Road Design & Construction Software

This characteristic was difficult to be accomplished. On the other hand the development of the above traditional confrontation with two dimensional (2D) individual units have been exhausted. Each effort of maintenance the traditional structure in future versions, would be disproportional to the desirable result, leading finally the software to scorn. The exploitation of the most latest developing technology replace the time-consuming and complicated briefings between the individual 2D units by a single 3D confrontation of the project, in all design stages.

This particular characteristic, differentiates DIOLKOS from all similar programs and gives the designer much more flexibility in the confrontation of special designing cases.

In the present version (7), DIOLKOS is automatically computing the geometry of the plan, stations, profile, cross-sections and 3D model of road in conjunction with the surrounding terrain in every change in alignment geometry. The user conceives the above calculations as a small delay during the commands that the program executes.

Based on calculated 3D model of the road in conjunction with the surrounding terrain, DIOLKOS can project perspective or to a plane the 3d model of the entire project in real time, without moreover calculations. The virtual 3D animation along the road axis constitutes the absolute method of controling the stopping sighting distance of a roadway.

Thus DIOLKOS constitutes a complete and robust 3D program, giving the designer the most powerful tool in order to monitoring the design process at all stages.
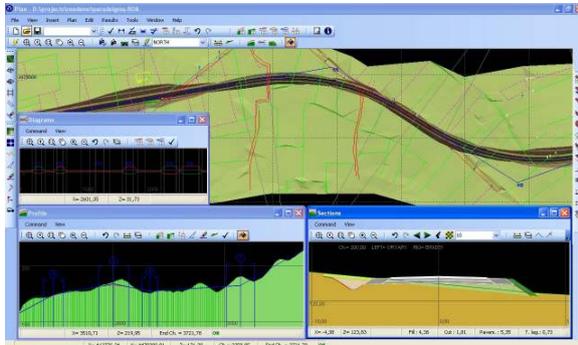
General

DIOLKOS is complete and autonomous new generation road design software. It covers all the cases of road design projects including highways, local and collector roads (at urban or rural regions), roads at wood areas, railways, airfield runways, multiple road projects such as intersections, motorways with service roads etc. Beyond the purely transportation projects, Diolkos is able to design hydraulic projects including riverbed delimitation and arrangement, projects for channels, ditches, booms etc. These projects are covered completely, from the preparation of background and the calculation of digital model of ground until the quantities measurement and printings.

Today DIOLKOS is found in version 7 incorporating a number of innovative characteristics and technologies. These features are setting up as one of the most advanced and complete software, in general technical software category.

The major characteristic of DIOLKOS is the integration of two dimensional (2D) entities composing the plan, profile and cross-sections designs into a three dimensional (3D) model of road in conjunction with the surrounding terrain.

Requirements

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CPU:	P4 2.4 GHZ or better
RAM:	512 MB
H.D.:	200 MB free space
Graphics:	128 MB DirectX
O.S.:	Windows XP, Vista, 7
Hardlock:	USB
Install:	CD-ROM

Digital terrain model

Among the most common data structures that have been proposed for the creation of Digital Elevation Models (DEMs), two are the most common, namely the Grid and the TIN (Triangular Irregular Network). Since TIN is better suited to fit our purposes, Diolkos has a built-in engine to create, edit and visualize such DTMs. The engine is robust enough to process and triangulate over 100000 points in less than 3 seconds (using a typical computer). The program includes break line and hole insertion possibilities, and also provides several filtering algorithms (points, breaklines, triangles filters etc.) for smoothing the surveyor's inserted data.

The engineer is also free to use any other software (in which he may be familiar), in order to create the terrain model.
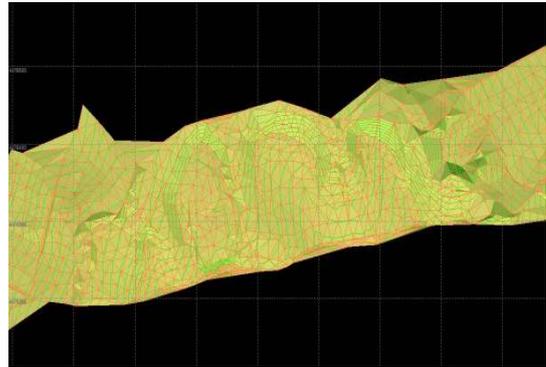

Horizontal alignment

The alignment vertices can be positioned in a multiple ways. On-line from AutoCAD via MS ActiveX automation technology, visually by using the mouse or by typing the coordinates by hand on a table. After the polyline definition the user can insert circular arcs with or without transition curves in order to formulate the road centerline. The program has a number of functions and operations through which the designer is able to manipulate with detail the road axis elements. Various chainage positions can be defined as the starting point for the road axis. Additionally, when the user inserts the background drawing the program organize within the same layers all the contained elements by this drawing. The stations along the centerline can be inserted automatically or manually. Then, the user may add or delete a single or a series of stations using both keyboard or mouse. Stations can be placed at specific positions (starting and ending points for transition curves and tangents) and at the intersections of centerline with TIN lines. Multiple stations insertion at the intersections of centerline and background lines of a certain layer, is also available. Stations can also be projected from another road axis. Finally if the designer changes the horizontal alignment geometry, the program is able to recalculate the stations automatically in real time. When the current project is a channel, the program calculate the areas that water covers over the two selected time periods. If it concerns existing channel design the definition of single layer as water-cover bound can help the designer to inverse define the desirable form for this channel. This can be done according the existing polyline bound that lies at the above layer.
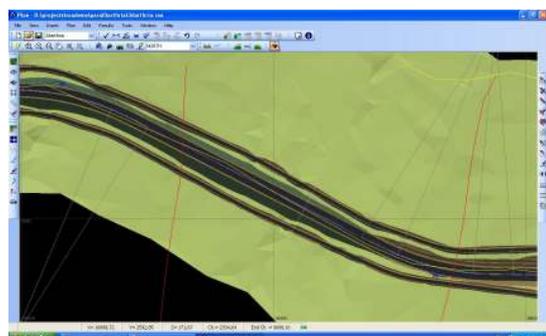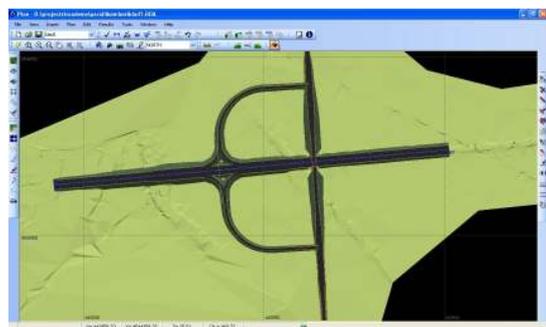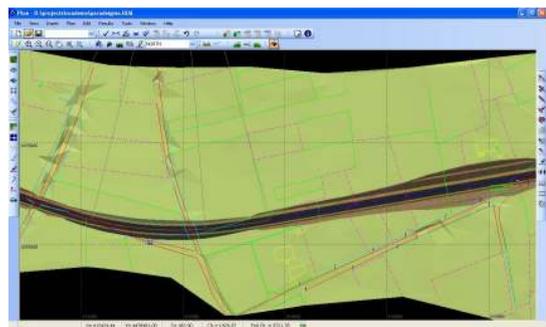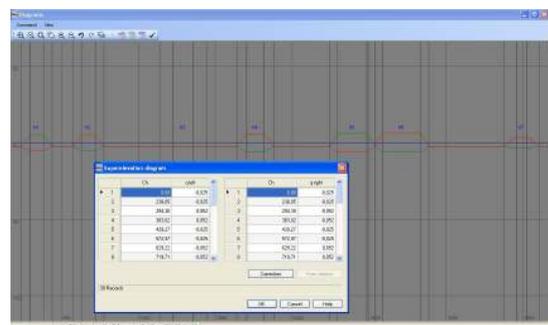
Vertical alignment

The ground profile is derived directly from the terrain which has been previously inserted to the program. The polyline which defines the road profile, can manipulated visually on screen (insert, delete, move operations on each vertex). After the insertion, the user is able to modify easily the geometrical properties of the vertices that define the profile grade line. One of the principle operations of DIOLKOS is the terrain reading. The program at design time, queries the linked terrain database. This database is stored in the form of Triangulated Irregular Network. Alternative the ground reading can be done from a batch of 3d lines describing the terrain (e.g. contour lines). In some design cases this way is preferable.

Help points are used frequently during the design of vertical alignment. These points are derived from the cross sections planes and placed to the corresponding positions of the vertical alignment. When the user modifies the polyline vertices which defines the road profile the values of grades and ground elevation difference for all stations are updated on the screen.
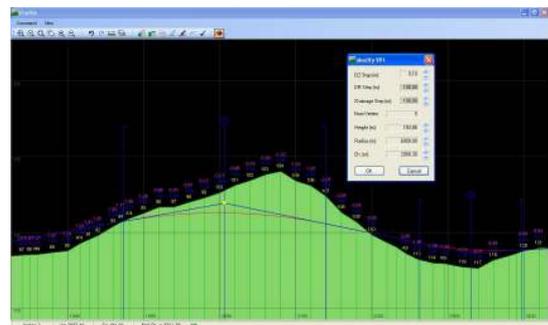
Diagrams

Using the geometric properties of the alignment elements the program calculates the V85 diagram according to the new Greek OMOE-X guidelines (Guidelines for the Design Facilities-Alignments, based on German RAS-L standards). At the same time, using the current selected regulation, Diolkos computes the superelevation rate diagram as well as diagrams for pavement widenings and diagrams for drainage layer (if exists). The form of this diagram effects the final shape of the drainage layer which is applied on the cross sections. The user can modify manually the above diagrams before they are used for the calculation of the cross sections.

Cross sections

After the insertion of the vertical alignment geometry and the computation of the superelevation rate diagram the designer must proceed to the calculation of the cross sections. Before this action, first must select the appropriate typical cross sections (templates) in order to comprise the cross sections of the current project. A typical cross section can be created by the user visually from scratch or can be inserted from another project. Each typical cross section can be used as a prototype by modifying, adding, or deleting some
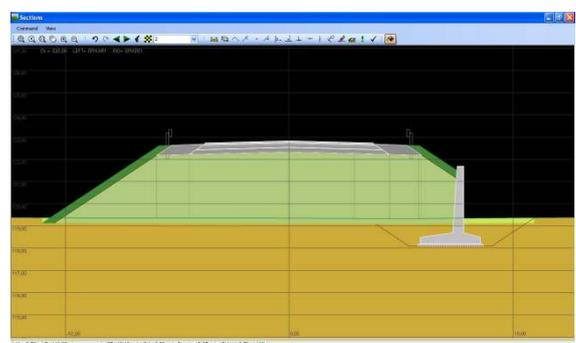
elements in order to produce a customized version. The resulting cross section can then be exported to an external library with a new name and can be used later as a prototype itself.

Every typical cross section is able to 'contain' over a thirty user defined polygonal boundaries enclosing customizable materials.

The side slopes of the cross sections can be defined freely and can have any shape. The side slopes pattern (left and right) may varies along the road axis. Generally, any combination of roadway typical cross section and side slope pattern can be used.

Additional data that designer may insert to the cross sections is the pavement widenings and an existing road pavement. The existing road pavement can be recognized from a respective layer of the background drawing. Diolkos adjusts the cross sections of the project taking into account the existing pavement and calculates the required material quantity for the binder layer.

The soil replacement layer that improves the stability under fill slopes is computed automatically. The shape and form of this layer may vary along the roadway. Also the program automatically calculates the fill benching and the pavement widenings on high fill slopes as well as the capping layer on fills and the regulating course layer on cuts (if exists).

In order to place a wall on the roadside the user needs to specify only its position. Diolkos suggests suitable dimensions by consulting the appropriate specifications (slope gradient, soil stress). Wall insertion can be done en masse by specifying a constant offset from the road axis or individually in each selected cross section. The program is able to place parametrically guardrails at the road shoulders. All the lines that comprise cross sections (pavement lines, soil crown lines, etc.) can be modified or redefined after the design stage. This lines can be inserted massively from specific text files (this text files have a simple format). The above capabilities give the construction engineer a utility to measure quantities at the construction stage of a corridor.

Diolkos has the ability to design multiple roads at the same time. The program compounds all the design elements of the parallel roads into a single project and then produce unite drawings for the plan and for the cross sections.
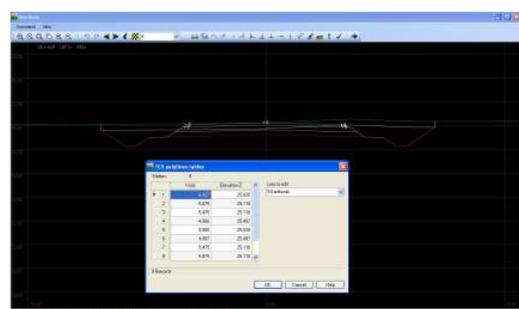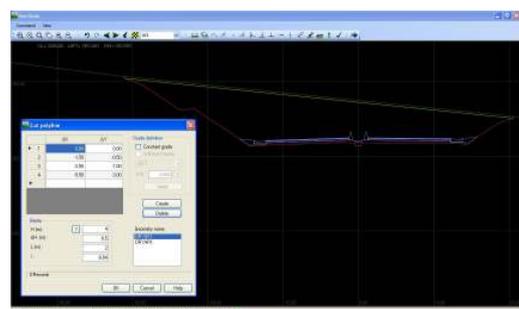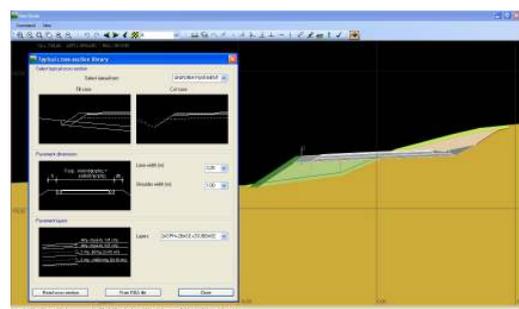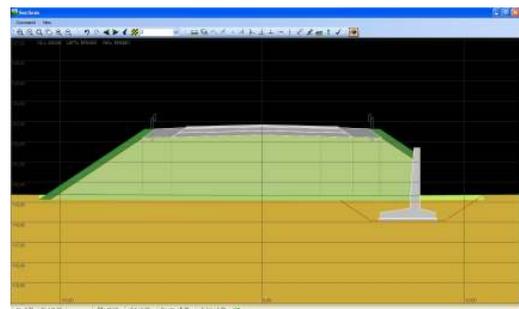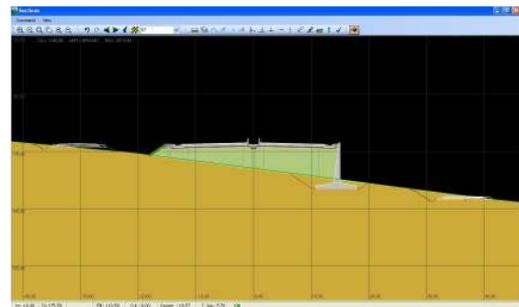
Drawings - Printing

The program quickly calculates the areas (layers) composing each cross section and then complete this procedure by computing the corresponding volumes along the road axis. The results of the above calculation are presented with details on the quantities table.

Diolkos draws automatically to AutoCAD in real time using the MS ActiveX automation technology. The program is able to produce plots including drawings for plan, profile, diagrams and cross sections as well as drawings for the road 3d model together with the current terrain model.

Alternative the program can export all generated drawings to a specific DXF file. The printing process includes also tables for horizontal alignment, vertical alignment, stations, soil quantities, etc.
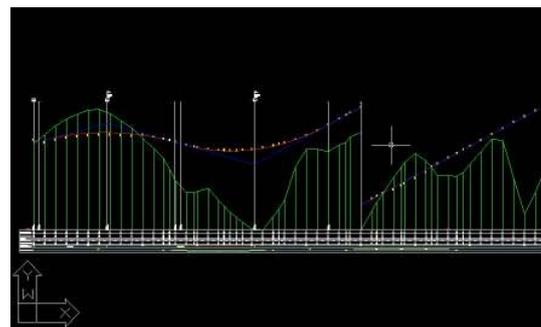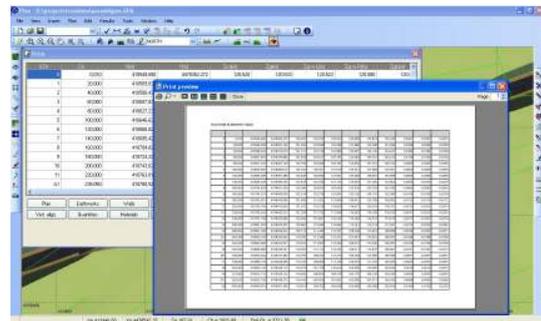
Hydraulics

After 5 years continual development, Diolkos now has the ability to execute hydraulic calculations for random shaped cross sections. Additionally, it can produce the related drawings and tables for a typical hydraulic project.

Therefore the engineer can use the program to study channel projects such as water cover boundary and river arrangement projects. Diolkos executes hydraulic calculations in order to estimate the depth of water flow in each cross section.

These cross sections can belong either to an open water pipe or to a riverbed. Based in these cross sections, Diolkos is able to calculate the areas that water covers along the corridor simplifying significantly this kind of projects.

The program produces drawings for plan, profile and cross sections adapted to the specific hydraulic project.

www.diolkos3d.com

Construction Quantities

Diolkos includes special utilities and functions for quantities and volume measurements at the construction stage of a corridor project. These utilities can be used in road and hydraulic projects simplifying significantly this kind of works. The program reads the lines that comprise the cross sections (soil lines, layer lines, etc) using one of the following ways:

a)   In a cross section to cross section form.
b)   Overall reading measurement data from XYZ text files
c)   From soil or layer models which are expressed as 3d   mesh objects

The user can define typical cross sections appling to the soil crown. He is able to choose the set of layers which is to be computed (topsoil remove, topsoil lagging, etc). The program can visually modify the cross sections lines (pavement lines, soil crown lines, etc.) either during the design or during the construction stage of a project. The programs capability to snap on any point or line of the cross section can greatly assist the user.

Swept Paths

One of the most important data the designer must know to study vehicle maneuvers in sharp curves is the space that vehicle needs while traversing along the turning path. Key feature to specify the required space is the paths the rear wheels follow during the turning maneuver. The definitions of these tracks are necessary at design time in order to define pavement widenings on curves with a high degree of curvature.

Diolkos has the ability to compute swept paths for variety type of vehicles. The program draws the boundary area that vehicle shares during the maneuver, as well as the convex hull for the front and rear wheels. Although the program calculates swept paths based on German RAS-K-1 standards, the user can define various vehicles with different proportions by modifying the default values.

The program extracts the above swept paths drawings to AutoCAD via ActiveX automation or to an external DXF file. These drawings can help the designer to study a great number of projects including parking facilities, barns, worksites, factories etc.