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**TRAFFIC NETWORKS' DESIGNER
COMPUTER AIDED DECISION MAKING IN TRANSPORT
ATTENDANCE ACCESSIBILITY IN REGIONS**

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Why This Project

Transportation has problems with deficiency of financial sources as well as other sectors of our national economy. State subsidy for transportation can't cover all its expenses. Public traffic systems are ignored thanks to not existing government's transportation strategy. This reality places a constraint on management of transportation companies to reduce their expenses. Fact of the reduction is not bad if suitable technological exchanges are used to get the savings. Unfortunately, a reduction of service lines is used instead of optimisation if appropriate rationalisation of technology or of control. Transport attendance accessibility is going down in certain regions and inhabitants of some areas are constrained to use other kinds of traffic, mostly more devastating environment, particularly cars.

We can meet with large quantity of variants of potential solution during solving rationalisation problems. A consequence of this large quantity of variants is a very long time of processing of this solution. There is valuable to use computers to obtain an optimal or a near-optimal solution. Computers offer relatively high performance today. It is a question of suitable software to take advantage of this performance only. One of the primary problems concerning the rationalisation of public transport is the creation of a model of the focused traffic network and input of transport demands. The aim of this work was to develop a software product,

which would enable the user to create and edit visual models of traffic networks and give him or her support in his or her decisions.

The Application

The Traffic Networks' Designer is a software product for a visualisation of traffic networks. The software, that brings the user tools for very fast traffic networks modelling. The application allows the user to apply built-in methods of operational research to created models. Results of applying are basis for integrated economical comparison apart from other things.

The Traffic Networks' Designer was developed in Borland Delphi 2 and is a fully MS Windows95/NT compatible application. It means, the user can work in the familiarly known application environment without any special course.

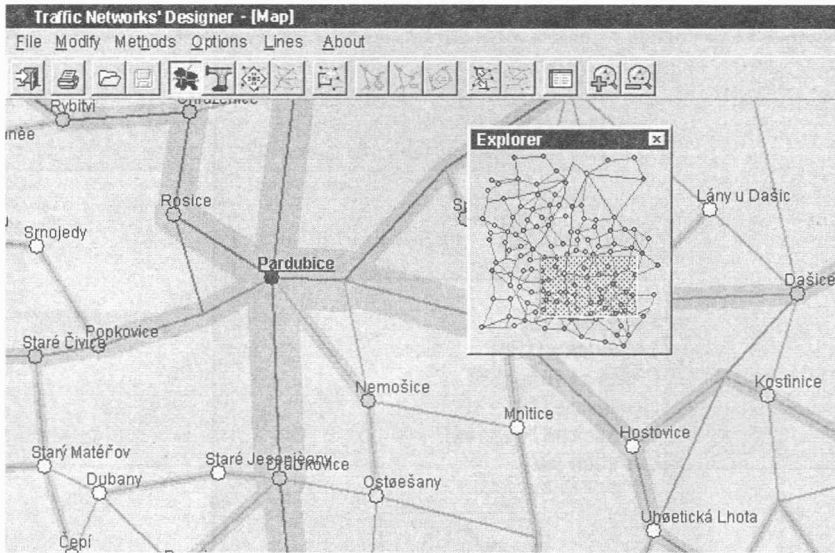
Creating and Modifying Models

The program allows create and modify entities of traffic networks, that is to say nodes and edges. These basic elements are displayed as a graph of Graphs theory interpretation. It is possible to choose some level of zoom to get a more detailed view. Application includes an explorer, which displays the whole network via the special small window. This explorer provides the user very quick movement of a visible area of the large network. Moreover, it is possible to show data as tables of database. This kind of view enables the user to filter records in tables. It means, table can show data convenient the user-defined conditions. The filtering allows show only data of user interest (for example impassable nodes). Data in tables can be exported to tables of Paradox and dBase or to ASCII text files.

The program allows display a graphic image with a scanned map of the focused territory. The image is displayed as the background of the main window. The user can use raster data of this backgrounds image as pattern for the creating of the vector-based model. This feature enables the user to get models with a very high level of accuracy and to spare some time of modelling. Naturally, the user can create models of fully fictitious traffic networks too. It is possible to set an exact scale of a model, units and other parameters before starting of modelling. All entities of the model are fully modifiable any time. The user can modify entities individually or in selections. Selections allow the user to apply changes of entities' properties to each of selected objects simultaneously. A model of a traffic network can be saved to a file any time.

Built-in Methods

The application provides the user built-in methods apart from modelling traffic networks. The user can input transport demands into the created model and then can apply the built-in methods to these demands. Included database support enables to filter these demands in space and time. Filtered demands can be shown as tables or graphics. The graphic impression of demands streams is possible in various forms and allows determine a location of centres with the highest transport demands. One of the filtering conditions can be a day - time interval. It is possible to get different solutions for different span of time by this way.



Integrated methods are based on algorithms of the operational research, exactly of the graph theory. The most basic method is searching of minimal path. The theoretical source of this method is the Floyd algorithm for filling distance matrix. Certain minimal paths are found by modified Dijkstra algorithm. It means for the user to select an origin and a destination node of network. The application allows determine an unlimited set of additional nodes, which can be included in a found path (each node can be in a path one times only). The application try to find desired path with taking into consideration defined global parameters and conditions. We can understand the minimal path as the shortest time to driving through or as the shortest distance between the origin and the destination. The founded path is marked by the different colour in the model of traffic network. Moreover there is shown an information box with data of the focused path (see figure). If there is more than one obtained solution the program will find all of these. If there was specified a set of additional nodes the application can optionally optimise the crossing order of these nodes.

Into the designer has been implemented the support for service lines construction. It is possible to create lines to cart transport demands to or from the central node. Lines can be constructed either manually or automatically. In both cases is it possible to fully modify a route of a line and a service value of each node of a line.

Lines are grouped to sets, which represent variations of the service. These sets can vary in time and space. It means, the service for each set of lines can be different in routes of lines, in span of time or in both together. This kind of administration allows the user not only to compare variations of route planning but also to keep track of service during a day.

Path information

Number of variants: **2**

Length: **16.50** km

Duration: **0** hod **11** min

Variant No.: through nodes:

Rosice (153)

Pardubice (0)

křížovatka (155)

Černá za Bory (65)

Hostovice (48)

Uhřetická Lhota (44)

Uhřetice (67)

The new created lines relate the actually selected set of lines and the actually filtered transport demands. Routes of lines are built completely visually. The user determines nodes one by one and these are linked to the route of line. When the user specifies first node (also starting point of a line) the application automatically tries to suggest him/her an expected route to the central node (the suggested route of line is based on the minimal path computing). Then the user can select other nodes of desired line to precise its route. Computer is recalculating the suggested route in consideration the user-defined node. The application allows the user to create arbitrary number of lines by this way or allows to generate lines completely automatically. The set of automatically generated lines is created to serve all demands on focused network. It is possible to combine these two approaches. It means, the user can create a few lines manually and then can let the computer to generate the rest of lines for remaining transport demands automatically. On the opposite side the user can let an entire set of lines to generate and then can modify selected lines.

The routes of lines can be changed by dragging, adding or removing nodes directly in map using the mouse cursor. The application enables to display the value of service for each of nodes, as an index alongside the symbol of node. Further it is possible to display a box with information about focused line (mentioned later). This information enables the user to keep track of service changes in interaction with these changes. Values of service are recalculated automatically during manipulation with route. Moreover the user can set these values manually in a special box or in an integrated Lines' editor.

The Lines' editor enables the user not only to modify values of service in particular nodes but also to keep track of detailed as well complex information on sets or lines.

Lines' editor

Available sets:
sada 1.lin

Lines:
Linka č.58
Linka č.60
Linka č.61
Linka č.62
Linka č.63
Linka č.64
Linka č.65
Linka č.66
Linka č.67

Line: **Linka č.65**

Nodes of line:	Values:
Lány u Dašic	18
Zminný	9
Černá za Bory	33
křižovatka	0
Pardubice	0

Length of line: 10.00 km
 Duration of ride: 0 hod 7 min
 Total costs: 170.00 Kč
 Total fare: 741.00 Kč
 Total profit: **571.00 Kč**
 Number of cars: 1
 Total service: 60 dem.
 Service in passing nodes

05:00 - 06:00

Set Line OK

Line No. 61	
Length:	11.50 km
Duration:	0 hod 7 min
Total service:	60
Total profit:	883.50 Kč

The routes of lines are highlighted on the screen and the route of the focused line is marked by the different colour. There can be displayed the information box during working with lines. This box gives notice of actually focused line and includes the length of the line, the duration of ride, total number of served demands and total profit of the line. The application allows specify average unit costs and average unit fare. These values allows to compute the profit of each line and thereby the profit of each set of lines. Moreover there is possible to specify the special costs, so called the traffic user's costs. These costs are incorporated into the total costs' computation, when the demands are carted to the central node by other than minimal path. In these cases there are added to the total lines' costs the addition values for the non-minimal parts of routes. The traffic user's costs are not covered by anybody in the real world. But if the user involves them in the model, then these costs can be used as a kind of comparing of the sets of lines (that's to say the variants of the service). The computation of costs can be never regard as complete from economical point of view, because it does not involve all aspects of the costs' theme.

Another option of the application is lock-out making. The user can disable an entity (or entities) of a traffic network's model. The application allows exclude these given entities from applying of methods (mentioned above). Practically it means the user can create service lines considering the up-to-date state of traffic network. Or it is possible to get variants of divergent routes.

Conclusion

Theme of this project is not only interesting but also very necessary and useful nowadays. Software facility of decisions makers is insufficient in domain of transport attendance accessibility. This software product can contribute to improving of service lines design efficiency and thereby to improving of traffic service quality.

Thanks to high level of visuallity the application can speed up a process of modelling. There is envisaged to continue to develop this application. Especially the application could be extended in wider database connectivity and in lines modelling.

Lektoroval: Ing. Martin Kopecký

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Summary

TRAFFIC NETWORKS' DESIGNER

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This application tries to offer the user-friendly environment with powerful tools for visual modelling of traffic networks and for service lines construction. Entire application is drawn to give the user just in-time information in quantity, with the high level of lucidity and visuality. But the final decisions still depend on the human factor.

Resumé

TRAFFIC NETWORKS' DESIGNER

EDITOR SÍTÍ

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Popisovaná aplikace nabízí uživatelsky přátelské prostředí s výkonnými nástroji pro vizuální modelování dopravních sítí, pro zadávání přepravních požadavků a pro konstrukci obslužných linek. Aplikace poskytuje uživateli just in time kompletní, srozumitelné a vizualizované informace, na základě kterých může uživatel rozhodovat o vedení tras linek.