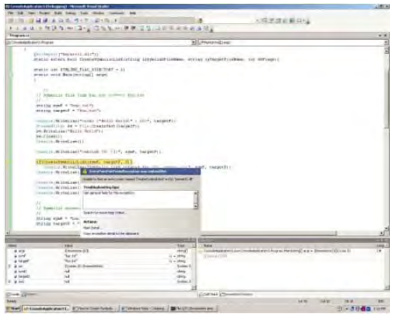
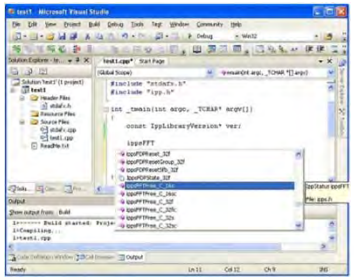
FORMEC Austria 2011

Pushing the Boundaries with Research and Innovation in Forest Engineering
October 9-13, 2011, Graz Austria

Development of a new computer program for designing forest roads





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Introduction

First use of a computer program for the process of designing forest roads in Croatia was in the year 1988. It was a computer program named SILVIA (Silvae VIA) written in Quick Basic programming language and developed by forestry experts from the FA Delnice.

Since 1999 for computer designing of forest roads in Croatia, software named "CESTA“has been used.

The majority of existing computer programs are not specialized for the design of forest roads. They offer many possibilities which are, most often, fully exploitable only in the design of public roads. As such, widely applicable and general computer programs are only partially useful in the design of forest roads.

According to actual situation we’ve started developent of new computer program, funded by Ministry of Science, Education and Sports (of the Republic of Croatia).

Main research objectives

The main objectives of this paper are divided into the following segments:

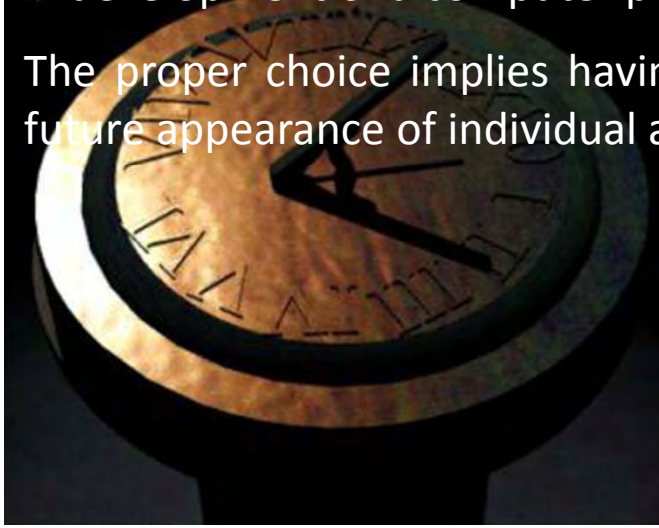
- development of a theoretical model of a computer program for the forest road design,

The functionality of the final computer program will significantly depend on the theoretical approach to the issue of forest road design.

The theoretical model includes all known algorithms for the forest road design. The proper selection of algorithms will increase the precision of the computer program and make it a useful tool in resolving all known situations.

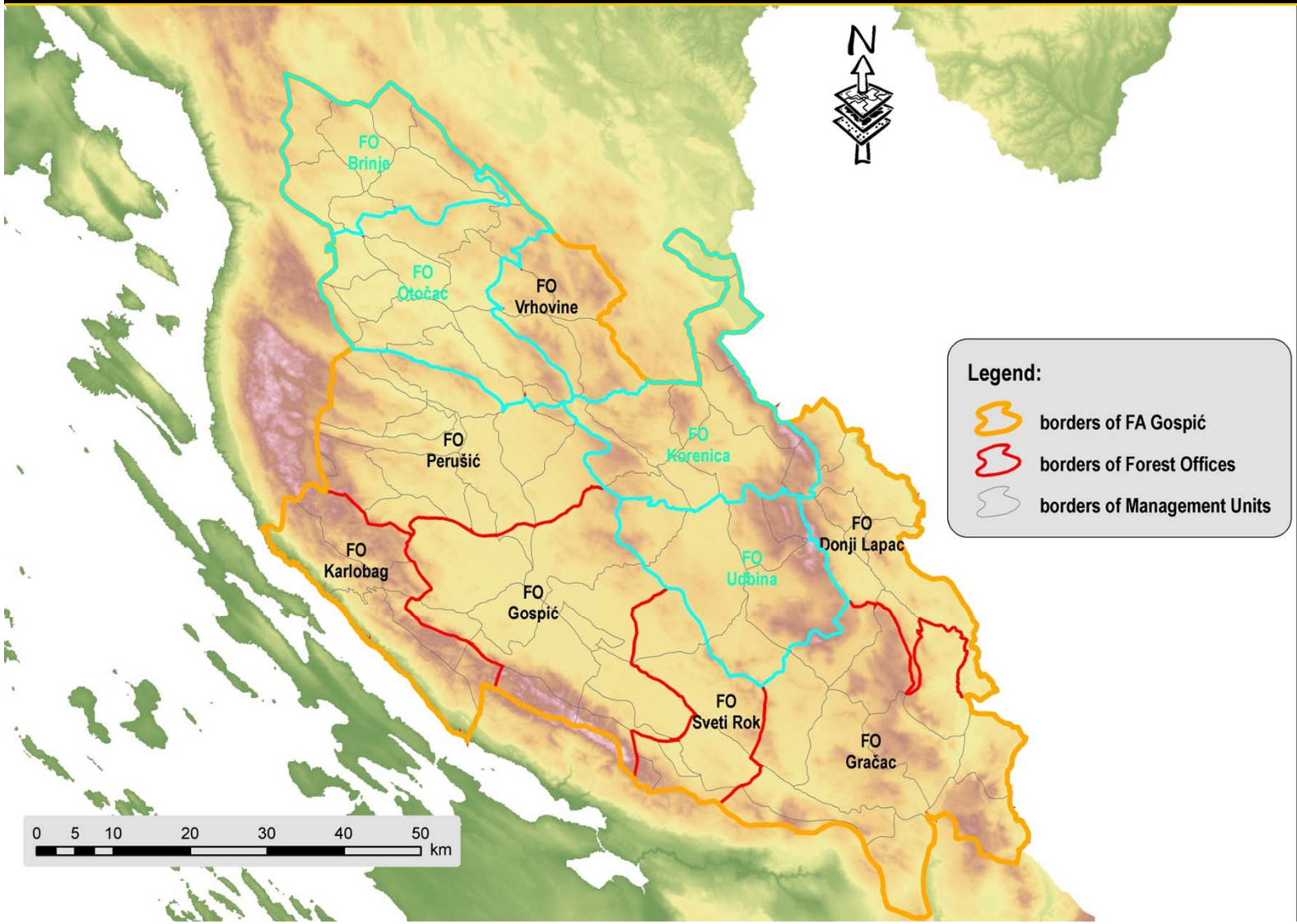
- development of a computer program for the forest road design.

The proper choice implies having knowledge of the existing solutions available, in which the future appearance of individual algorithms will determine the functionality of the final program.



The C++ programming language was selected as an important and virtually irreplaceable tool with a broad spectrum of capacities, thereby allowing programmers to find a solution to every problem when developing their ideas into programs.

Research area

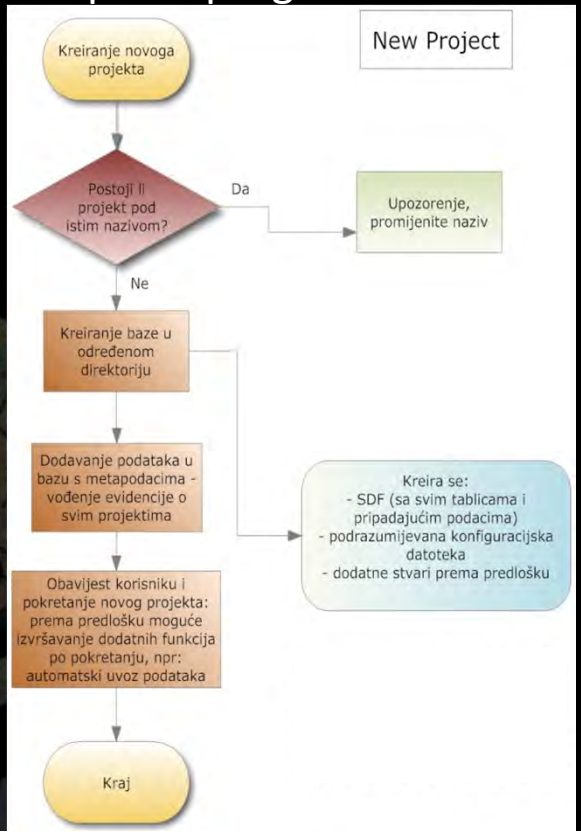


Field measurements were conducted within four Forest Offices. A total of 63 forest road routes were measured.

Results

The development of a new application should be approached very systematically, as the development of a high quality “frame” is the foundation of functionality of the future computer program.

Generally speaking, the computer program will consist of the following phases:



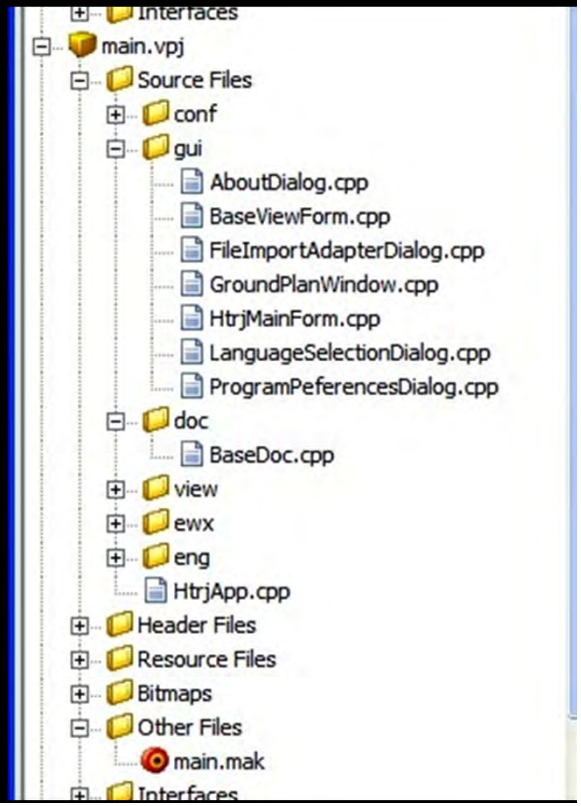
1. creating of a new project,
2. data input,
3. situational sketches,
4. design of the longitudinal profile,
5. design of the cross sections.

Results

In the development phase, the computer program is divided into five subprograms which separately execute the tasks necessary for the functioning of the overall program.

One of the subprograms **(Main)** unites all the information and manages it, while the remaining subprograms have an auxiliary task in order to ensure that the entire program can quickly execute the requested observation.

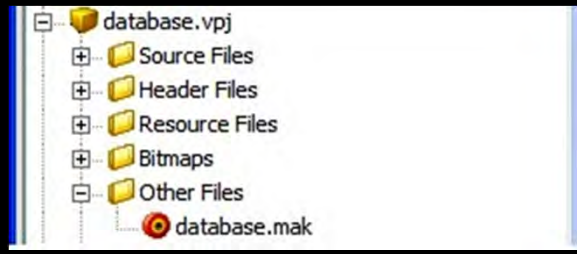
Subprogram **(Calc)** contains all the calculations and represents the mathematical and logical part of the application. This subprogram represents the fundamental part of the computer program.



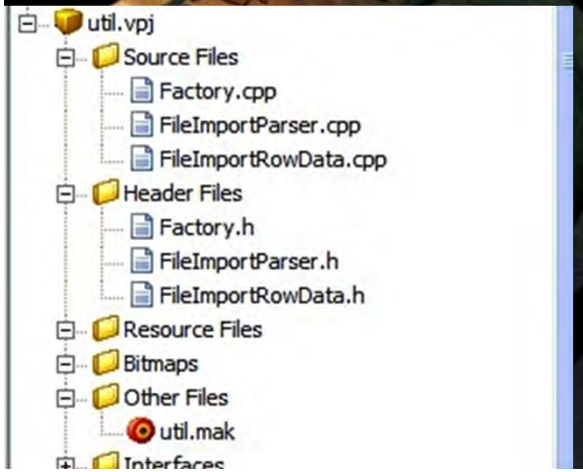
Results

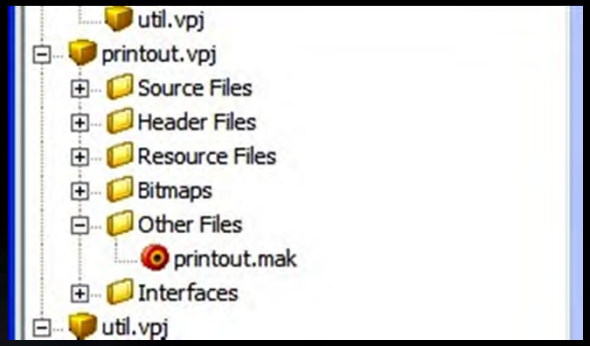
In the subprogram **(Database)**, the functions necessary for connection with the database will be implemented. The subprogram will be able to accept a new Module at any time (if needed).

Development of the entire computer program will lean towards the possibility of accepting external, independent modules, created in line with the user desires and the possibility of implementing new and more demanding tools that will increase the scope of future users.



One of the subprograms **(Util)** was developed with the goal of unburdening the management subprogram, in order to accelerate of the coding – compilation – connection cycle.



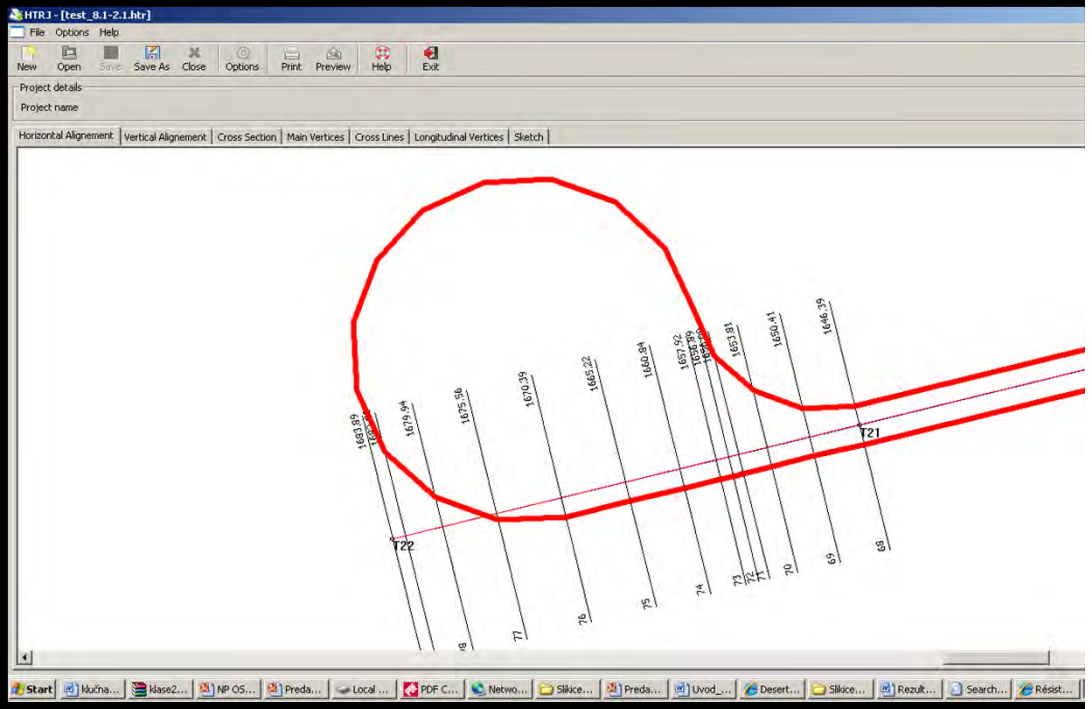


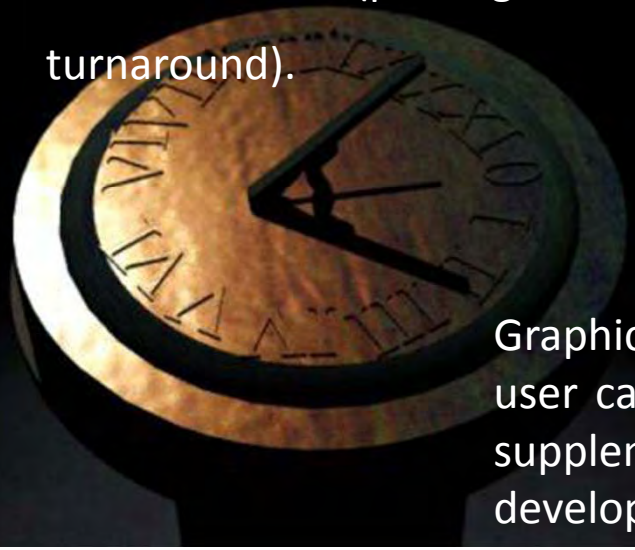
Last, but not least important is the subprogram **(Printout)** that allows printing of all the components of the main forest road project.

Results

The first window shows the layout of the forest road – horizontal alignment. This window contains all the functions associated with the horizontal layout of the route:

- the axis polygons (polygon segments),
- polygon points (number and codes),
- width of the road,
- profiles (number, code and stationing),
- road structures (passing area, turnaround).



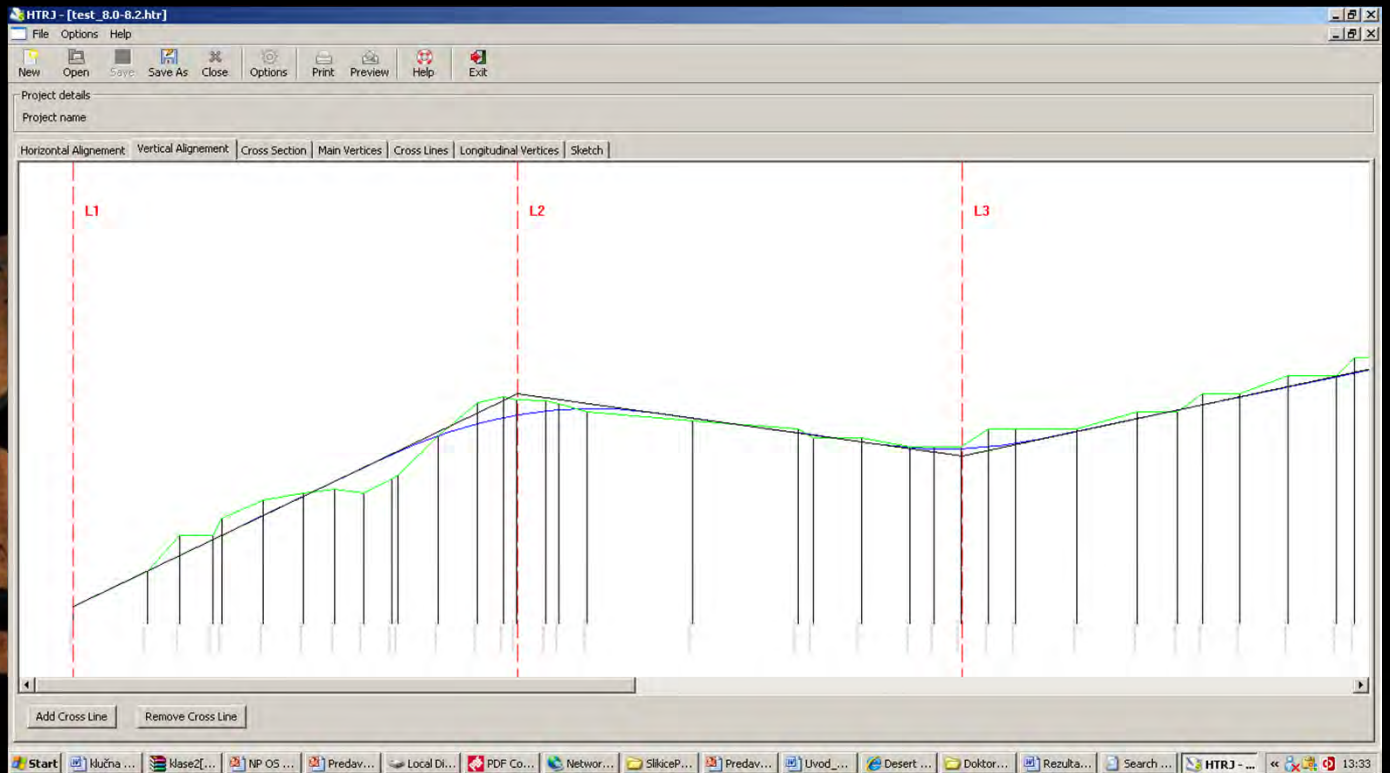


Graphical modification of the existing data is made possible, so that the user can work further on sections that he is not satisfied with, i.e. to supplement specific atypical situations that could arise in the project development process.

Results

Unrounded levels in the longitudinal section of the terrain can be embedded either numerically and graphically. Once the unrounded level lines are accepted, these can be corrected and altered multiple times.

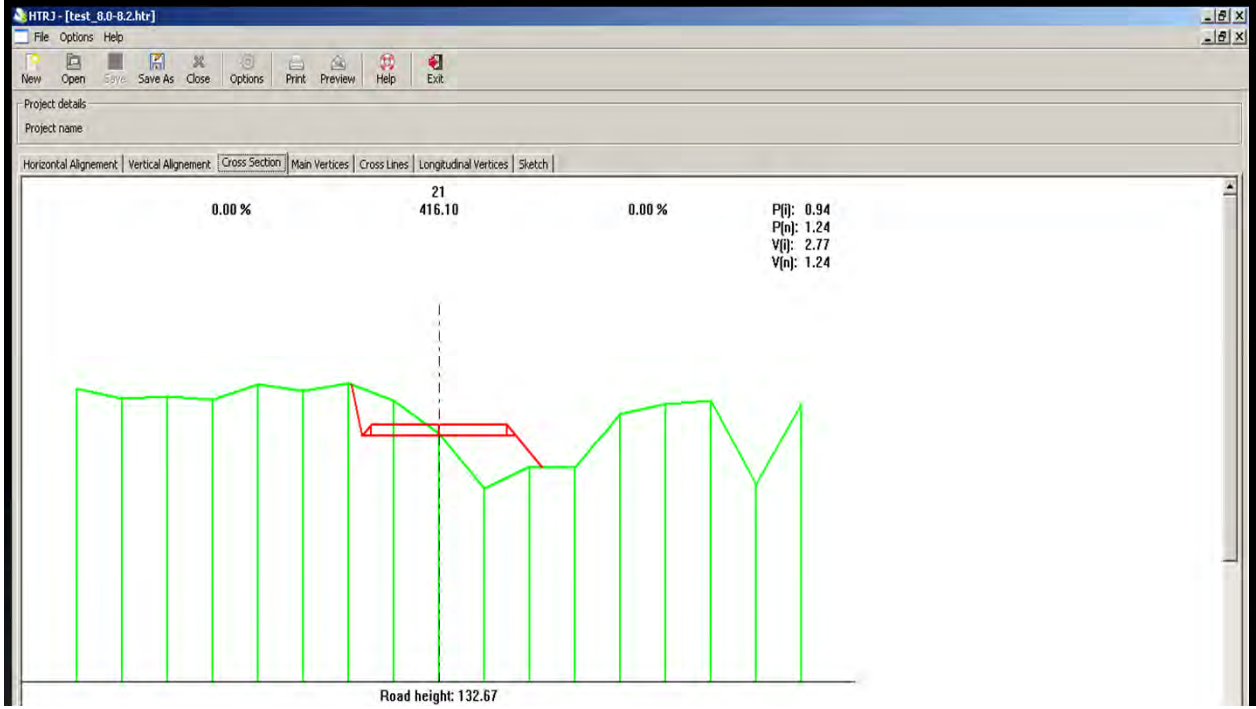
Subsequent corrections to the designed rounded level lines are possible, both numerically (using various entry parameters) or graphically (directly).



Results

Cross section is the view that shows the actual appearance of an individual profile of the forest road perpendicular to the road axis, and depending on the cross-section of the terrain. Cross sections are drawn (and calculated) based on the normal cross section.

The area of the cuts and fills and the value of quantities belonging to individual cross sections are added so as to immediately obtain insight into the distribution of the haul mass of individual segments of the forest road route.



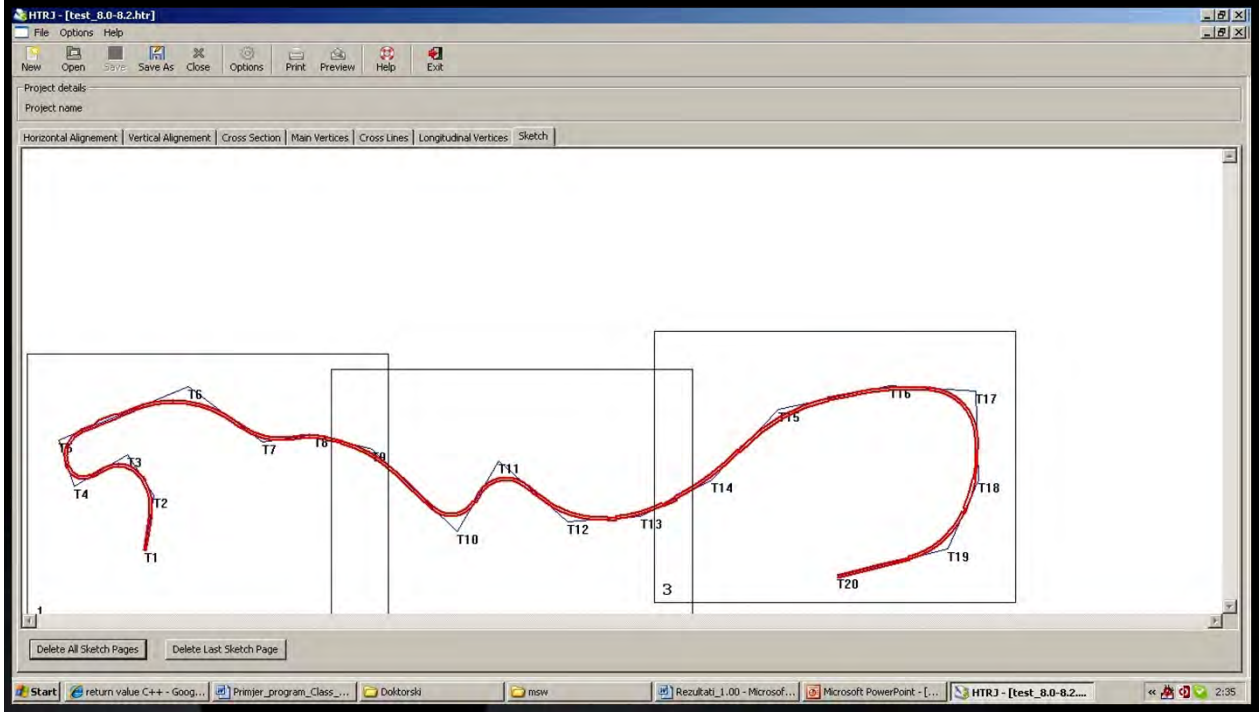
The axis polygon is drawn into the existing data automatically, currently they are defined in the computer program by reading *.dxf and ASCII format, or the entire entry of the polygon points can be conducted manually.

Results

The road route profile is calculated from the polygon and is represented by its spatial coordinates.

Each individual profile can be shaped by changing each of the three axes (x, y, z).

Each correction to individual data is independent of the other data, as the computer program recalculates the horizontal appearance of the route with every change in this layer of data.



The described indicates the possible burdening of the computer if they are entered, the great processor speeds compensate for the frequent calculations, and so there is no influence of the speed of executing the operation.

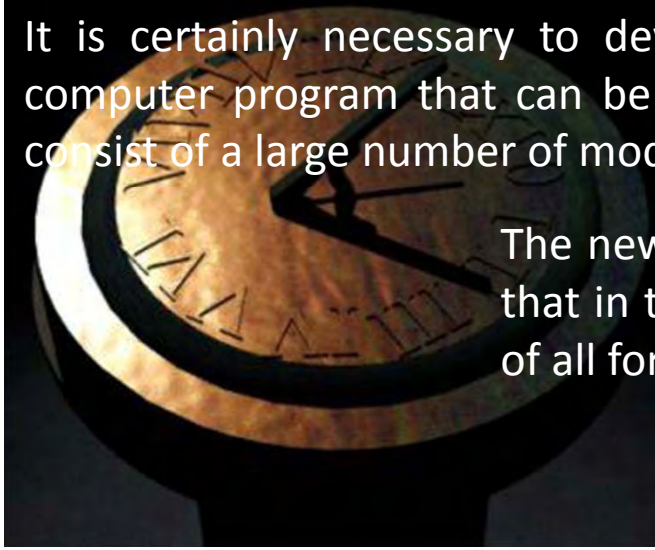
Conclusions

The design of forest roads, in comparison with the design of public roads, has many specificities that are not considered in the design of computer programs intended for the design of public roads.

The computer program CESTA is the most commonly used program in Croatia. This program was also primarily intended for the design of public roads, and subsequent adaptations in the design of forest roads.

Software CESTA represents an acceptable transitional solution, but in no way represents an ultimate and long-term solution for Croatian forestry.

It is certainly necessary to develop a theoretical model and, based on this, a specialized computer program that can be used to design various categories of forest roads, and would consist of a large number of modules.



The newly designed computer program is an original Croatian product, that in the future should be used as the official program for the design of all forest roads in the Republic of Croatia.

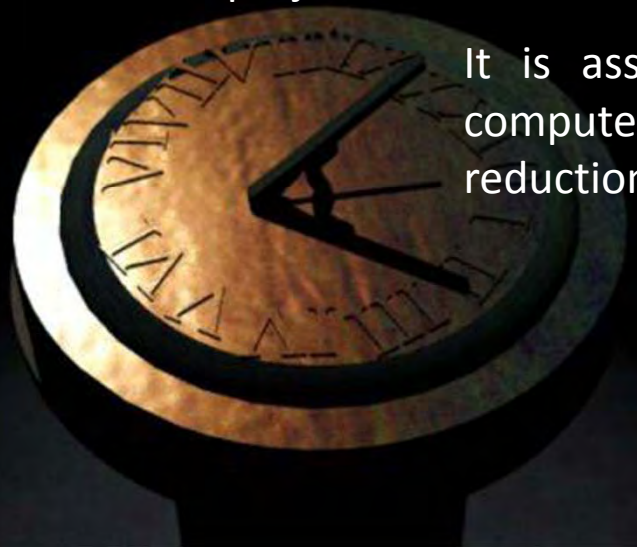
Conclusions

There are the possibilities of expanding the computer program by adding specially designed modules.

The same computer program will be used to educate the students of the Faculty of Forestry as well as life-long education of forestry experts working with forest roads.

The computer program is adapted for work on virtually all platforms, and is open to diverse challenges, ideas and needs of the forestry profession.

The computer program will ensure the development of better quality and more standardized forest road projects, which are then easier to compare and allow for improved control.



It is assumed that better quality projects (created with the new computer program) will guarantee construct of high quality roads and reduction of maintenance costs.

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