axis**, **Tunnel**, **Boring**, **Stratigraphy** and **Sample**. The user first inserts the sites, followed by the axes and borings related to the sites, then the stratigraphy of the borings, and finally the samples from the borings. Some fields are mandatory and are identified by different background and text colors, defined in the preferences editing window (see paragraph 7 of chapter 6 of the X3D guide).

The **Tunnel** form is used to enter monitoring data during tunnel construction. The option is active only when TUN_ tables exist in the database.

6. WINDOW AND HELP MENUS

None of the options of the **Window** and **Help** menus is specific to Pro. A detailed description of each option of these menus is done in chapter 8 of the X3D guide.

7. INTERACTIVE EDITING

In the different graphs, sub-graphs and secondary graphs, the user can click with the right button of the mouse to display the contextual menu shown in figure 6.

The 1st and 3rd items are active only in **3D_VIEW**, in a **PROFILE_n** when the mouse is over a property column or in a secondary graph. The first item is used to **create** a new record in the table whose data are displayed in the column. The depth or chainage clicked will be displayed by default for the new record.

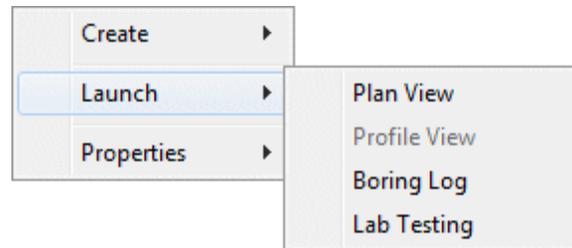


Figure 6 - Interactive menu

The **Properties** option of the interactive menu opens the appropriate entry form on the data of the record where the user clicked. Double-clicking on data has the same role. In **PLAN_VIEW**, the user can double-click on a boring, an axis point or an axis to open the appropriate form on the current data. Note that if the seismic lines are displayed for information (see paragraph 4.3.3), they cannot be clicked.

With the interactive menu, it is also possible to launch the modules of Geotec with the options **Plan View**, **Boring Log** and **Lab Testing** under **Launch**, to show the various types of data that can be displayed for the current boring or site with the Site, Log and Lab modules respectively.

8. ORGANIZATION OF A PLAN OF PROFILE VIEWS

Pro can produce three types of primary graphs:

- a plan view (**PLAN_VIEW**)
- a tridimensional view (**3D_VIEW**)
- n profile views (**PROFILE_n**)

The plan view is required but can be hidden. Sub-graphs are associated to the primary graphs:

- One of these sub-graphs, **HEADER**, displays the symbols, names and offsets of the borings.
- The other sub-graphs show properties measured along the borings; for example, the stratigraphy, results of laboratory tests, results of in-situ tests such as the absorption etc.

These sub-graphs are considered property graphs; they are displayed as columns drawn parallel to the axis of the borings. The number and type of the property graphs are decided by the user; some of these graphs have predefined displays.

Each boring displayed in the 3D view and / or the profiles will show the defined sub-graphs.

Secondary graphs can also be displayed, with their parent graph (#P) being PROFILE. The X-axis (chainage) will be the same as in the profile. These graphs are used for monitoring during tunnel construction.

All graphs are defined in the style file by their number, name and graphic characteristics. The association between the data and the secondary / sub-graph is done:

- By a correspondence between the names of the secondary / sub-graphs defined in the style file and the names of the tables from the database, and by a correspondence, for each secondary / sub-graph, between the names of the curves of the secondary / sub-graph and the names of the fields of the table.



The secondary / sub-graphs are defined in the graph editing window opened by selecting the **Graphs** option of the **Tools** menu or by clicking the button shown here. Paragraph 4 of chapter 6 of the X3D guide provides more details.



The curves of a secondary / sub-graph are defined in the legend and curves editing window opened by selecting the **Legend** option of the **Tools** menu or by clicking the button shown here. Paragraph 5 of chapter 6 of the X3D guide provides more details.

- By inserting, in an object anchored to the page or to a primary graph, a keyword referring to a value from a table of the database, to a predefined value such as a logo, or to a value provided by the system like the date or by the application like the page number.

The addition of data from the database to “text” and “text zone” objects is described in details in paragraphs 8 and 9 of chapter 4 of the X3D guide. The association is done with a keyword like **&&table.field** to display the field value, or by a keyword like **@@table.field** to display an expression equivalent to the field value.

In a style file:

- There can be as many graphs as desired and graphs can be superimposed;
- The column graphs display properties taken along the boring. These graphs, as well as the HEADER graph, must be defined as sub-graphs with a negative #P value;
- The curves representing fields from the table displayed by the graph must be defined in the curve editing window, except if the graph has predefined curves (see paragraph 9).

9. GRAPHS WITH PREDEFINED DISPLAY

Pro associates to certain graphs a display that is completely or partially predefined. These graphs are in the following table.

The predefined curves have numbers greater or equal to **100**. Pro manages the display of these curves, but the user can still modify some of the drawing attributes of the curves.

Paragraph 5.2.3 of chapter 6 of the X3D guide explains how to modify the display attributes of a curve.

Graph	Characteristics
Page	The Page primary graph shows the information about the axis points and seismic lines. It has 5 curves generated automatically: the curves End_Point , Intermediate , Intersection , Projection and Velocity .

Graph	Characteristics
PLAN_VIEW	<p>The PLAN_VIEW primary graph shows the borings and axes in a plan view. It has five curves automatically generated:</p> <ul style="list-style-type: none"> • The Axis_Points curve shows the turning points of the axes • The Axis_Curve curve shows the curve of the axes, their identification and their symbol • The Axis_Profile curve shows the location of the geophones and their profile obtained • The Boring curve shows the numbers and symbols of the borings and their projection • The Limit curve shows the rectangular or polygonal limits
3D_VIEW	<p>The 3D_VIEW primary graph shows the borings in a tridimensional view. It has the same curves as the PLAN_VIEW graph except for the Boring curve.</p>
PROFILE_n	<p>If profile data are present in the AXIS_PROFILE table, the graph has as many curves as the number of different profiles associated to the axis, each profile being identified by a type of material defined in the AXIS_STRATA table. These curves are automatically generated. The seismic velocities and markers limiting the ranges of velocities along the profiles are managed in the options (see paragraph 4.3.3).</p> <p>Profiles can also be calculated from the DTM or GRD of the surface of each layer. The curves in PROFILE_n must then have as name the suffix of a .dtm or .grd file associated to the site map file (FILE_NAME field in the SITE table), and, as Series, either “dtm” or “grd” depending on the file extension. These curves only show the profiles. These curves must be inserted by the user.</p> <p>For example, to display the rock profile for a site whose site map is named Geotec.sit, the file Geotec_rock.dtm must be in the directory of the input files and the ROCK curve must be inserted for the PROFILE_n graph with “dtm” as Series.</p>
HEADER	<p>The HEADER sub-graph, with its Boring and Offset curves, shows the symbols of the borings, their numbers, their offsets to the axes and a displayed for distant borings.</p> <p>The BORING table provides information about the borings retrieved, including their number, their type (which influences the display of their marker or box) and their position (which is used to determine their offset to the profiles).</p>
STRATIGRAPHY	<p>Typically, the STRATIGRAPHY sub-graph shows the symbols of the stratigraphic horizons (CODE1 field) or the color of their material (MATERIAL field).</p> <p>The STRATIGRAPHY sub-graph has predefined curves if the field displayed is CODE1, DEPTH_TOP or DESCRIPTION.</p>

Graph	Characteristics
SAMPLE	Often, a SAMPLE sub-graph is defined to show the RQD of the cores. Special displays exist for the numbers and the state symbols of the samples.
BORING	The BORING sub-graph is mainly used to display the water levels, defined by WATER_DEPTH and STABLE_WATER_DEPTH and their respective dates.
PIEZOMETER	The PIEZOMETER sub-graph shows the installations of the piezometers, of the observation and supply wells and the measurements of the last piezometric levels. This sub-graph displays the contents of the PIEZOMETER , PIEZOMETER_SEAL and PIEZOMETRIC_LEVEL tables. It only contains predefined curves.
LIMITS	The LIMITS sub-graph shows the measurements of the Atterberg limits. A predefined curve displays the plastic and liquid limits using their typical representation (vertical dashes joined by a horizontal line) and the water content represented by a circle.
CONSOLIDATION	The CONSOLIDATION sub-graph shows the results of consolidation tests. A predefined curve displays the minimum and maximum preconsolidation stresses using their typical representation (vertical dashes joined by a horizontal line) and the probable preconsolidation stress represented by a down arrow.
ROCK_JOINT	A special display exists to represent jointly the type, angle and azimuth of the joints, or to represent the angle of the joints.
CPTU_ZONE	The CPTU_ZONE sub-graph shows the ranges of SBT zones if the #1 curve is SBT. 9 curves are automatically generated in the Page to allow the user to define the colors of the 9 different ranges.

10. THE PRIMARY GRAPHS

10.1. The Page graph

The **Page** graph represents the graphic page and cannot be deleted. It displays the following predefined curves:

- The curve **End_Point** to identify the 1st and last point of the axis in PROFILE_*n*
- The curve **Intermediate** to identify all intermediate points of the axis in PROFILE_*n*
- The curve **Intersection** to identify all the intersections of seismic lines in PROFILE_*n* and PLAN_VIEW
- The curve **Projection** to display the projection of the seismic line or axis line in PROFILE_*n*
- The curve **Velocity** to define the display of ranges of seismic velocities in PROFILE_*n*

However, we recommend editing these options in the window of options for geotechnical properties display (see paragraph 4.3.3).

10.2. The PLAN_VIEW graph

The **PLAN_VIEW** graph shows the plan view of the selected site. It should always be numbered #1. The plan view displays:

- the symbols of the borings with their identification as well as their projection, if applicable. The borings are displayed on the plan view if their coordinates are defined or if they are associated to an axis retrieved and have a chainage and an offset.
- the axes retrieved with their identification next to their end points; an axe must have at least 2 turning points.
- the sismic lines of the current site or the nearby sites, if the option to display the intersection of sismic lines is checked (see paragraph 4.3.3).
- a topographic background, if requested by the user. See paragraph 4.3.4.

Figure 7 shows the predefined curves of the **PLAN_VIEW** graph. The display of these curves is not affected by their type.

- For each axis, the **Axis_Points** curve shows:
 - markers at the turning points of the axis; these markers are different from the end points of the axis;
 - a line passing through the turning points of the axis; this line merges with the outline of the axis except in the curved sections of the axis;
 - the attributes that can be modified for the **Axis_Points** curve are the line and the marker.

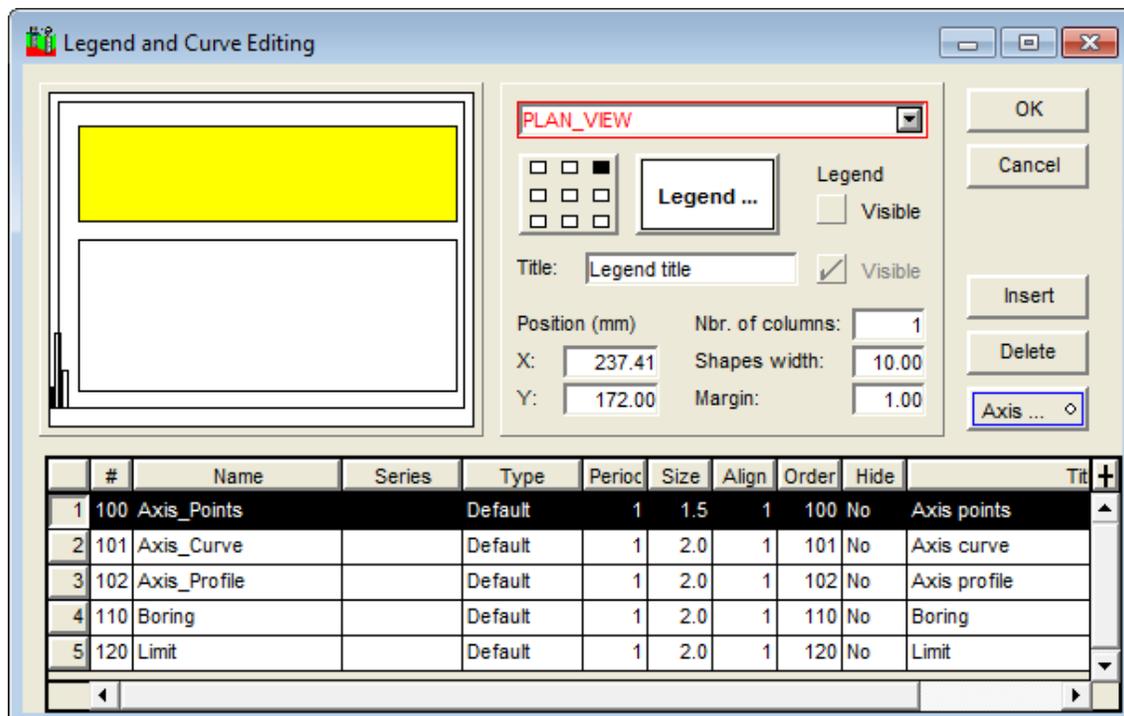


Figure 7 - Predefined curves of the **PLAN_VIEW** graph

- For each axis, the **Axis_Curve** curve shows:

- its outline; this line follows the eventual curves defined by a radius at some turning points;
- its identification; the name and symbol of the axis are displayed at both ends of the axis; the orientation of the text shows the origin of the axis: in reading position, the origin is left; the marker used for each axis in the one in the current markers file whose name is the concatenation of the type and state of the axis, for example, LS_R for a realised seismic line. If no corresponding marker is found, the one defined for the Axis_Curve curve will be used. The color and dimension of the markers can always be modified.
- the attributes that can be modified for the **Axis_Curve** curve are the line, the text and the marker (color and dimension, the symbol has no effect if there exists a marker for the type and state of the axis in the markers file).
- For each axis, the **Axis_Profile** curve shows:
 - the location of the geophones; their location is shown by a marker;
 - the profile obtained; the thickness and color of the line can be modified by the user;
 - the attributes that can be modified for the **Axis_Profile** curve are the line and the marker.
- For each boring, the **Boring** curve shows:
 - its identification;
 - its symbol; the marker used for each boring is the one in the current markers file whose name is the concatenation of the type and state of the boring, for example, TP_R for a realised test pit. If no corresponding marker is found, the one defined for the Boring curve will be used. The color and dimension of the markers can always be modified.
 - the projection of the boring on the axis, if the boring is inclined (with an azimuth and a dip);

this projection is a line starting at the center of the boring's symbol, oriented according to its azimuth, and whose length is the projection value of the boring onto the axis; a marker, as a dash, is displayed at the end of the projection line. If the user does not want to see the marker for the projection, he will set the period of the Boring curve to anything other than 1.
 - the attributes that can be modified for the Boring curve are the line (for the projection and its dash), the text and the marker for the boring (color and dimension, the symbol has no effect if there exists a marker for the type and state of the boring in the markers file).
- The **Limit** curve shows the rectangular or polygonal limits. The attributes that can be modified for the Limit curve are the line and the marker (for each corner of the limit).

10.3. The 3D_VIEW graph

The **3D_VIEW** graph shows a tridimensional view. The 3D_VIEW graph has the same curves as the PLAN_VIEW graph, except the **Boring** curve. The **Axis_Points**, **Axis_Curve**, **Axis_Profile** and **Limit** curves are used the same way as in PLAN_VIEW. The 3D_VIEW graph shows:

- the borings according to their dip and their sub-graphs of properties as columns parallel to the boring; the display of the properties of the borings is managed by the sub-graphs.
- the identifiers of the borings with their number only, their number above a marker characteristic of the type and state of the boring, or their number in a box. This selection is done in the options window (see paragraph 4.3.2).

if the markers are used, each boring will have as marker the one in the markers file whose name is the concatenation of the type and state of the boring, for example TP_R for a realized test pit. If no corresponding marker is found, the one defined in the options window or for the Boring curve of the HEADER sub-graph will be used (see paragraphs 4.3.2 and 11.4).

if the boxes are used, their dimensions in millimeters are defined by the user for the HEADER sub-graph (see paragraph 11.4); the test pits and trenches have rectangular or square boxes; the other borings have elliptical or circular boxes.

- the projections on a horizontal plan of the axes retrieved with their identification next to their ends; an axis must have at least 2 turning points.
- the profiles of the stratigraphic horizons measured using geophysical methods;
the profiles are defined in the **AXIS_PROFILE** table, each profile being identified by a type of material defined in the **AXIS_STRATA** table. The color of each profile is the one associated to the material of code **S** defined in the **MATERIAL** table for the **SPEC** site. If the material is not defined in the **MATERIAL** table with the **S** code, the color of the **Axis_Profile** curve is then used.
- a 3D topographic background, if requested by the user. See paragraph 4.3.4.

10.4. The PROFILE_n graphs

The **PROFILE_n** graph shows the profiles associated to the nth axis obtained from the data query. Each profile view can show:

- one or several profiles (natural ground, rock, raft, etc.)
 - if Tunnel data are entered, the material in the **AXIS_STRATA** table must be **RAFT** and the raft elevation at several chainages in the **AXIS_PROFILE** table.
- the seismic velocities taken along the profiles and a marker limiting the ranges of velocities, if the profiles are read in the **AXIS_PROFILE** table and velocities are entered
- the borings according to their dip and their sub-graphs of properties as columns parallel to the boring; the display of the properties of the borings is managed by the sub-graphs. The borings displayed are those retrieved and located on both sides of the axis at a distance smaller or equal to the offset defined in the options window (see paragraph 4.3.1) or in the **DISTANCE** field of the **AXIS** table
- the identifiers of the borings with their number only, their number above a marker characteristic of the type and state of the boring, or their number in a box. This selection is done in the options window (see paragraph 4.3.2).

if the markers are used, each boring will have as marker the one in the markers file whose name is the concatenation of the type and state of the boring, for example TP_R for a realized test pit. If no corresponding marker is found, the one defined in the options window or for the Boring curve of the HEADER sub-graph will be used (see paragraphs 4.3.2 and 11.4).

if the boxes are used, their dimensions in millimeters are defined by the user for the HEADER sub-graph (see paragraph 11.4); the test pits and trenches have rectangular or square boxes; the other borings have elliptical or circular boxes.

- the offset from the boring to the axis with an arrow indicating on which side of the axis the boring is located: an up-arrow indicates that the boring is left of the axis; a down-arrow indicates that the boring is right of the axis. The right and the left of the axis are determined from the point of view of an observer located on the turning point with the smallest index, and facing towards the other end.
- vertical lines indicating the end points of the axis
- vertical lines indicating the intermediate points of the axis
- vertical lines indicating the intersections of seismic lines
- a horizontal line indicating the projection of the axis line
- If a spacing between the borings was defined in the options window (see paragraph 4.3.1), the profiles and velocities are not displayed.

To split the profile of the n^{th} axis in several sections, the user can define several graphs with the same **PROFILE_** n name. The user can then adjust the limits of the X-axes of the graphs.

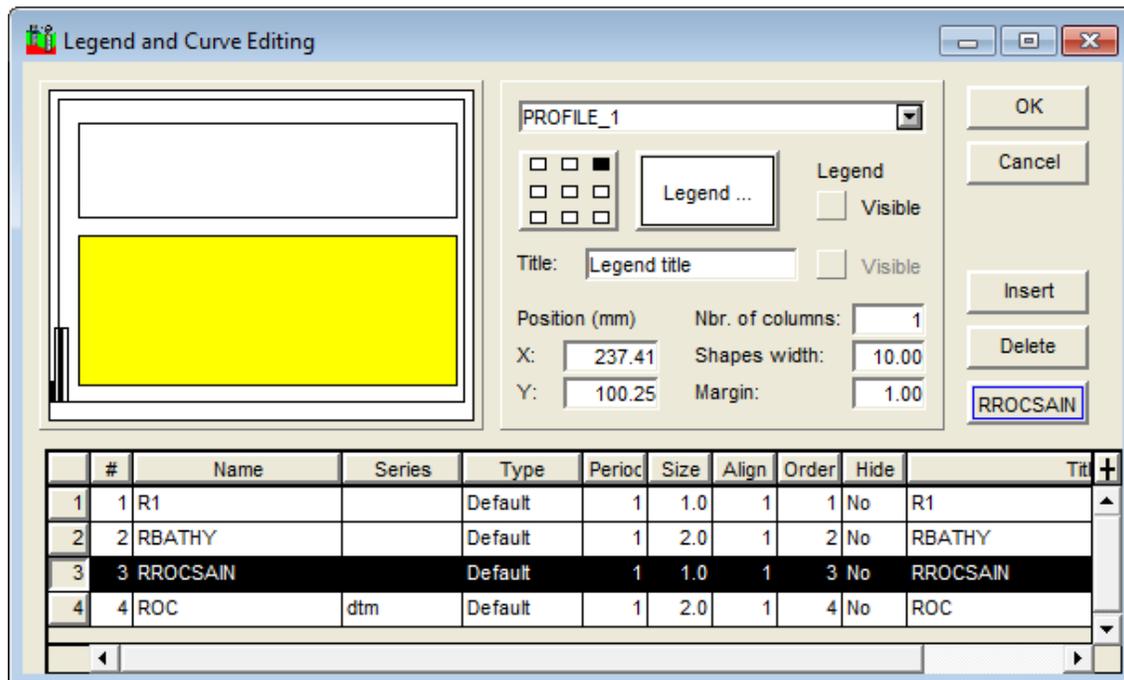


Figure 8 - Curves of a PROFILE_ n graph

Figure 8 shows an example of curves of a PROFILE_ n graph. The display of these curves is not affected by their type.

- The curves **R1**, **RBATHY** and **RROCSAIN**, in our example, are the profiles associated to the axis in the **AXIS_PROFILE** table, each profile being identified by a type of material defined in the **AXIS_STRATA** table. These curves are automatically generated. The color of the profile is by default the one associated to the material of code **S** defined in the **MATERIAL** table for the **SPEC** site, but it can be modified. If the material is not defined in the **MATERIAL** table with the **S** code, the color of the **Axis_Profile** curve of the **PLAN_VIEW** graph is then used by default, but can be modified.

A marker can show the location of the geophones for each profile curve. You can add a marker and adjust its period.

The attributes that can be modified for each profile curve are the marker, its dimension and its period to show the location of the geophones, and the line for the profile. The color of the line can also be used for the values and vertical marker of each profile if the option is selected (see section about Sismic Velocity in paragraph 4.3.3).

- Curve #4 in our example is a calculated profile. Profiles can be calculated from the DTM or GRD of the surface of each layer. The curves must then have as name the suffix of a **.dtm** or **.grd** file associated to the site map file (FILE_NAME field in the SITE table), and, as Series, either “dtm” or “grd” depending on the file extension. These curves must be inserted by the user.

For example, to display the rock profile for a site whose site map is named **Geotec.sit**, the file **Geotec_rock.dtm** must be in the directory of the input files and the **ROCK** curve must be inserted for the **PROFILE_n** graph with “dtm” as **Series**.

The attributes that can be modified for the calculated profiles are the line for the profile, and the marker, if the user wants to see the interpolation points.

11. THE SUB-GRAPHS

The sub-graphs define the identification of the borings (HEADER sub-graph) as well as the columns of properties of the borings in the profile(s) and the tridimensional view.

Figure 1 shows the graph and sub-graph editing window. Contrary to the primary graphs, the position and dimensions of the sub-graphs are not relative to the page.

The position of the top of each boring is:

- its position in X, Y and Z, in the **3D_VIEW** graph;
- the projection of the top on the axis and its elevation, in a **PROFILE_n** graph

The display of each boring represented in the 3D view is done according to its apparent dip, i.e. the tip of the boring’s projection onto the plane perpendicular to the direction of observation of the 3D block. The angle and the length of the projection of each boring determine the angle and the length of the columns, therefore of the property graphs.

The representation of each boring on the profiles is also done according to its apparent dip, i.e. the dip of the boring’s projection onto each profile where it appears. However, if a fixed spacing is defined in the options window, all the borings are displayed vertically. The angle and the length of the projection of each boring determine the angle and the length of the columns, therefore of the property graphs.

For the property graphs, the **Left**, **Width** and **Right** fields define the layout of the columns with respect to the axes of the borings and the width of these columns. A property graph with a value of 0.00 in the **Left** cell will lie against the right side of the boring. If a width of 0.00 is defined for a sub-graph, the column is not displayed. The **Bottom**, **Height** and **Top** fields are not used.

11.1. Creation of a property graph

A property graph is created in the graph editing window. More details about graph editing are available in paragraph 4 of chapter 6 of the X3D guide. Figure 1 shows the graph editing window in Pro. To create a property graph:

- In the graph editing window:
 - Click on the **Copy** button, which creates a complete copy (with axes and curves) of the graph selected, or substitute a graph by another.
 - Enter a **negative value** in the **#P** column of the graph.
 - In the scrolling list of the **Name** cell, select the name of the table from the Geotec database that contains the property to display. Many graphs can have the same name because they will not have the same number.
 - Define the position of the property column with respect to the borings in the **Left**, **Width** and **Right** cells.
 - Define the graph as **Visible**.
 - Click OK.
- In the legend and curves editing window:
 - Select the new property graph in the scrolling list at the top of the window.
 - Modify the desired curves of the graph copied.
 - Click on **Insert** and choose the name of the field from the table whose data are to be displayed, in the scrolling list of the **Name** cell.
 - Choose the type of curve and define its drawing attributes by clicking on the button under Delete.
 - Click **OK**.
- Execute a new data query to fill the new graphs.
- In the axes editing window, configure the limits of the X-axis of the property graph.

11.2. Types of curves in the sub-graphs

There are several display types for the values in the property graphs: **Default**, **Text**, **Point**, **Histo**, **Step**, **Polyline**, **Polygon**, **Color** and **Pattern**. All types are described in details in paragraph 12 of the Log guide.

11.3. Format of the numerical values

The user can define the desired format for the display of numerical values in the **Format** field of the drawing attributes window for each curve; for example, "9.999" to have 3 decimals.

No format is predefined for texts placed as graphic objects representing numerical values from the database. The user can define a format right after the value string in the object's property window. For example, to display with 1 decimal number the dimensions of the site at the top of the report, the user will define a graphic object of **Text** type with the value "**&&SITE.WIDTH**"**9.9**" , **&&SITE.HEIGHT**"**9.9**" " .

11.4. HEADER sub-graph

The **HEADER** sub-graph is the graph for the identification and positioning of the borings in the profile(s) and the 3D view. For each boring, the HEADER sub-graph can show:

- Its symbol
- Its number
- On the profiles, its offset to the axis

The anchor point of the symbol of each boring is:

- its position in X, Y and Z, in the **3D_VIEW** graph
- the projection of the top on the axis and its elevation, in a **PROFILE_n** graph

The user can define how the borings identifiers will be presented in the profile views and the 3D view, as well as their positioning, by editing the characteristics of the HEADER sub-graph and its curves. It is however recommended to edit them in the options window (see paragraph 4.3.2).

The boring number and its offset (in the profile view(s)) are positioned relative to the symbol. In the options window, there are three ways to represent the borings:

- by their **number only**;
- by their **number above a marker** characteristic of the type and state of the boring; the marker used for each boring is the one in the current markers file whose name is the concatenation of the type and state of the boring, for example TP_R for a realized test pit. If no corresponding marker is found, the one defined for the Boring curve of the HEADER sub-graph is used.
- by their **number inside a box** whose dimensions in millimeters are defined by the user; the test pits and trenches have rectangular or square boxes; the other borings, elliptical or circular boxes.

For the **HEADER** sub-graph, the **Left, Width, Right, Bottom, Height** and **Top** fields reflect the position and size of the boxes that include the identifiers of the borings:

- the **width** and the **height** define the size of the boxes, in millimeters; the two values must be positive.
- the **right** and the **left** indicate the position, in millimeters, of the right and left sides of the boxes with respect to the verticals at the implementation points of the borings. If the markers are displayed, they are always centered on the verticals at the implementation points.
- the **bottom** indicates at which distance will be located, in millimeters, the center of the markers or the boxes from the top of the graph, or the center of the markers or the bottom of the boxes from the anchor points of the borings. The choice to place the borings identifiers relative to their top or relative to the top border of the graph is done in the options window.

The legend and curves editing window for the HEADER sub-graph is shown in figure 9.

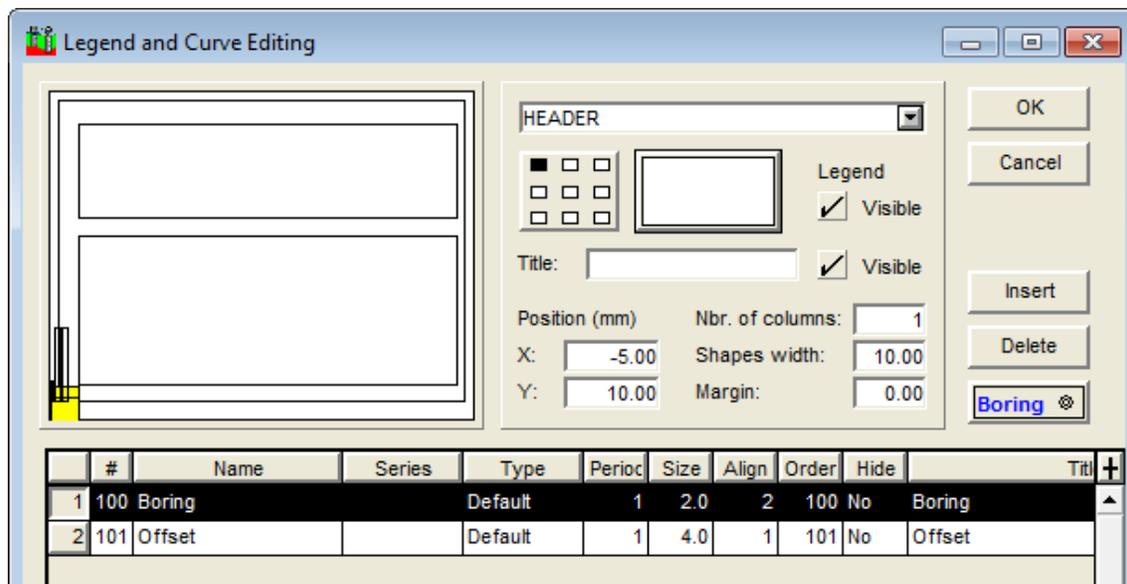


Figure 9 - Predefined curves of the HEADER sub-graph

For each boring, the **Boring** curve shows, for the profile(s) and the 3D view:

- the marker for the boring, if it has a positive size;
- the line between the anchor point and the marker or the box; if the boring number is in a box, the border of the box will have the same drawing attributes as the line;
- the boring number;
- the button of the **Boring** curve opens the drawing attributes window, where the user can define how the boring numbers, the boxes and / or the markers (color) will be drawn. The marker defined for this curve will only be used for the borings for which the concatenation of the type and state does not correspond to any marker in the **.mrk** file used.

For each boring, the **Offset** curve shows, only for the profile(s):

- the distance between the boring and the axis, as text, if this offset to the axis is greater than the minimum distance specified in the options window (see paragraph 4.3.1).
- an arrow indicating on which side of the axis the boring is located. An up-arrow indicates that the boring is left of the axis. A down-arrow indicates that the boring is right of the axis. The right and the left of the axis are determined from the point of view of an observer located on the turning point with the smallest index, and facing towards the other end.
- a different border can be defined for distant borings, i.e. borings whose offset to the axis is greater than the minimum distance specified in the options window (so the offset value is also displayed). This attribute is only applicable to the CODE1 column of the STRATIGRAPHY table. The user can modify the type (dotted, dashed) and the color of the line that will only affect distant borings. By default, a dashed line is used.
- the button of the **Offset** curve opens the drawing attributes window, where the user can define how the offset values, the marker and the border around CODE1 column of Stratigraphy will be drawn. The marker used by default for the offset is the one in the current markers file whose name is **Offset**. If no marker with this name is found, the one defined for

this curve will be used. The user can modify the color and dimension of the marker, and choose another one than the one named Offset.

11.5. STRATIGRAPHY sub-graphs

The stratigraphy of a boring is read in the **STRATIGRAPHY** table. Generally, the user displays the symbols representing the materials of the stratigraphic layers, by defining the CODE1 curve. Figure 10 shows the predefined curves associated to the CODE1 field. When CODE1 is displayed, its border can take different attributes for distant borings; the user will define the desired line format in the Offset curve or in the options window (see previous paragraph).

The user also often displays the color of the materials constituting the layers (MATERIAL field). The content of the other fields of the STRATIGRAPHY table can also be displayed. The STRATIGRAPHY sub-graph has predefined curves if the field displayed is CODE1, DEPTH_TOP or DESCRIPTION.

11.5.1. Layers and sub-layers

The layers and sub-layers are strata, which are records in the **STRATIGRAPHY** table.

- the strata can be classified as three **types**: **R** (rock classification), **S** (simplified classification) or **U** (unified classification);
 - for an **R** type stratum, only one material can be defined; its code is entered in **code 1**;
 - for an **S** type stratum, up to six materials can be defined; their codes (one character each) are entered in **code 1**;

the relative proportions of the materials are entered in the **proportion** field; the main material has a proportion of 1, a material with traces has a proportion of 4; the proportions must be entered in the same order as the materials in code 1; more than one material can have the same proportion;

code 2 is used to indicate grain size or plasticity characteristics, it does not have an impact on the display;

the **line** can be used to force the display of the top horizon limit using a specific format; the type of line requested will prevail over the one used for the lines belonging to the curve; the types of line that can be imposed are:

- **L0** blank line;
- **L1** continuous line;
- **L2** dotted line;
- **L3** dashed line;

the values of L0 to L3 entered in **code3** in the previous versions of Geotec will be used if there are no values in Line.

- for a **U** type horizon, two materials can be defined in **code 1** from the scrolling list; they are separated by a dash;
- each layer is limited by top and bottom depths and can have a text description.

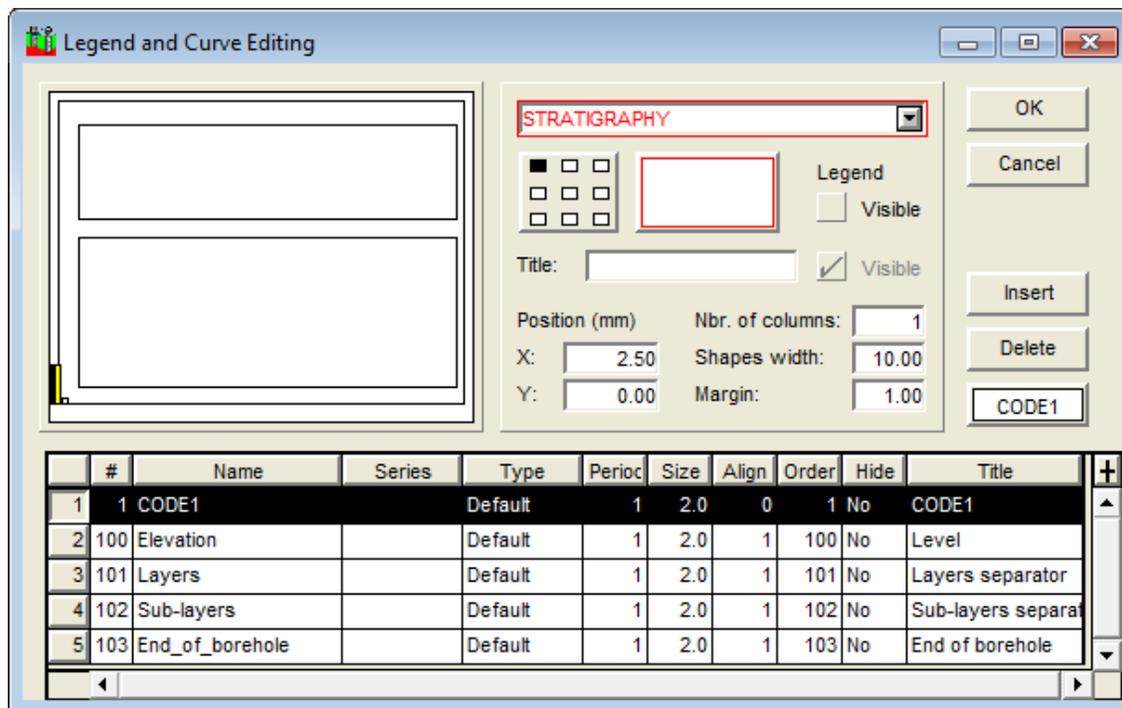


Figure 10 - Predefined curves of a STRATIGRAPHY sub-graph

In addition to the strata:

- descriptions can be added at specific depths along the boring; these records of type **T** (text) have a top depth but no bottom depth;
 - if a record of type **T** has a negative depth, its description is displayed above the top line of the column, generally the ground surface;
 - if there is no record of type **T** at a negative depth, Pro automatically displays, at the top of the log, the title of the **Elevation** curve of the **STRATIGRAPHY** sub-graph associated to the **DESCRIPTION** field;
- a description can be associated to the bottom of the boring; this record of type **E** has a top depth but no bottom depth;
 - if there is no record of type **E**, Pro automatically displays at the bottom of the column the title of the curve **End_of_borehole** of the **STRATIGRAPHY** sub-graph associated to the **DESCRIPTION** field;

A stratum is a **layer** if its classification type, its code 1 or its proportions (for the S type) is different than the preceding stratum. A horizon is a **sub-layer** if its classification type, its code 1 and its proportions are the same as those from the preceding stratum. The **Layers** and **Sub-layers** curves affect the stratigraphic layers and sub-layers.

11.5.2. Display of the STRATIGRAPHY sub-graph for the CODE1 field

Depending on the field specified as the non-predefined curve of the **STRATIGRAPHY** sub-graph, the display associated to the curves varies and depends on Pro.

The only case described in this guide is the one where the field entered as the non-predefined curve is **CODE1**, which is the most common case. The reader can find information in [paragraph 16 of the Log guide](#) about the display particularities when the field entered as the non-predefined curve is **DEPTH_TOP**, **DESCRIPTION**, **MATERIAL** or another field.

If the **CODE1** curve is of **Default** type:

- The column shows the stratigraphic symbols in graphic format if they are defined in the current **.ptn** pattern file, otherwise using a text format (see paragraph 11.5.3 about the display of stratigraphic symbols).
- The **Elevation** curve displays nothing.
- The **Layers** curve displays the upper limit of the layers.
- The **Sub-layers** curve displays the upper limit of the sub-layers.
- The **End_of_borehole** curve displays the end of boring limit and, if the record of type **E** has a **code 1** of **R**, the bedrock symbol (illustrated in figure 11) indicating the refusal (or stop) of the boring on the bedrock, is drawn with the drawing attributes of the curve.

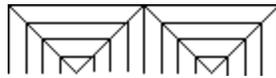


Figure 11 - Symbol of the bedrock as the end of boring

If the **CODE1** curve is of **Text** type, the columns displays the stratigraphic symbols using a text format and the predefined curves are not considered. The attributes of the limits of the layers and sub-layers and of the textual stratigraphic symbols are those defined for the **CODE1** curve.

If the **CODE1** curve is of a type other than **Default** or **Text**, nothing is displayed in the column. The types of the predefined curves are irrelevant.

11.5.3. Display of the stratigraphic symbols

To graphically display a stratigraphic symbol, an X3D pattern must be associated to the material code to be represented in the pattern file (**.ptn**) used (and the **CODE1** curve must be of **Default** type). Otherwise, the material will be represented textually.

- If a record is of type **R**, its code 1, for example **CAL**, will be represented graphically if there is a pattern named **R_CAL**, according to our example.
- If a record is of type **S**, the graphic representations of the materials specified in code **1** will be superimposed if a pattern exists for each of these codes, whose name begins with **S_** followed by the code to be represented and the proportion of the material;
for example, the **CMG** code with a proportion of **123** will be represented by three superimposed patterns if the patterns **S_C1**, **S_M2** and **S_G3** exist in the **.ptn** pattern file being used.
- If a record is of type **U**, if a pattern exists for the complete **code1**, for example **ML-MH**, and whose name is **U_ML-MH**, it will be used for the graphic representation.

The **geotec8.ptn** file provided with the installation contains patterns for most of the standard codes used. The user can refer to the **X3D** library guide for information about how to look up, edit and create patterns.

11.6. SAMPLE sub-graphs

Typically, a **SAMPLE** sub-graph is defined to show the RQD of the cores. The content of the other fields of the **SAMPLE** table can also be displayed. The curves **SAMPLE_NO**, **STATE**, **USCS** and **MATERIAL** have a special display.

11.6.1. Display of the **SAMPLE_NO** curve

If the **SAMPLE_NO** curve is of **Text** type, only the sample number is displayed.

If the **SAMPLE_NO** curve is of **Default** type, it shows the sample numbers concatenated to their type, for example SS-01; this layout cannot be modified.

The user can modify the attributes of the text and line showing the top and bottom depths of each sample.

11.6.2. Display of the **STATE** curve

If the **STATE** curve is of **Text** type, the states of the samples are represented by their textual code.

If the **STATE** curve is of **Default** type, a graphic symbol represents the state of the samples along their entire length.

Four symbols, shown in figure 12, are generally used to represent the state of the samples.

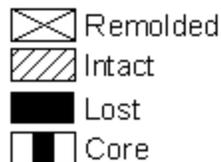


Figure 12 - Symbols representing the state of the samples

To display these symbols, the drawing attributes of the **STATE** curve must be defined as follows:

- The **Line** is defined with the color, type and size desired; the line attributes apply to all states; the line is used as the symbol border and for the cross, for a **remolded** sample;
- The **Pattern** must contain an **X3D** pattern (usually a hatched pattern); this pattern applies only to **Intact** samples.
- The **Filling** applies to the **Lost** and **Core** samples; it must be defined in two steps:
 - It must be defined with the desired color;
 - It must be "erased" with the "-" button for the filling not to affect the intact samples.

The **remolded** samples are the only ones with a symbol set by the **Pro** module; only the line attributes forming the cross can be modified.

The **lost percentage** of a sample can be graphically represented at the bottom of the sample with a height proportional to the lost percentage. To do this, indicate a **period of 2** for the STATE curve. The filling attributes will be used. If a sample has a **recovery of 0%**, it is drawn as 'lost'.

11.6.3. Display of the USCS curve

If the **USCS** curve is of **Default** type with a **period of 1 or less**, the column shows the X3D patterns defined in the current **.ptn** patterns file, named "**U_USCS**", for example, U_GW.

If the **USCS** curve is of **Default** type with a **period greater than 1**, the column shows the colors associated to the materials of code **U** defined in the **MATERIAL** table for the **SPEC** site.

If the **USCS** curve is of **Text** type, the column shows the USCS classification in text format. The attributes of the text and of the limits between the samples are defined for the **USCS** curve.

If the **USCS** curve is of a type other than **Default** or **Text**, nothing is displayed in the column.

11.6.4. Display of the MATERIAL curve

If the **MATERIAL** curve is of **Default** type, the column shows the background colors for the materials constituting the samples (materials of the borrow pits). The colors are the ones associated to the materials of code **S** defined in the **MATERIAL** table for the **SPEC** site.

If the **MATERIAL** curve is of **Text** type, the column shows the codes of the materials in text format. The attributes of the textual materials and of the limits between the layers are defined by the **MATERIAL** curve.

If the **MATERIAL** curve is of a type other than **Default** or **Text**, nothing is displayed in the column.

11.6.5. Selection of the types of samples to present

Pro allows the user to restrict the display of the samples to just one type. To do this, indicate the type of samples to display in the **Series** column. In the example in figure 13, "**SS**" requests the representation of the split spoons.

Each cell of the **Series** column has a scrolling list which displays all the types of samples inserted in the current database.

The user can select a different type for each curve of a **SAMPLE** sub-graph. Only the values associated to the selected type will be displayed. If the cell of the **Series** column is empty or if it contains "@@", all the samples will be represented for this curve.

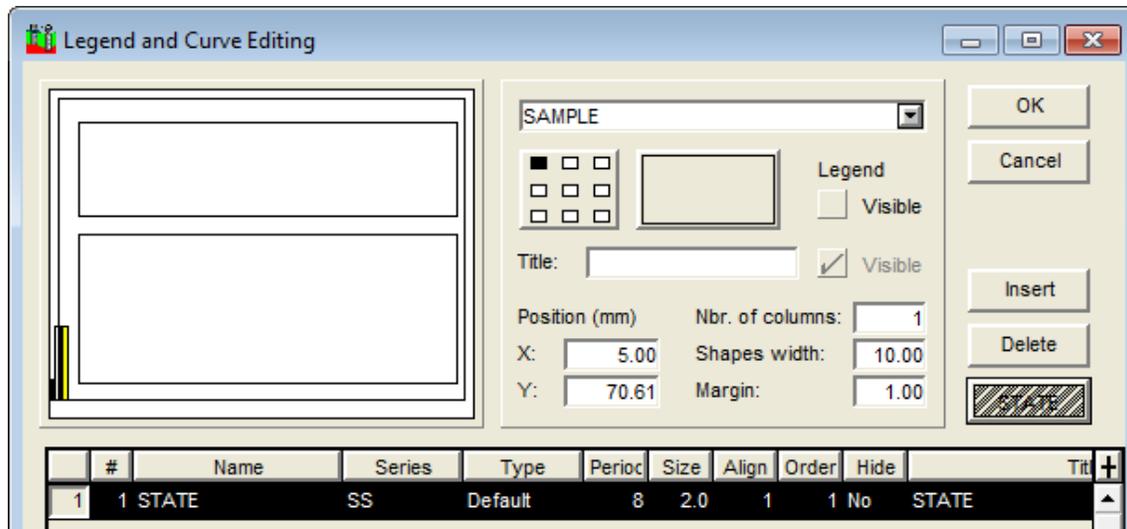


Figure 13 - Selection of a sample type in a SAMPLE sub-graph

11.7. PIEZOMETER sub-graph

The installations of the piezometers, observation and supply wells as well as the seals, lanterns and piezometric levels are shown in the **PIEZOMETER** sub-graph.

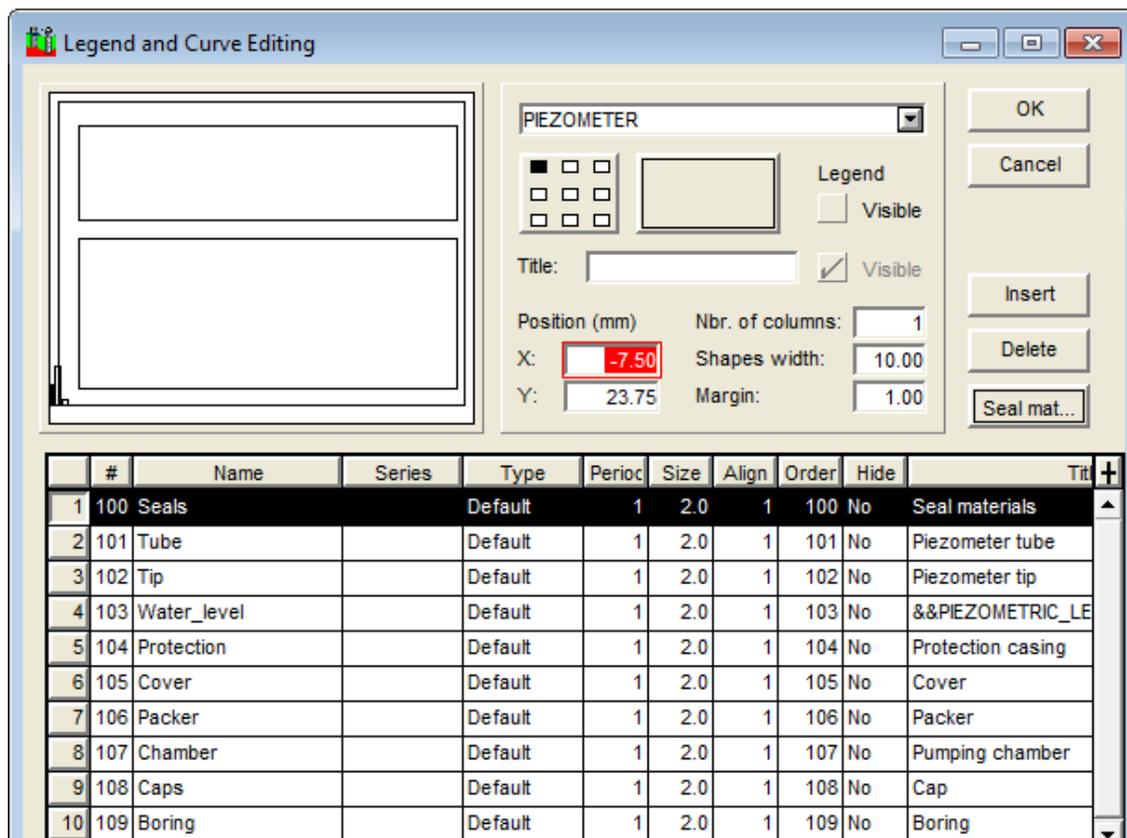


Figure 14 - Predefined curves of the PIEZOMETER sub-graph

Pro reads the information about the piezometers in the **PIEZOMETER** table, the information about the seals and lanterns in the **PIEZOMETER_SEAL** table and on the piezometric levels in the **PIEZOMETRIC_LEVEL** table.

The **PIEZOMETER** sub-graph can only contain the predefined curves shown in figure 14, which are of Default type. The type of the curves has no effect on the display. Paragraph 18 of the **Log guide** gives a complete description of each predefined curve of PIEZOMETER. Please refer to it.

11.8. LIMITS sub-graph

The **LIMITS** sub-graph displays the results of the Atterberg limits measurements: the plastic limit, the liquid limit and the water content. Pro reads the data in the **LIMITS** table.

When a **LIMITS** sub-graph is created, the predefined curve **PL-LL** is created, as shown in figure 15. This curve shows a typical display, i.e. two vertical dashes representing the plastic and liquid limits and joined by a horizontal line, as well as an empty circle representing the water content. The curve type is Default. The symbols are positioned at the depth corresponding to the center of the samples.

The user can open the drawing attributes window and modify the **marker**, which will then be the symbol for the water content. The **line** can be modified; it will have an effect on the horizontal line and the vertical dashes for PL and LL. The **text** is displayed by default, but can be modified or removed ("-") button) via the attributes window.

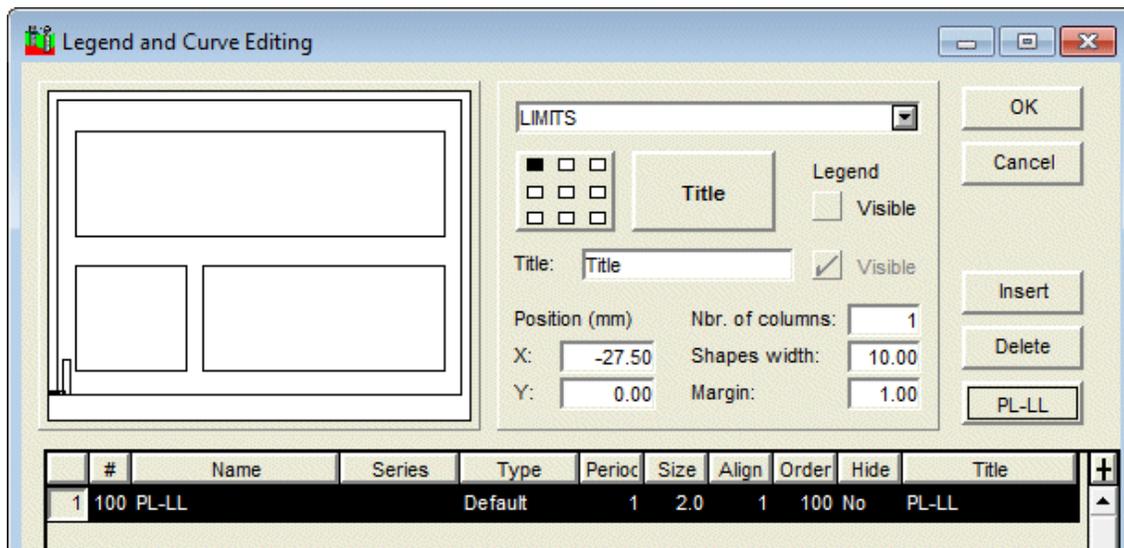


Figure 15 - Predefined curve of the LIMITS sub-graph

If the user does not want to display any marker, he will enter a size of 0 for the PL-LL curve. If he only wants the markers for the limits, he will enter a period of 0 in the attributes window for the curve.

It is also possible to add curves for the **W**, **LL** and **PL** fields to impose a specific display; for example, to connect all the plastic limits, the liquid limits and the water contents, select the

Polyline type for these curves. Each polyline is defined by the **line** attribute. If the **W**, **LL** and **PL** curves are of **Point** type, only the markers will be displayed.

11.9. CONSOLIDATION sub-graph

The **CONSOLIDATION** sub-graph displays the measurements of consolidation pressures read in the **CONSOLIDATION** table.

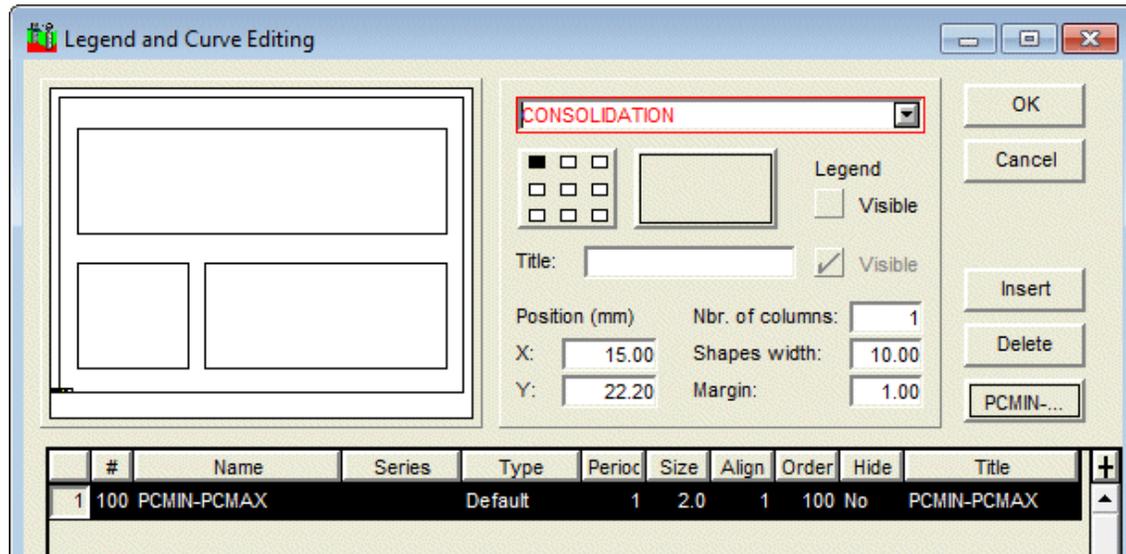


Figure 16 - Predefined curve of the CONSOLIDATION sub-graph

When a **CONSOLIDATION** sub-graph is created, the predefined curve **PCMIN-PCMAX** is created, as shown in figure 16. This curve shows a typical display, i.e. two vertical dashes representing the minimum and maximum preconsolidation stresses and joined by a horizontal line, as well as an empty down arrow representing the probable preconsolidation stress. The curve type is Default. The symbols are positioned at the depth corresponding to the center of the samples.

The user can open the drawing attributes window and modify the **marker**, which will then be the symbol for the probable PC. The **line** can be modified; it will have an effect on the horizontal line and the vertical dashes for the minimum and maximum preconsolidation stresses. The **text** is displayed by default, but can be modified or removed ("-") button) via the attributes window.

If the user does not want to display any marker, he will enter a size of 0 for the PCMIN-PCMAX curve. If he only wants the markers for the minimum and maximum stresses, he will enter a period of 0 in the attributes window for the curve.

It is also possible to add curves for the other fields of the table, the same way as for the curves of the LIMITS sub-graph (see paragraph 11.8).

11.10. ROCK_JOINT sub-graphs

All the fields from the **ROCK_JOINT** table can be displayed in curves of a **ROCK_JOINT** sub-graph.

The **ALPHA** (or **ANGLE** in the previous versions of Geotec), **DIP** and **TYPE** curves have a special display. These three curves cannot be displayed in the same sub-graph.

The curve associated to the **ALPHA** (or **ANGLE**) field has a specific display if it is of **Default** type. It then displays the joints as lines inclined according to their angle relative to the core axis and centered on their average depth. The lines have a length of 80% of the column's width. The elements that can be edited for the **ALPHA** (or **ANGLE**) curve depend on the type of curve chosen.

The display is similar for the curve associated to the **DIP** field, except that the line is inclined relative to the horizontal, in counter-clockwise direction.

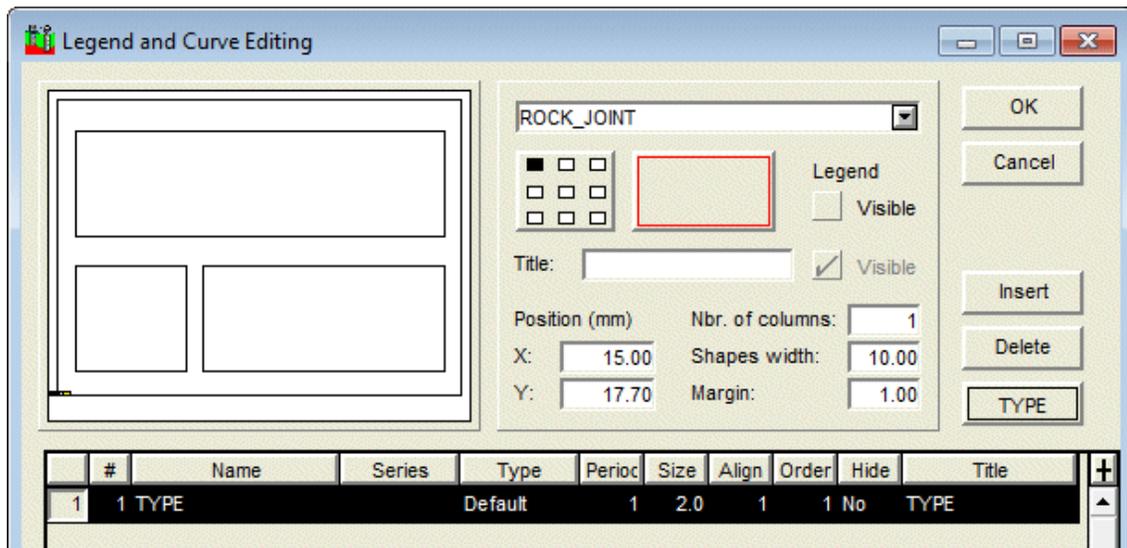


Figure 17 - TYPE curve of the ROCK_JOINT sub-graph

The curve associated to the **TYPE** field (see figure 17) is used to display information relative to three fields: **TYPE** and of one of the following pairs depending on the reference taken for the measurement of the angles: **ALPHA** and **BETA**, or **DIP** and **DIRECTION**. If a marker named **J_type** is defined and an angle is entered in the database for the same depth, the marker representing the type will be displayed at the location of the value between 0 and 90 on the X axis, and will be inclined according to the azimuth value (between 0 and 360). If no azimuth value is defined, a value of 0 (vertical) will be used. For this display, the **TYPE** curve must be of **Default** type. If the curve is of **Text** type, only the type values will be displayed textually.

11.11. CPTU sub-graphs

It is possible to display the ranges of SBT zones calculated as histograms or as textual description for the results of piezocone tests. For this, the curve #1 of the CPTU_ZONE sub-graph must be associated to the **SBT** field.

- If the **Series** cell of the SBT curve is empty, the column will display the ranges of SBT zones as histograms. The period for the curve must be 0 or a filling must be defined for the curve to show the different colors for the ranges.

- If the **Series** cell of the SBT curve contains "@@", the column will display the SBT ranges as descriptions. If the **EQUIVALENCE** table contains the description of the zones as equivalences to their value, this description is displayed; otherwise, the numbers of the zones are displayed.

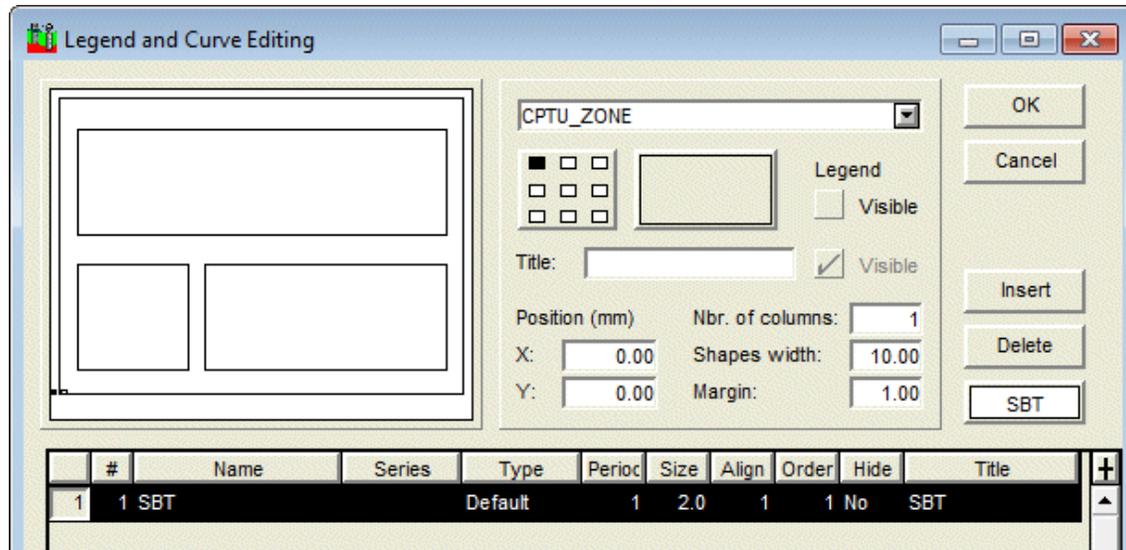


Figure 18 - Curve of the CPTU_ZONE sub-graph

Nine predefined curves are automatically included in the **Page** graph when the SBT curve of CPTU_ZONE is displayed. These curves named "**Zone_1**" to "**Zone_9**" are used to define the colors of the various values of SBT zones. A series of colors commonly used is proposed by default. However, the user can modify these colors by editing the "**Zone_n**" curves.

11.12. Display of property values or of concentrations of contaminants

The **PROPERTY_VALUE** table contains the values of various properties according to depth; the properties are defined by the user. Also, the **CONCENTRATION** table contains the concentrations according to depth of various contaminants defined in the **CONTAMINANT** table.

To display the values of the **PROPERTY_VALUE** table for a specific property in a column, the user must:

- associate the **PROPERTY_VALUE** table to a sub-graph;
- define at least one curve associated to a field of the table in the curve editing window; usually, it is usually the **CVALUE** field.
- in the **Series** column of the curve definition, enter the property for which values are to be represented;

The display in a column of values from the **CONCENTRATION** table for a contaminant is done the same way, with the name of the **contaminant** in the **Series** cell.

11.13. Display of elevations and information associated to a depth curve

In a sub-graph other than the ones described above, we can define curves associated to a field starting with **DEPTH_** or finishing with **_DEPTH**. These curves must be of **Default** type. We can add information at each depth in the sub-graph by entering the information to be displayed in the title of the **DEPTH_xxx** or **xxx_DEPTH** curve.

The information displayed can be any text. It can contain the value of a field from a **Geotec** table; the syntax is then **&&table_name.field_name"format"** to display the values, or **@@table_name.field_name"format"** to display the values or eventual equivalences (see paragraph 11.14). The format is not required.

For example, the user can create a column to display the initial and stabilized depths of the water table using a marker and the reading date. For this:

- the user associates the **BORING** table to a sub-graph;
- the user defines two curves. The first curve is associated to the **WATER_DEPTH** field and has this expression in the **Title** cell: **&&BORING.WATER_DATE"yyyy-mm-dd"**. The second curve is associated to the **STABLE_WATER_DEPTH** field and has this expression in the **Title** cell: **&&BORING.STABLE_WATER_DATE"yyyy-mm-dd"**. A marker for the water level can be associated to each curve.

It is also possible to display the elevations corresponding to the depths presented. These elevations are displayed if the **ELEVATION** keyword is specified in the title of the curve. These keywords cannot be included in a string. The dip of the boring is taken in account to determine the value of the elevations.

If no title is provided for a **DEPTH_xxx** or **xxx_DEPTH** curve of **Default** type, the depth is then displayed.

If the user wants to display the depths and the elevations, two **DEPTH_xxx** or **xxx_DEPTH** curves of **Default** type must be created in the sub-graph. One of the titles will remain empty, while the other will be **ELEVATION**. By aligning the characters of a curve by the top and the other by the bottom, both texts will not be superimposed in the graph.

11.14. Display of equivalences to values

It is possible to display equivalent expressions to some values in a curve if the following conditions are met:

- The curve does not belong to a sub-graph with **predefined curves**;
- The curve does not belong to a sub-graph representing the **CONCENTRATION** or **PROPERTY_VALUE** table.
- The curve does not represent a **DEPTH_xxx** or **xxx_DEPTH** field;
- Expressions equivalent to one or many values are defined in the **EQUIVALENCE** table or in the **LIST_ENG** table for the field represented by the curve;
- The @@ expression is entered in the **Series** column of the curve.

Regardless of whether the field values are numerical or textual, if the equivalent expressions are textual, they will only be displayed if the curve is of **Default** or **Text** type. If the equivalent expressions are numerical, they can be displayed regardless of the type of curve.

12. THE SECONDARY GRAPHS

The secondary graphs are used to display monitoring data during tunnel construction.

The secondary graphs are dependent on the PROFILE_1 primary graph, whose number appears in the **#P** column, or 4 in the example of Figure 1. The secondary graphs have the same X-axis as the profile, i.e. the chainage.

For the secondary graphs, the **Left**, **Width**, **Right**, **Bottom**, **Height** and **Top** fields define their position and dimension in the page; the user can modify these values. It is logical to use the same horizontal dimensions as the profile.

The secondary graphs are created the same way as the sub-graphs, except that the value in the **#P** column must be the **#** of the parent graph (PROFILE); see paragraph 11.1.

The same types of value displays can be applied to curves of secondary graphs (see paragraph 11.2). Note that the curves are displayed in increasing order by their **#**. If several curves of Color type are displayed, the color of the 1st curve may be hidden by the color of the following curves. It is similar for the curves of Pattern type, which should be displayed after the curves of Color type.

The numerical values can also be formatted like the sub-graphs (see paragraph 11.3). Also, equivalences to values can be used with the @@ expression as with the sub-graphs (see paragraph 11.14).

12.1. TUN_SECTION secondary graph

To display Tunnel data, an axis must be created with its turning points in AXIS_PI, its material **RAFT** in AXIS_STRATA, and the raft's elevation points based on chainage in AXIS_PROFILE.

The TUN_SECTION secondary graph must be displayed in the style for data from the other TUN_ tables to be displayed. This graph shows the geometry of each tunnel section.

12.1.1. Display of the SHAPE curve

In the TUN_SECTION graph (see Figure 19), the SHAPE curve shows the geometry of each section. Each section follows the elevation of the raft with chainage. The height of each section is either the HEIGHT of the conduit, of the DIAMETER if the height isn't defined. The curve must be of Color type.

The filling and line defined for the curve will be used if no color is associated to the conduit shape in LIST_ENG. In addition, they are used to illustrate the sections in background of the other TUN_ graphs, with their diameter along the chainage.

12.1.2. Display of CHAINAGE curves

The CHAINAGE_S and/or CHAINAGE_E curves can be displayed for all TUN_ graphs to indicate the start and/or end chainage of a displayed property.

The format of the values in the drawing attributes window for the CHAINAGE_ curves can be set as %02d+%3.0f, to display the chainages, for example, like “00+183” for the value 183 m, or “01+367” for the value 1366.736.

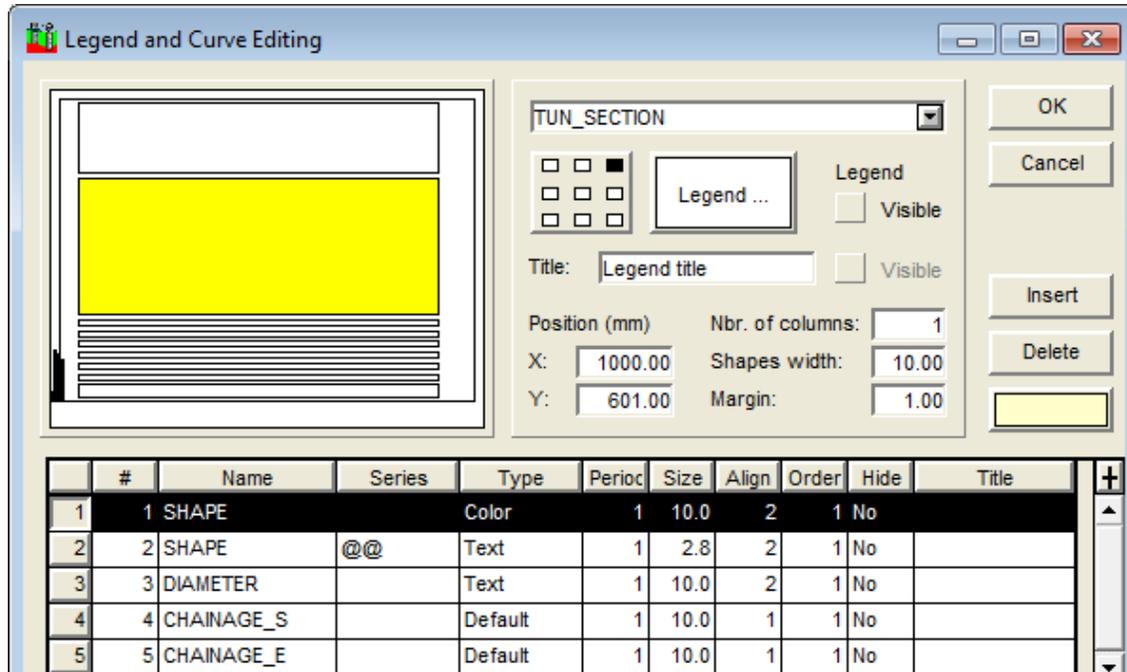


Figure 19 - Curves of the TUN_SECTION secondary graph

12.2. TUN_EXCAVATION secondary graph

The TUN_EXCAVATION secondary graph (see Figure 20) shows information about the excavation methods used during the tunnel construction.

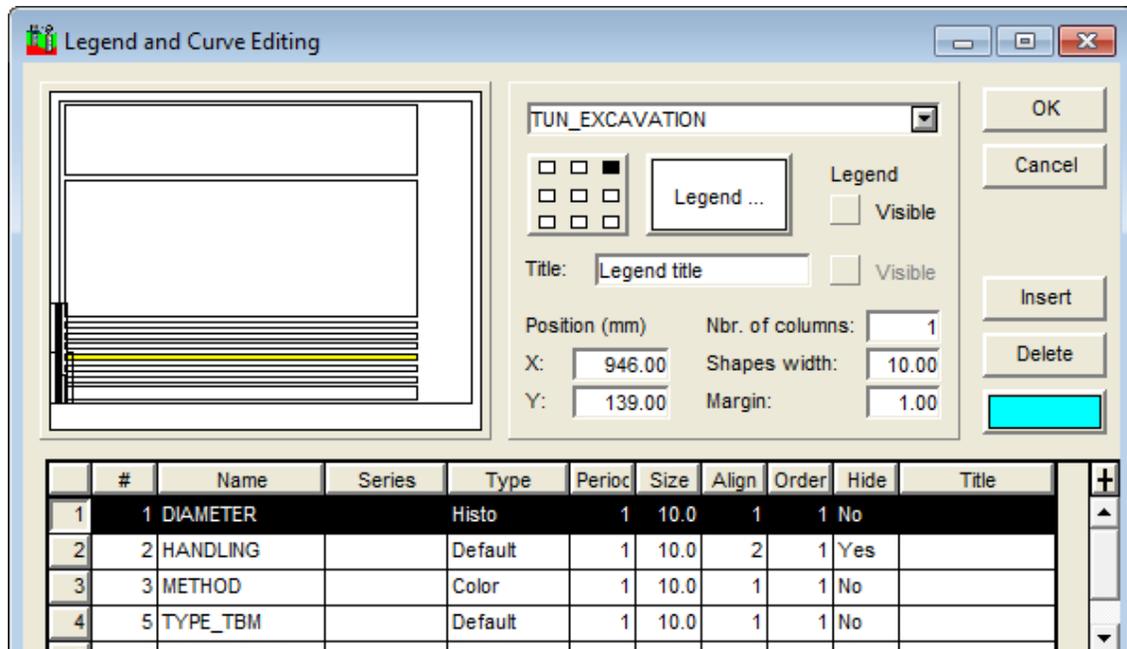


Figure 20 - Curves of the TUN_EXCAVATION secondary graph

Typically, the DIAMETER of the blast round or the TBM is displayed as a histogram, showing the difference with the section diameter.

The default display of the TYPE_TBM, POWER, THRUST or TYPE_BLADE field shows a concatenation of several data as:

METHOD - TYPE_TBM - EQUIPMENT - POWER HP - THRUST kg - TYPE_BLADE

12.3. TUN_RETAINING secondary graph

The TUN_RETAINING secondary graph (see Figure 21) shows information about the type of retaining works and their characteristics.

Typically, the RET% field is displayed with the Color type.

In addition, the default display for the RET%, NUMBER% and CARACT% fields shows a concatenation of several data as: "RET: NUMBER CARACT".

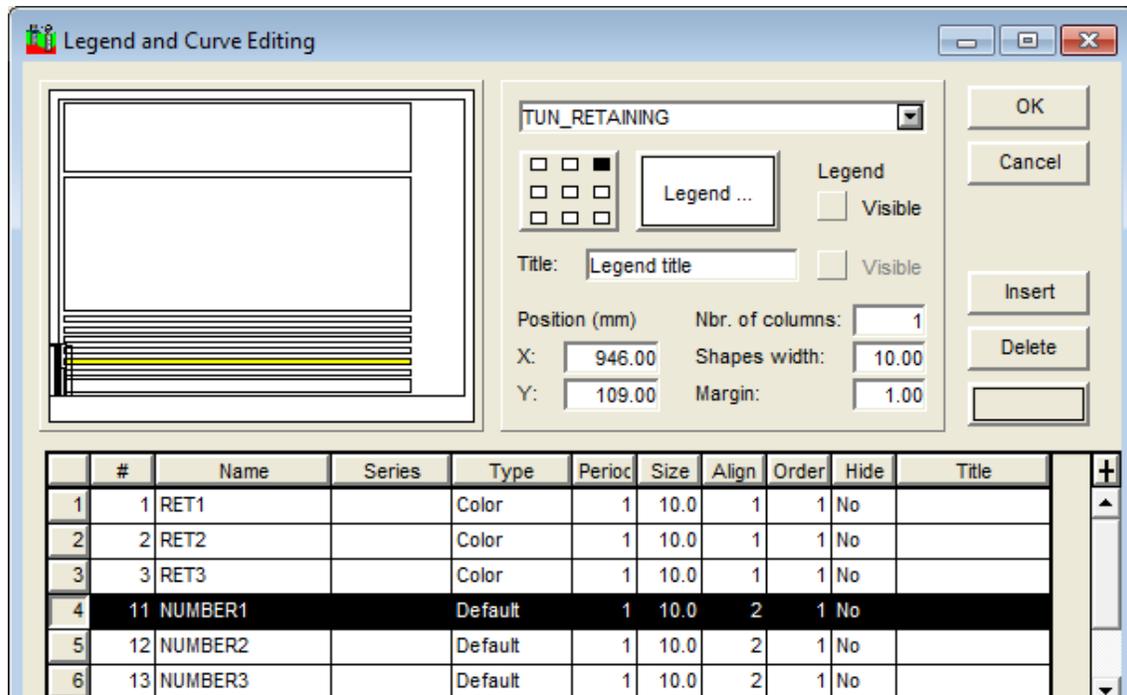


Figure 21 - Curves of the TUN_RETAINING secondary graph

12.4. TUN_PERFORMANCE secondary graph

The TUN_PERFORMANCE secondary graph (see Figure 22) displays the performance during the tunnel construction works.

The Y-axis of the TUN_PERFORMANCE graph is a rate (typically, in meters/day) instead of a diameter, like the other TUN_ graphs. Typically, the PENETR_RATE and PROGRESS_RATE fields are displayed as histograms.

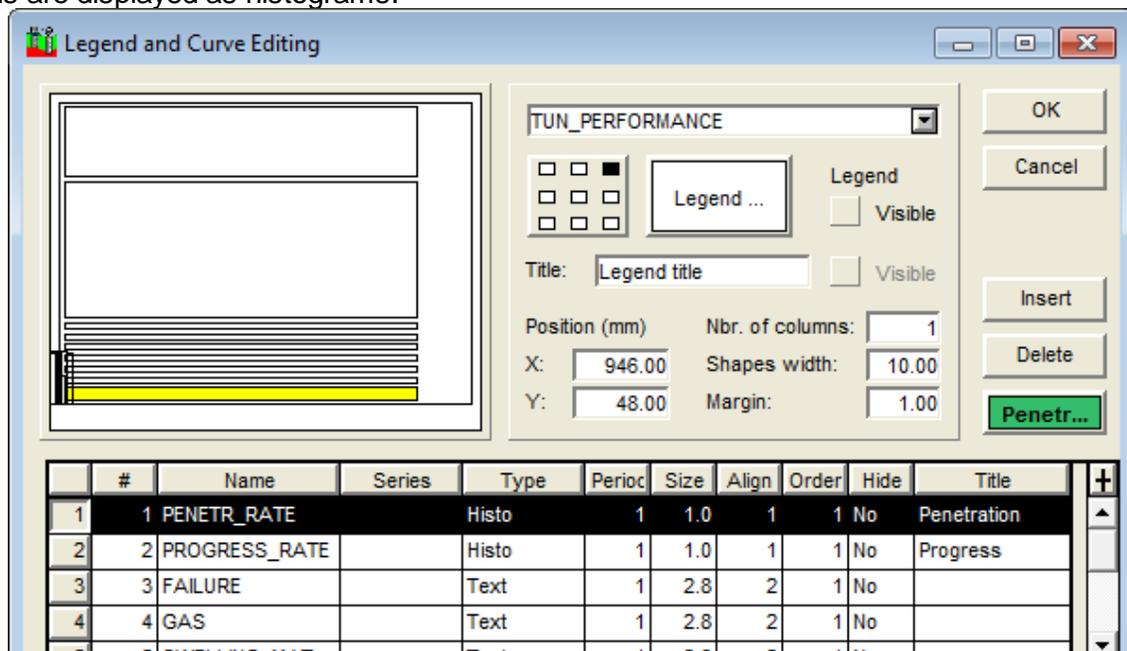


Figure 22 - Curves of the TUN_PERFORMANCE secondary graph

12.5. TUN_LITHOLOGY secondary graph

The TUN_LITHOLOGY secondary graph (see Figure 23) shows the stratigraphic units encountered during the tunnel construction. Typically, the information of the STATE (of the rock), LITHO (lithology) and FORMATION (lithostratigraphic formation) fields can be displayed.

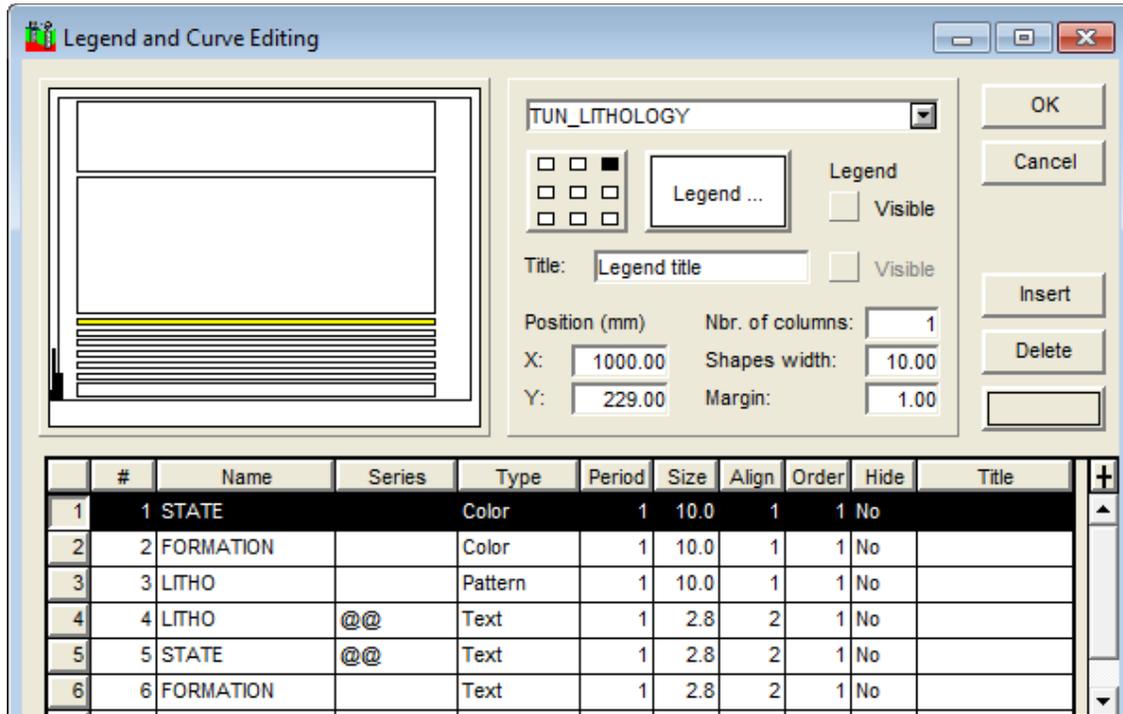


Figure 23 - Curves of the TUN_LITHOLOGY secondary graph

12.6. TUN_GEOSTRUCTURE secondary graph

The TUN_GEOSTRUCTURE secondary graph (see Figure 24) shows the structural elements listed during the tunnel construction. It is information about the types of discontinuities. Typically, the information of the TYPE (of joint or discontinuity) field is displayed, as well as details about the joints.

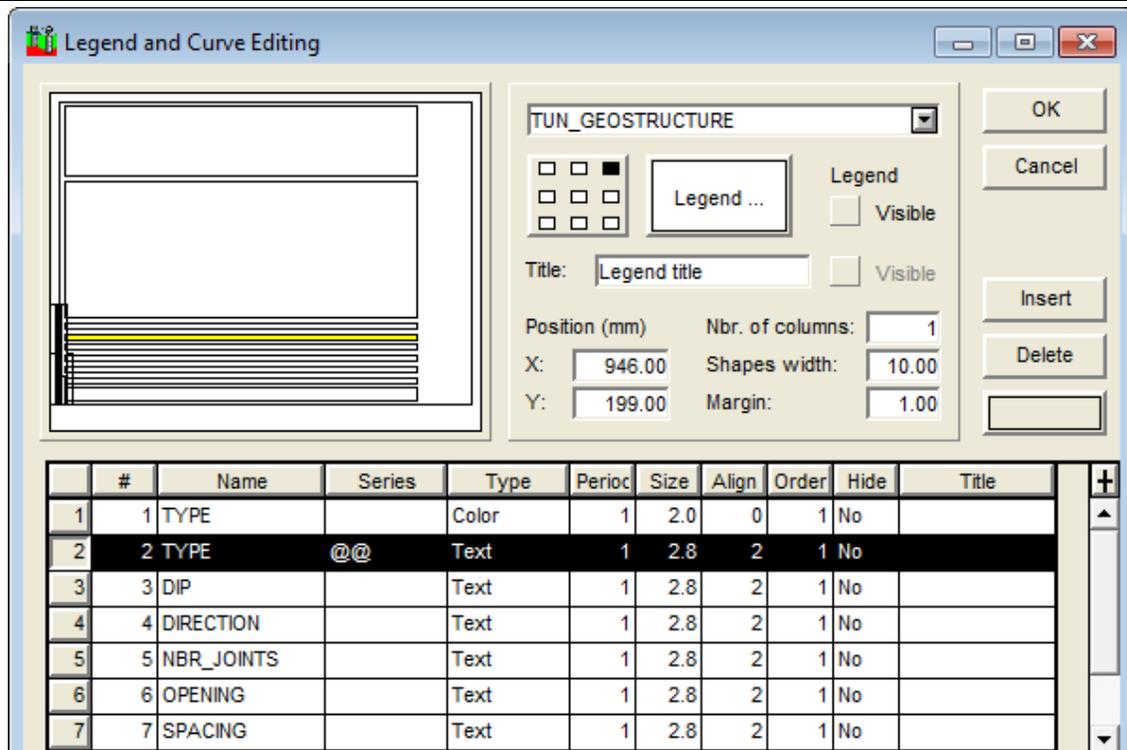


Figure 24 - Curves of the TUN_GEOSTRUCTURE secondary graph

12.7. TUN_HYDROGEOLOGY secondary graph

The TUN_HYDROGEOLOGY secondary graph shows the water conditions encountered during the tunnel construction. Typically, the information of the HYDROGEO field is displayed.

12.8. TUN_CLASSIFICATION secondary graph

The TUN_CLASSIFICATION secondary graph shows the quality class of the tunnel rock mass according to two geomechanical classification systems, the RMR and the Q-value systems. Typically, the information of the CLASS field is displayed.