FastTerrain 3.0

TIN Models and Quantities Estimation
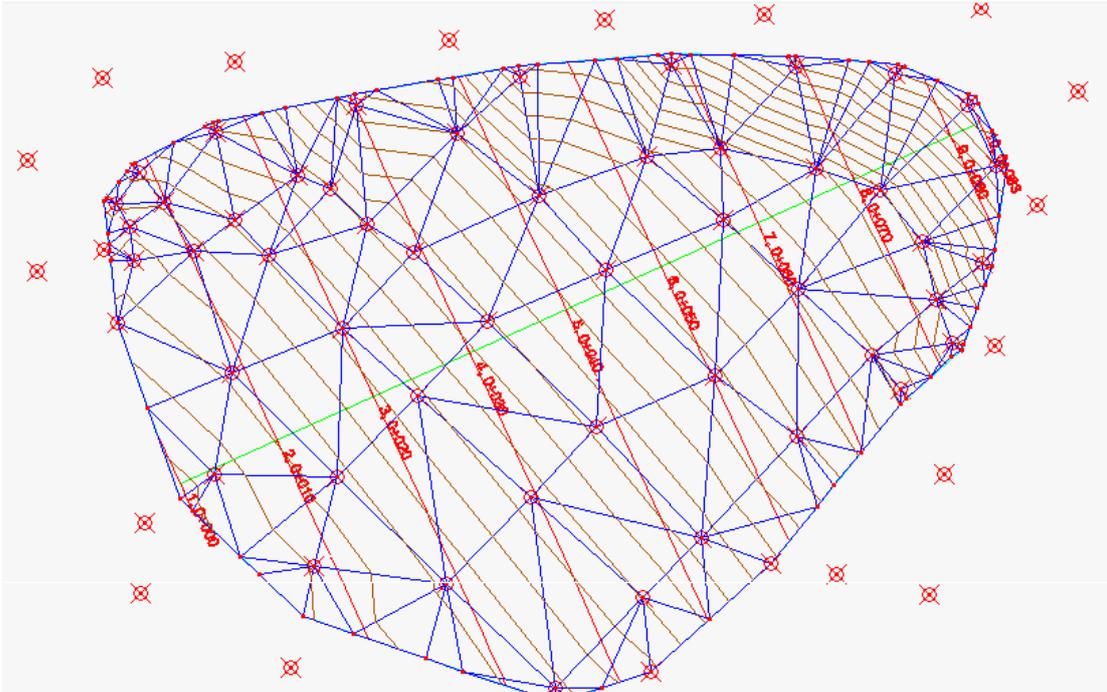
User's Guide

December 2015

CONTENTS

FastTerrain

GENERAL

FastTerrain is slightly integrated within standalone CAD environment including all well known CAD commands for drawing production.
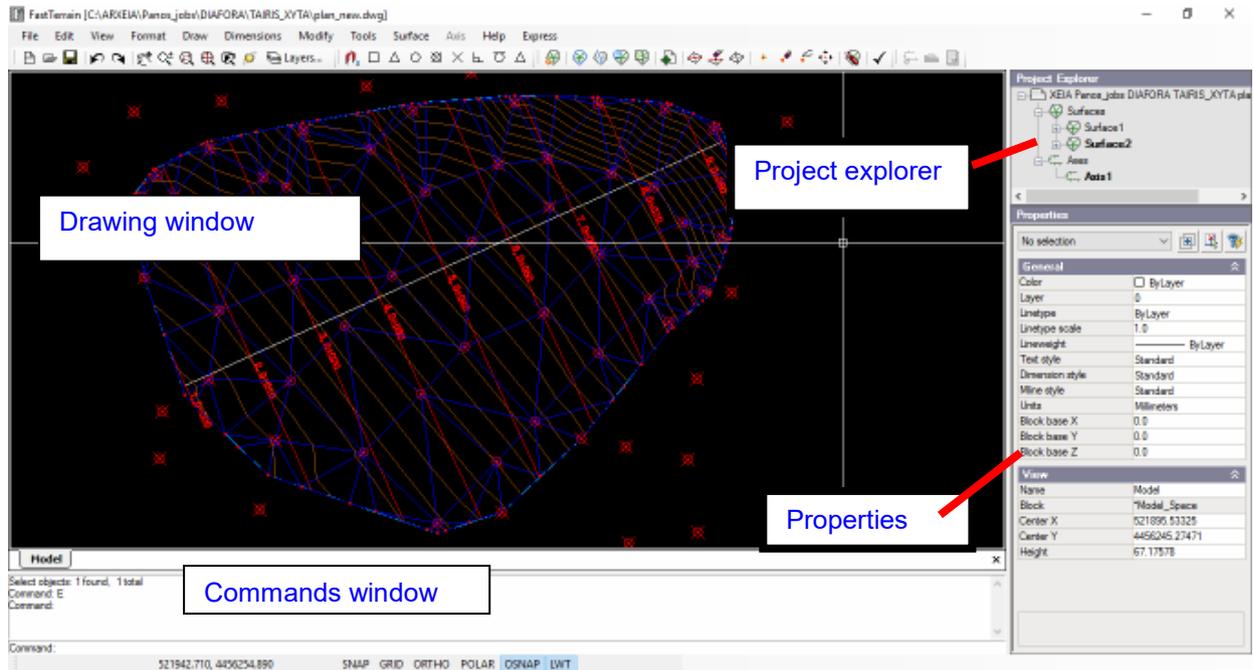

Main window

The main window of the application is divided in three parts. In the central area you will find the drawing canvas, in the area below you will find the drawing commands window and in the right side you will find the properties window. Below the commands window the program have the drawing status toolbar including: the cursor coordinates, the drawing control buttons (SNAP, GRID, ORTHO, POLAR, OSNAP, LWT) and finally the buttons controlling the current time pattern of hydraulic analysis.
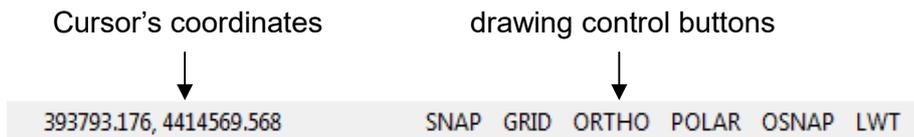
Drawing status toolbar

Above the drawing canvas you will find toolbars for graphical entities creation and modification as well as toolbars for hydraulic networks design and analysis.
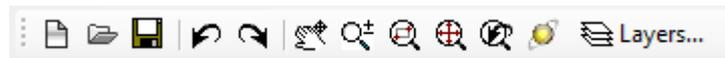
Basic toolbar
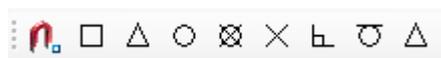
Snap to graphical entities

Surface and Axis toolbar

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SURFACE MENU

The "Surface" menu contains all commands used to create and edit digital terrain models.
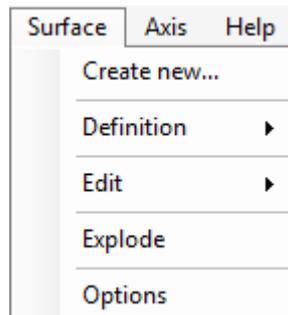
Surface Menu

- **_Create new..._**   This command adds a new surface model in the project. When you execute this command the program shows a form in which you must provide details for the new created surface.
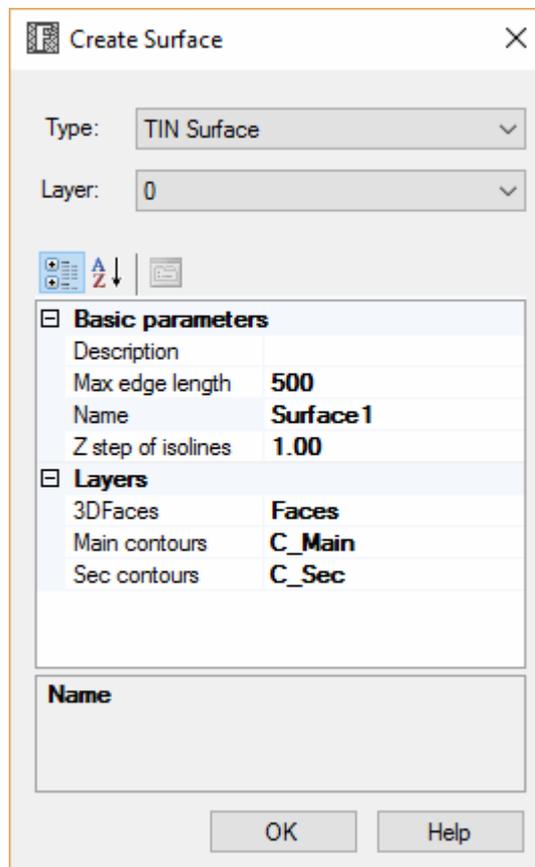
The _Create TIN surface_ dialog box

In the first drop-down list you specify the type of the surface. There are three types of surface available in FastTerrain: i) TIN surface ii) Volume surface. The volume surface is the result of the interesection between two TIN surfaces. iii) Grade surface. The Grade surface is a volume surface between a TIN surface and an earthworks surface. The types ii) and iii) are closed and manifold surfaces.

In the second drop-down list you define the layer in which the surface will be placed. If yoy choose the <New layer> option the program will prompt you to insert the name for the new layer.

In the *Basic Parameters* properties you can define a description for the surface, the manimum allowed length for the faces edges, the surface name and the elevation interval for the contours.

If you choose the *TIN Surface* type the program shows the *Layers* properties in which you can define the layers in which the program will place the faces, the main and secondary contours respectively when the surface will be exploded (see bellow about *Explode* command).

If you choose the *Volume Surface* type, the program shows the *Volume surface* properties in which you can define the base and comparison surfaces that will create the volume surface, the colors of fills and cuts and the corresponding bulking factors.
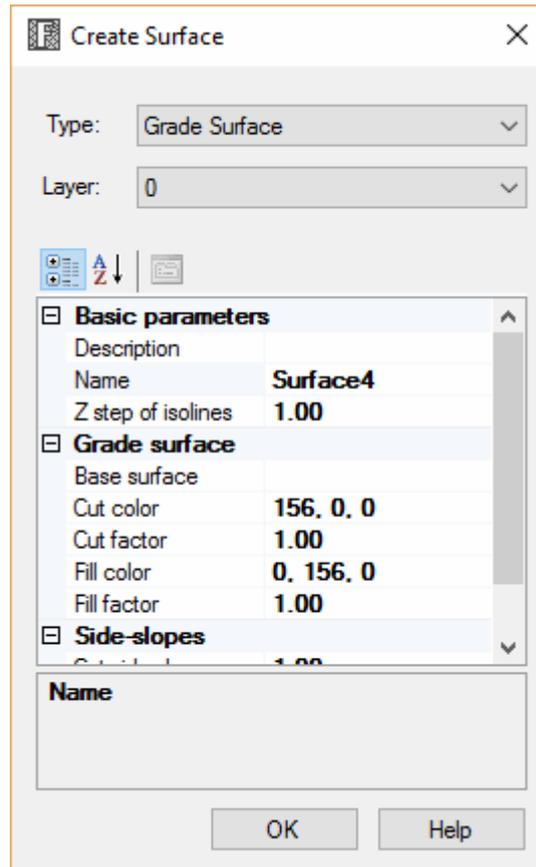
The *Create volume surface* dialog box

If you choose the *Grade Surface* type, the program shows the *Grade surface* properties in which you can define the base surface that will create the volume surface, the colors of fills and cuts regions and the corresponding bulking factors. Under the *Side-slopes* label you can define the grade for the cut and fill side-slopes.
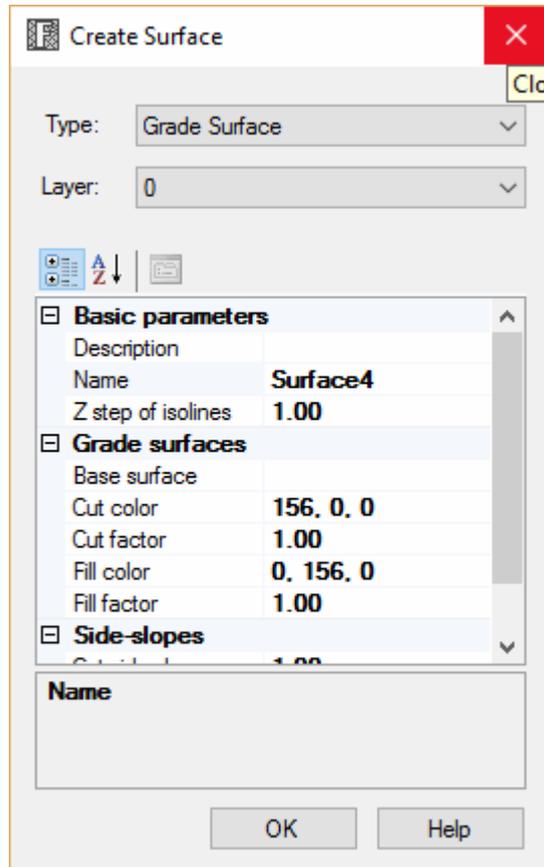
The *Create grade surface* dialog box

By creating a TIN Surface or a Volume surface, the program adds the new surface to the project explorer tree under the *Surfaces* leaf.
By creating a Grade surface, the program prompts you to select the foundation polyline from which the earthworks surface will be created. The foundation polyline must be a closed 2D polyline having elevation equal with the elavation of the foundation level.

• **Definition**

This command group contains several operations for the surface definition. Bellow you will find a short description of each command.

Boundaries:

With this command you can define boundaries on the active surface. By executing this command the program shows a dialog box in which you must select the kind of boundary that you want to define.
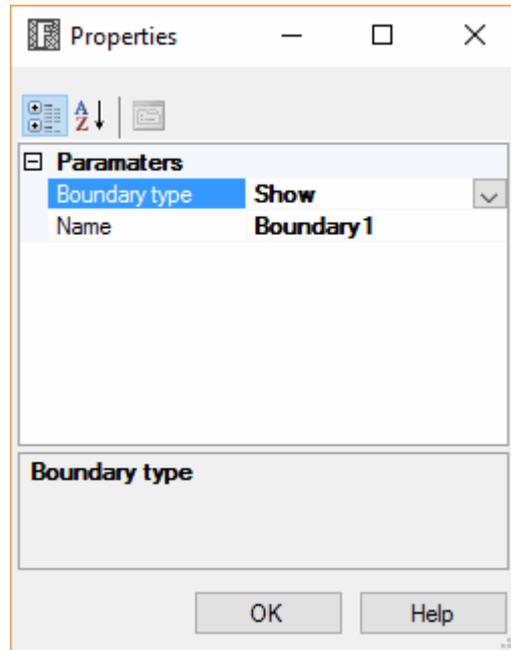
The *Boundaries* dialog box

In the *Boundary type* field you can define the type of boundary. If you choose the *Outer* option the program will take the inserted polyline as outer boundary. If you choose the *Hide* option the program will take the inserted polyline as inner boundary in the surface. Finally, if you select the *Show* option, the program will insert the polyline in the surface.

By pressing the *OK* button the program prompts you to select the boundary poyline in the drawing.

When the command is completed, the boundary is added in the project explorer under the boundaries label of the current surface.

Breaklines:

With this command you can add breaklines to the current surface. By executing this command the program shows a dialog box in which you can define the name of breaklines set and if the program will add new points at the end points of each line (in the case that not already exist). By default this parameter is *false* meaning that if the drawing does not have points at the line ends then this line will not inserted to the breakline set.
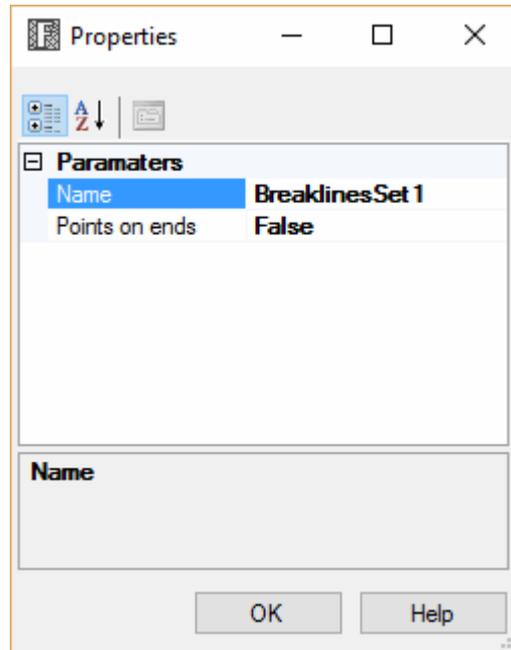
The *Breaklines* dialog box

When the command is completed, the breakline set is added in the project explorer under the breaklines label of the current surface.

Contours:

With this command you can add contours (2D poylines with elevation) to the current surface. By executing this command the program shows a dialog box in which you can define the name of the inserted contours.
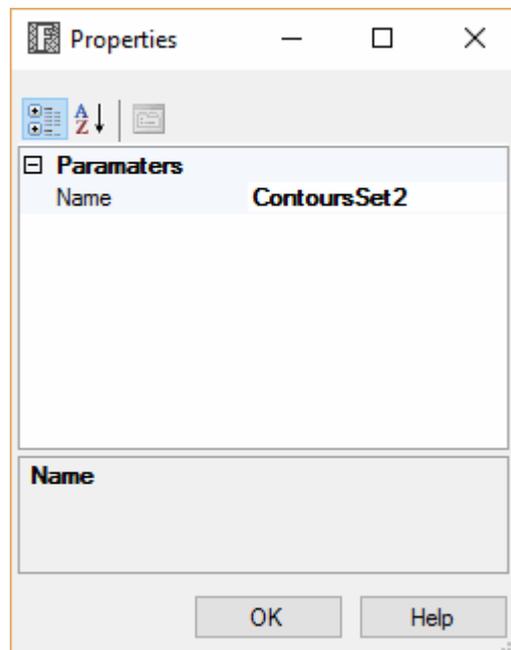
The *Contours* dialog box

When the command is completed, the contours set is added in the project explorer under the contours label of the current surface.

Drawing objects:

With this command you can add drawing points (points, lines or 3d faces) in the current surface. By executing this command the program shows a dialog box in which you can define the name for the drawing objects set that will be inserted.
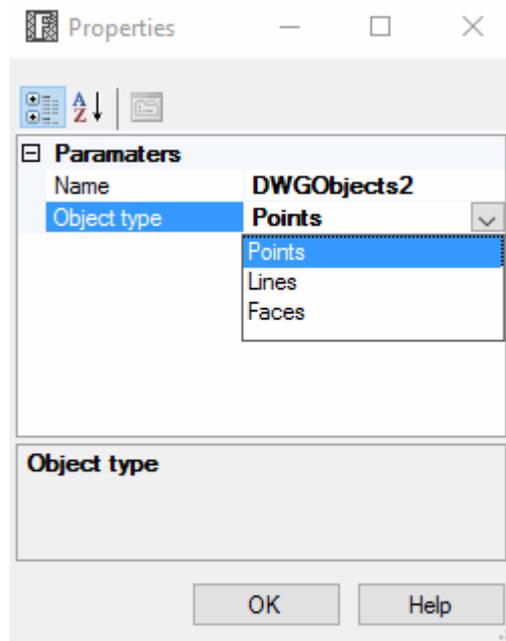
The *Drawing objects* dialog box

When the command is completed, the drawing objects set is added in the project explorer under the contours label of the current surface.

Points file:

With this command you can add points in the current surface from a text file. By executing this command the program shows a relative dialog box in which you can define details about the format of the selected file as well as details about the way in which the points will be presented in the drawing. If you check the *Draw points* option the program will draw also the point code and point elevation in specific layers. If you select the *Don't add to surface* option then the program will draw the points in the model space without adding these points into the surrent surface.

By pressing the *Options* button the program shows a secondary dialog box including additional drawing options. Under the *Draw options* label you can set i) if the points will be 3D or 2D ii) if the points will have code texts iii) the precision of the elevation text and iv) if the points will have elevation texts. Under the *Layers* label you can define the layers in which the program will place the Code and elevation texts as well as the points entities.
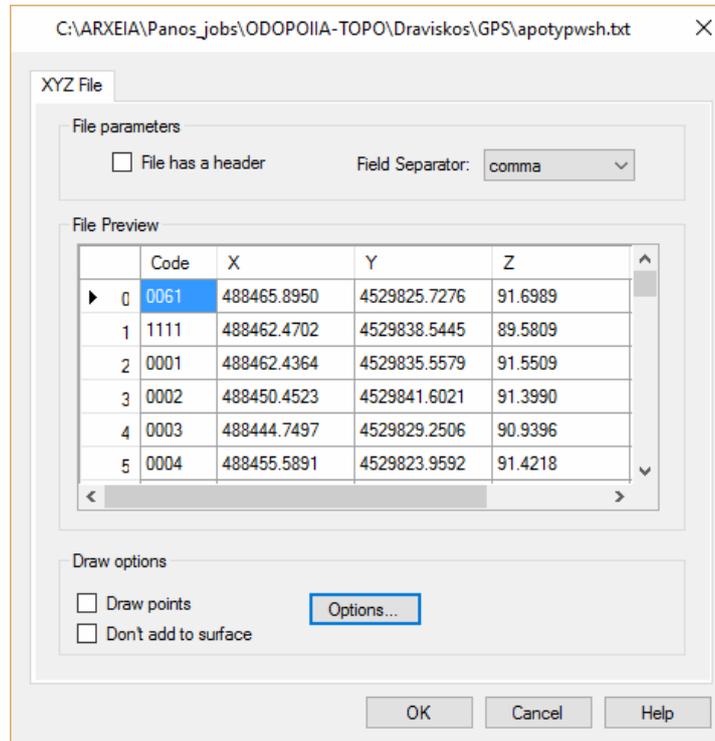
The *Points file* dialog box
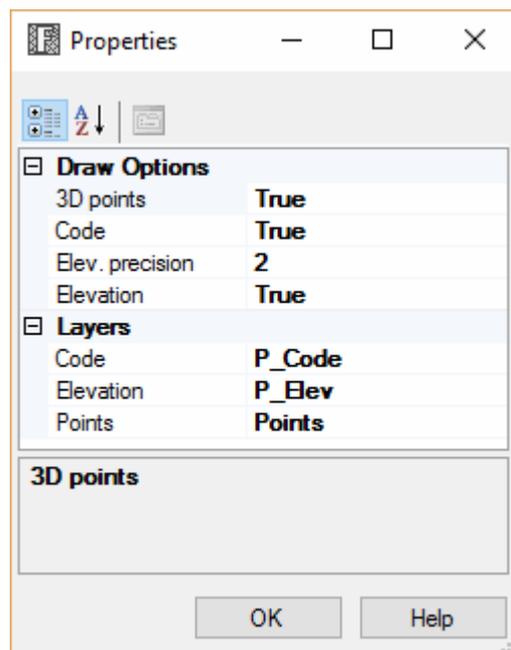
The *Options* dialog box

- ***Edit***   With this command you can modify the current surface. The group contain the following commands:

Add Line	
Delete Line	
Swap Edge	
Add Point	
Delete Point	
Modify Point	
Move Point	
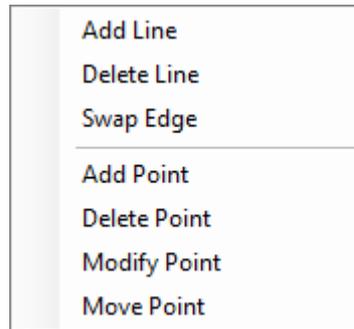
The *Surface edit* command group

Add Line:

This command add a TIN edge between two points of the active surface.

Delete Line:

With this command you can delete an edge from the surface.

Swap Edge:

With this command you can swap the common edge between two faces.

Add point:

With this command you can add a new point in the surface. The elevation for the new point is taken from the face on which the point will be inserted.

Delete point:

With this command you can delete an existing point from the surface.

Modify point:

With this command you can change the elevation of a point. By clicking on the desired point, the program shows a dialog box in which you can define the new elevation value.

Move point:

With this command you can move a point of the surface in a new position.

The edit commands are added in the project explorer under the *Edits* label.

- **Explode**   With this command you can explode the current surface to its components. After *Explode* the active surface is converted to 3d faces and the contours to 2d polylines with the corresponding elevation.

- **Properties**   If you execute this command the program shows the *Options* dialog box.
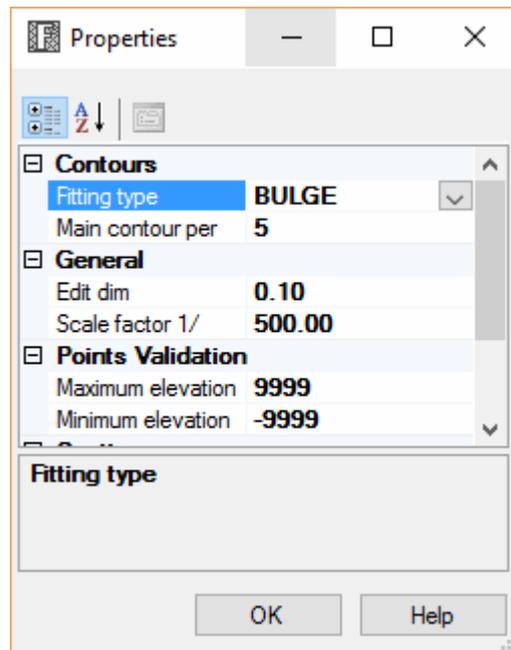
The *Options* dialog box

In *Contours* label you can define the fitting type and the grouping interval for the contours.

In *Cross-sections BOQ* you can define the computation method for volumes estimated using cross-sections areas. There are two computation methods available i) average end area ii) fitted length. In *General* label you can define tolerance in picking objects during surface editing. In *Points Validation* label you can insert the elevation range in which points are valid. In *Sections* label you can define the paper height to fit the cross-sections drawing as well as the scale factor for the texts and scale factor for the Y axis.

AXIS MENU

The "Axis" menu contains all commands used to create and edit axis upon surfaces.
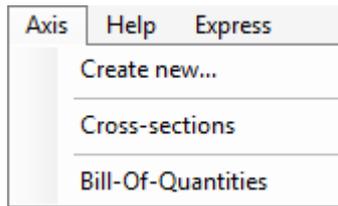
Axis Menu

- ***Create new...*** With this command you can create a new axis on the drawing by selecting an existing 2D polyline. By executing this command the program shows the following dialog box:
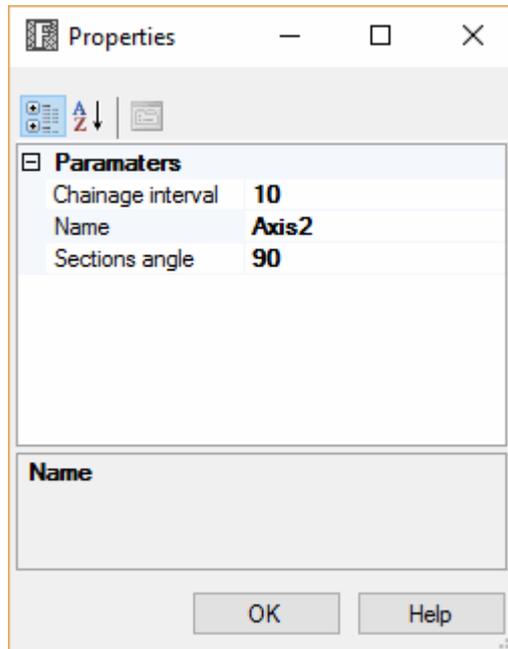
The *New Axis* dialog box

Under the *Parameters* label you can define: i) the stations chainage interval ii) the name of the new axis iii) the angle of cross-sections along the axis (the angle is measured starting from axis direction).

- ***Cross-sections*** With this command you can draw the cross-sections within the drawing by defining an insertion point. The program draws the cross-sections according to the defined scale factor and paper height.

- ***Bill-Of-Quantities*** If you execute this command, the program shows the Bill-Of-Quantities table report.

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PROJECT EXPLORER

On the upper right area of the main window you will find the project explorer. The project explorer contains all the objects (surfaces, axes) included in the project.

The *Project Explorer*

The active surface (or axis) is showed in the project explorer with bold font. You can select another surface to set as active surface (or axis) by right click on its label and selecting the *Set Active* option from the popup menu. All commands included except *Create new...* and *Options* in the Surface (or Axis) menu are applied on the active surface (or axis).

- **Surface popup menu**
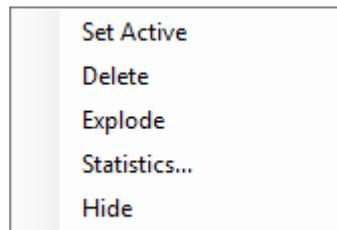
The *TIN Surface* popup menu
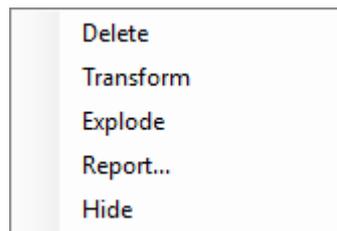
The *Volume and Grade Surface* popup menu

Set Active:

This command sets the active surface.

Delete:

This command deletes the selected surface.

Transform:

This command is available only for volume and grade surfaces and when you execute it the program shows a dialog box in which you can modify the position and/or rotation of a grade or a volume surface relatively to its base surface.

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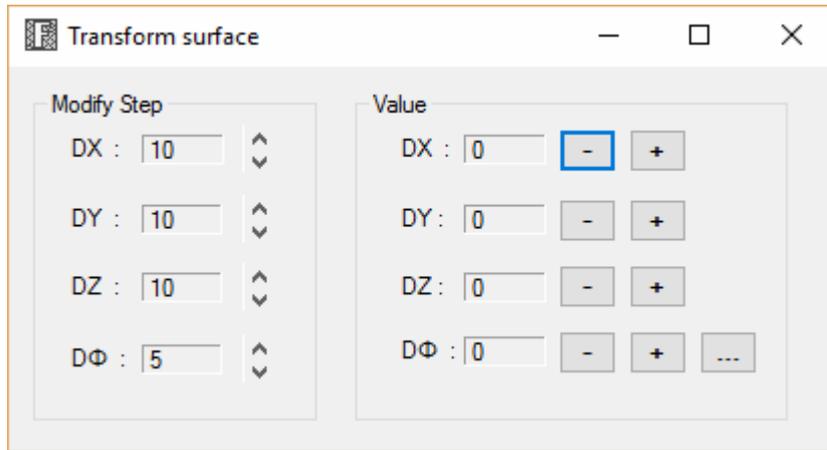
The *Transform Surface* popup menu

In the modify group you can define the modification step for each coordinate or the modification angle if you want to rotate the surface about an vertical axis. The center point for the rotation is defined by pressing the button *ΔΦ* within the group *Value*.

Explode:

If you execute this command the surface will be exploded.

Statistics:

This command shows the surface statistics. The *Statistics* command is available only for TIN Surfaces.

Report:

This command shows the report of a boolean operation between surfaces. The *Report* command is available only for Volume and Grade surfaces.

Hide:

With this toggle command you can hide a surface from the model space.

CAD   PLATFORM

STANDALONE CAD PLATFORM

The CAD platform of the program have the following features:

➢ Graphics objects: Point, Line, Polyline, Circle, Arc, Ellipse, Rectangle, Text (single, multiline, arc), Hatch, Dimension (rotated, aligned, angular, ordinate, radial, diametic), Leader, Block Insertion, Viewport.

➢ Raster images of various formats: BMP, JPG, GIF, TIF, PNG, PCX, etc., and also huge ER Mapper Compressed Wavelet (ECW) and Jpeg2000 images. With TWAIN support you can acquire images directly from scanners and digital cameras..

➢ Named objects: Block, Layer, Linetype, Text Style, Dimension Style, Multiline style, Layout..

➢ Supports Windows TTF fonts and AutoCAD SHP/SHX fonts.

➢ Supports AutoCAD hatch patterns (PAT) and linetypes (LIN).

➢ Edit operations with graphic objects: Copy, Move, Rotate, Scale, Mirror, Explode, Erase, Join, Offset, Trim, Extend. Single objects can be edited by moving their control points (grips).

➢ Various snap modes allows you to draw/edit objects accurately without tedious calculations. Snapping modes use ID markers to enhance operator speed and vision. Superior Polar Tracking capability. Command line interface offers exact placement of objects. You can enter values for coordinates, lengths and angles from keyboard.

➢ Zoom capabilities allows you to view the entire drawing or any desired part of it.

➢ Mouse Wheel supports real-time Zoom and Pan.

➢ Export / import of drawings with various file format via plugins.

➢ Print Preview. Also you can use Paper space layouts to prepare paper sheets ready for printing.

➢ Clipboard copy and paste capabilities.

➢ Undo-Redo buffer saves 100 commands.

In the following pages you will find a brief description for all commands of the CAD platform.

FILE MENU
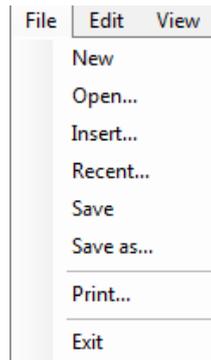
➢ **New.** Creates a new drawing.

➢ **Open...** With this command you can load an existing drawing. If together with the *.dwg file the folder contain the surfaces and axes *.xml file, the surfaces and axes will be loaded also.

➢ **Insert…** With this command you can insert a drawing file in the existing drawing.

➢ **Recent…** With this command you can load the recently opened files.

➢ **Save.** Saves the current drawing. If you have defined hydraulic networks in the project the program will create a secondary file with same name having *.xml extension. This file contains all data for surfaces and axes. Without this file the *.dwg file is simple drawing file.

➢ **Save as…** Saves the current drawing in a new directory. If you have defined hydraulic networks in the project the program will create a secondary file with same name having *.xml extension. This file contains all data used in hydraulic analysis. Without this file the *.dwg file is simple drawing file.

➢ **Print…** By executing this command the program shows the plot dialog.

➢ **Exit.** This command close the program.

EDIT MENU
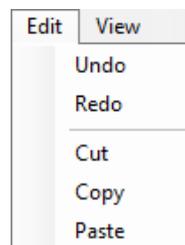
➢ **Undo.** Undo command.

➢ **Redo.** Redo command.

➢ **Cut.** Cut graphic objectss.

➢ **Copy.** Copy graphic objects.

➢ **Paste.** Paste graphic objects.

VIEW MENU
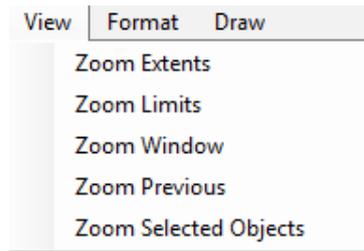
➢ **Zoom Extents.** By executing this command the program zooms to display the maximum extents of all objects in the drawing.

➢ **Zoom Limits.** (This command is not available in this version)

➢ **Zoom Window.** By executing this command the program zooms to display an area specified by a rectangular window. With the mouse cursor, you can define an area of the drawing to fill the main window.

➢ **Zoom Previous.** Zooms to display the previous view.

➢ **Zoom Selected Objects.** Zooms to display one or more selected objects as large as possible and in the center of the view.

FORMAT MENU
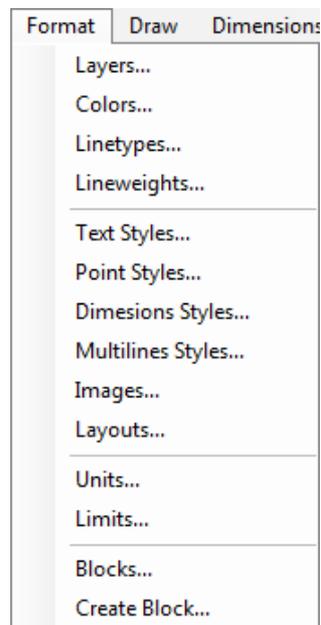
➢ **Layers...** If you execute this command, the program shows the *Layers properties manager* dialog box. Use layers to control the visibility of objects and to assign properties such as color, linetype or lineweight.

➢ **Colors...** By executing this command the program shows the *Select color* dialog box in which you can set the color of graphic objects.

➢ **Linetypes...**
    This command shows the *Linetype Manager* dialog in which you can set the linetype for graphic objects. Also, in this dialog you can load LIN files.

➢ **Lineweights...**

This command shows the *Lineweight Settings* dialog box. This dialog box sets the current lineweight. Controls the display scale of lineweights and sets the default lineweight value for layers.

➢ **Text Styles...**

If you execute this command the program shows the *Text Styles Manager* dialog box in which you can create, modify or specify text styles. In this dialog you can specify the font, height, width and other parameters for text styles.

➢ **Points Style...**

This command shows the *Point style* dialog box in which you can specify the style and size of point objects.

➢ **Dimesions Styles...**

This command shows the *Dimension styles* manager. In this dialog you can create new styles, set the current style and set overrides on the current dimension style.

➢ **Multiline Styles...**

This command shows the *Multiline Styles* dialog box. In this dialog you can create, modify, save and load multiline styles.

➢ **Images...**

This command shows the *Image Manager* dialog box. In this dialog box you can manage available images in the current drawing.

➢ **Layouts...**

This command shows the print *Layout* dialog box.

➢ **Units...** This command shows the *Drawing units* dialog box. In this dialog you can control, for the current drawing, the displayed precision and format for coordinates and angles.

➢ **Limits...** With this command you can define the canvas limits for the current drawing.

➢ **Blocks...** If you execute this command the program shows the *Blocks* manager dialog box in which you can manage the available blocks in the drawing.

➢ **Create Block...**

By using the *Block definition* dialog box you can define blocks in the current drawing.

DRAW MENU
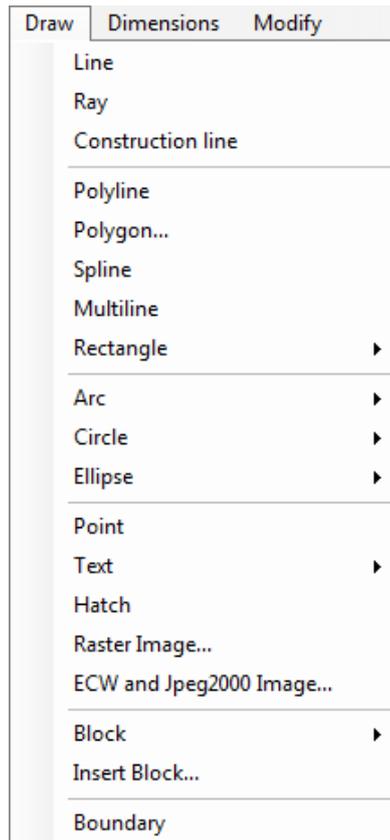
- ➤ **Line.** With this command, you can create a series of contiguous line segments. Each segment is a line object that can be edited separately.

- ➤ **Ray.** This command creates a linear object that starts at a point and continues to infinity.

- ➤ **Construction Line.**
    This command creates a linear object that continues to infinity.

- ➤ **Polyline.**
    With this command, you can create a 2D polyline, a single object that is composed of line and arc segments.

- ➤ **Polygon.**
    This command creates an equilateral closed polyline.

- ➤ **Spline.**
    Creates a smooth curve that passes through or near a set of fit points, or that is defined by the vertices in a control frame.

- ➤ **Multiline.**
    This command creates multiple parallel lines.

- ➤ **Rectangle.**
    With this command you can create a rectangular polyline. You have three options available: 1) by defining the diagonal cross 2) by defining one side and the height of the rectangle 3) by defining the center of the rectangle, the mid-length of the diagonal cross and the angle from the X-axis.

➢ **Arc.**

With this command you can draw an arc in the current drawing. You have eleven (11) options to create the arc: by inserting 1) the start, mid and end points 2) the start, center of the circle and end point 3) the start point, center and included angle 4) the start point, center and chord length 5) the start point, end point and included angle 6) the start point, end point and tangent direction in the beginning 7) the start point, end point and radius of the arc 8) the center, start point and end point 9) the center, start point and included angle 10) the center, start point and chord length 11) contiguous arcs by defining two (2) points for each arc.

➢ **Circle.**

With this command you can draw a circle in the current drawing. You have four (4) available options to define the circle: by inserting 1) the center and radius 2) the center and diameter 3) two points defining the diameter 4) three points

➢ **Ellipse.**

With this command you can draw an ellipse in the current drawing. You have two (2) available options to define the ellipse: 1) major axis, minor axis 2) center, major axis, minor axis.

➢ **Point.**

By using this command you can add a 3d point in the current drawing.

➢ **Text.**

By executing this command, you can add a text in the current drawing. You have four (4) options to do this: 1) one line text 2) multiple lines text 3) text on arc 4) text with true type font.

➢ **Hatch.**

With this command you can select the object on which the hatch will be applied. After object selection the program shows a dialog box with the available hatch patterns.

➢ **Raster Image….**

If you execute this command the program shows a dialog box with which you can select an image to insert in the current drawing.

➢ **ECW and Jpeg2000….**

If you execute this command the program shows a dialog box with which you can insert the ECW and Jpeg2000 file types in the current drawing.

➢ **Block.**

For blocks of graphical objects, the program has three (3) available options: 1) make a block definition by selecting graphical objects in the screen. Ορισμός block γραφικών αντικειμένων 2) define insertion point 3) define attributes for the block.

➢ **Insert Block...**

By executing this command the program shows a dialog box in which you can select the block that you want to insert in the current drawing as well as the insertion point, the scale factor and the rotation angle.

➢ **Boundary.**

With this command you can draws a boundary polyline.

DIMENSIONS MENU
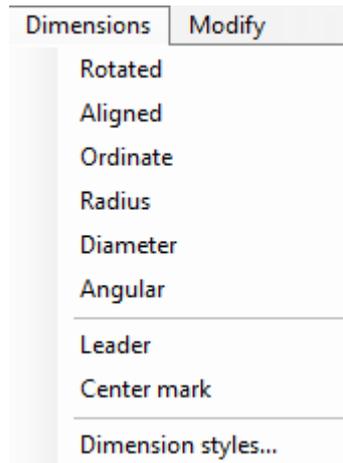
> ➢ **Rotated.**
>> This command inserts dimension in the drawing having vertical or horizontal direction.
> ➢ **Aligned.**
>> This command inserts dimension in the drawing having arbitrary direction.
>
> ➢ **Ordinate.**
>> This command inserts a level dimension in the drawing.
>
> ➢ **Radius.**
>> This command inserts radius dimension in circles or arcs.
>
> ➢ **Diameter.**
>> This command inserts diameter dimension in circles or arcs.
>
> ➢ **Leader.**
>> This command inserts a line that connects annotation to a feature.
>
> ➢ **Center mark.**
>> When you execute this command the program prompts you to select a circle or arc in order to mark its center point.
>
> ➢ **Dimensions styles.**
>> (see in the Format menu)

MODIFY MENU
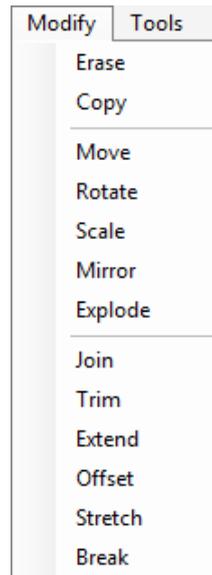
➢ **Erase.**
  If you have already objects selected, the program erases these objects. If you don't have selected objects the program prompts you to select objects in the screen in order to erase them from the current drawing.

➢ **Copy.**
  You can use this command to copy graphical objects. After the objects selection the program asks for the start and end points of the moving vector.

➢ **Move.**
  You can use this command to move graphical objects. After the objects selection the program asks for the start and end points of the moving vector.

➢ **Rotate.**
  This command rotates graphical objects in the drawing. After the objects selection you must insert the rotation point.

➢ **Scale.**
  This command enlarges or reduces the selected objects, keeping the proportions of the object the same after scaling. After the objects selection you must insert the base point for the scale operation and the corresponding scale factor.

➢ **Mirror.**
  This command creates a mirrored copy of the selected objects. After the object selection you must specify the mirroring axis.

➢ **Explode.**
  This command breaks a compound object into its components.

➢ **Join.**
  This command joins the endpoints of linear and curved objects to create a single object.

➢ **Trim.**
  Trim objects to meet the edges of other objects. To trim objects, select the boundaries. Then select the objects that you want to trim.

➢ **Extend.**

Extents objects to meet the edges of other objects. To extend objects, first select the boundaries. Then select the objects that you want to extend.

➢ **Offset.**

Offset an object to create a new object whose shape is parallel to the original object. To complete this command, first you must select the object that you want to offset and then you must specify either the trough point of the new object or the offset distance. The offset option can be changed by clicking the right mouse button and select the desired option.

➢ **Stretch.**

This command stretches objects crossed by a selection window or polygon. Objects that are partially enclosed by a crossing window are stretched. Objects that are completely enclosed within the crossing window, or that are selected individually, are moved rather than stretched.

➢ **Break.**

This command breaks the selected object between two points. You can create a gap between two specified points on an object, breaking it into two objects.

TOOLS MENU
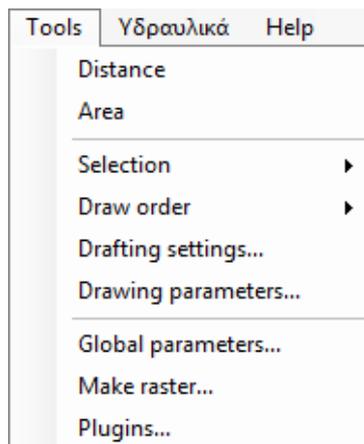
➢ **Distance.**

This command measures the distance between two points in the plane.

➢ **Area.**

This command calculates the area of a defined region.

➢ **Selection.**

Commands group for objects selection. The command group has four (4) commands: 1) Select All. Select all objects in the design window. 2) Unselect All. Deselect all the selected objects in the design window. 3) Select by Current Layer. Select all objects of the current layer. 4) Select by Polygon. Select all objects that are within a given polygon.

➢ **Draw order.**

Commands group defining the draw order for the graphical objects in the screen. The commands group contains four (4) commands: 1) Bring to Front. Move the selected objects to the top of the order of objects in the drawing. 2) Send to Back. Move the selected objects to the bottom of the order of objects in the drawing. 3) Bring Above Object. Move the selected object above the specified reference

objects. 4) Send Under Object. Move the selected objects below the specified reference objects.

➢ **Drafting settings...**
When you execute this command the program shows the *Drafting settings* dialog box. In this dialog you can specify the grid to snap, the polar tracking and the object snap properties.

➢ **Drawing parameters...**
By executing this command the program shows the *Drawing's Parameters* dialog box including details and statistics for the current drawing.

➢ **Global parameters...**
By executing this command the program shows the *Global parameters* dialog box including the general settings of the CAD platform.

➢ **Make raster...**
With this command you can create an image file from the current drawing in the main window.