Radovan SOUŠEK, Zdenek DVOŘÁK*

COMPUTER AIDED EVACUATION OF PERSONS

W niniejszym artykule został zaprezentowany produkt software przeznaczony do ewakuacji osób za pomocą transportu drogowego przy stosowaniu się do wszystkich obowiązujących warunków. Oprogramowanie to wyświetla wszystkie punkty istotne przy ewakuacji i jej procesie za pomocą map cyfrowych, podaje trasy w zależności od nadzwyczajnej stacji. Możliwa jest również ręczna kontrola danych wejściowych, parametrów oraz procesu rozwiązania.

INTRODUCTION OF CREATED SOFTWARE

This computer program is intended to run under Microsoft Windows. Its graphical environment enables to edit maps of road network, to insert objects important for evacuation planning, and to solve the process of evacuation. It is possible to print out or export (in BMP format) the graphical outputs of the program. The software contains also some additional functions like calculation of the depth of wounding, contamination from escape of harmful substances (according to handbook CO-51-5); or visual display of above sea level. These additional functions should help during modification of evacuative routes in the event of chemical accident or flood.

## REQUIREMENTS AND LIMITATIONS

Hardware and software requirements:
- x86 compatible (recommended PII@450 MHz) PC with 128 MB RAM
- graphical resolution at least 800x600 pixels, 24 or 32 bit colour depth
- MS Windows 98 or later

* Dr inż. Zdenek Dvořák, Uniwersytet w Żylinie, Słowacja, dr inż. Radovan Soušek, Uniwersytet Pardubicki, Czechy.

MAXIMAL AMOUNT OF CERTAIN ELEMENTS (INPUTS FOR SOLVING):

- count of edges: 6 000
- count of segments of single edge: 220
- count of vertexes: 6 000
- count of urban areas: 2 000
- count of curves standing for rivers and water sheets: 5 000
- count of objects important for evacuation: 500

It is advisable to reduce imported data (specify the area where the evacuation will take place) in the interest of calculation speed enhancement.

USED DATA

The program uses digital maps of the territory (digital model of territory DMU200), created by Military Institute in Dobruška. There were the data relevant to road network, urban areas and water sheets utilized for the purposes of evacuation planning. The program also uses digital model of terrain (DMT) which provides information about above sea level.

These initial data (stored in ESRI Shape file format) had to be converted to a special data format which makes possible to use the algorithms of graph theory (like the algorithm of searching of minimal path). These functions for data conversion are available from the menu Service functions.

Picture 1: The main window

The auxiliary program DMTView enables data conversion to the Windows Bitmap format, where the above sea level is represented in a different colour tone.

USAGE OF THE SOFTWARE

Working with the application is possible after initial loading of map data. Inserting or modification of objects important for the evacuation planning is possible through the dialog called Insert object visible on picture 2.
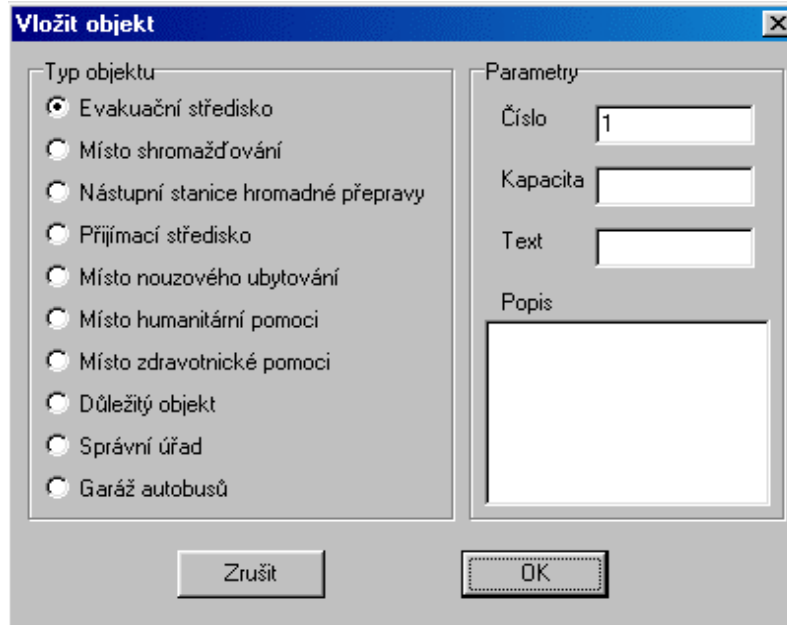
Picture 2: Inserting of objects

It is possible to choose the type of object important for evacuation planning in the field called Object type and to enter its parameters in the field called Parameters.

It is also possible to specify the criterion and parameters for path searching through the function Path - Search. The field Criterion is intended for switching between the shortest or the fastest path. It is possible to specify the average speeds (in kilometres per hour) for the individual communication classes in the field called Average speed.

The dialog called Evacuation planning is intended for entering parameters and for the calculation of course of evacuation process. There are five sheets placed on this dialog:

PARAMETERS

This sheet is intended for entering the constants which are necessary for the calculation. The capacity of means of transport and their average fuel consumption can be set in the field Vehicles. The field Durations is for entering time constants needed for the calculation of entrance and exit times during evacuation. The value Departure period stands for the period needed for going out from garages after an announcement of evacuation. The value Distance of vehicles means the average time distance between single vehicles going out from the garage. The field Speeds contains information about average speeds of vehicles depending on the class of communication being used. The field Assignment of places is intended for setting up the criterion for minimal path searching (between single places of evacuation).

Picture 3: Entering of parameters

Picture 4: The sheet Places

Picture 5: The sheet Assignment

PLACES

This sheet contains all the evacuation centres, bus garages and places of temporary accommodations. Only the checked objects are taken in the calculation. The field Vehicle counts contains information about the number of vehicles dedicated to individual evacuation centre. The button Calculation starts up the calculation according to given parameters.

ASSIGNMENT

If the calculation has been finished successfully, the sheet Assignment shows the tables of assignment. Upper table displays the assignment of evacuation centres to places of temporary accommodation. The values in the fields indicate the number of persons transported from certain evacuation centre to certain place of accommodation. Lower table displays assignment of garages to evacuation centres. The values in the fields indicate the number of vehicles.

EVACUATION COURSE

The table from the sheet Evacuation course displays activities of particular buses participant in evacuation. All the important instants of time of the course of evacuation are recorded there. Basic data describing the course of evacuation are written up below the table.
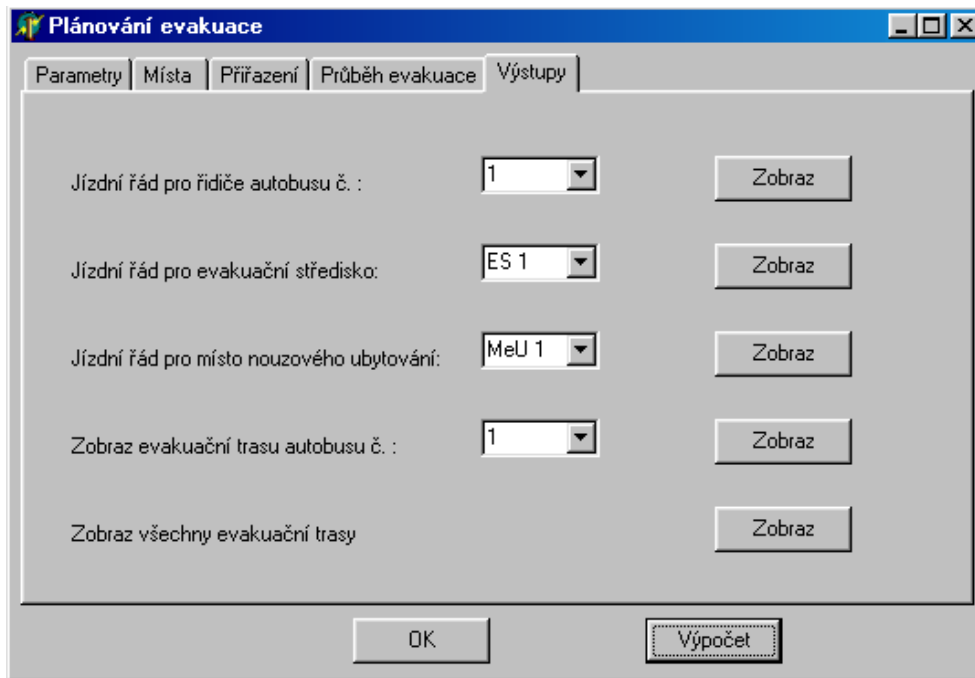

Picture 6: The sheet Evacuation course

OUTPUTS

The functions, which enable to display the outputs of the calculation in this sheet, are placed there. All the particular outputs are displayed as a plain text - it is possible to save them as a text file or to copy them to the Windows clipboard. The program also contains function for displaying the evacuation routes in the map. It is possible to print out this map or to export it as a BMP file.

Picture 7: The sheet Outputs

CONCLUSION

The created software "Počítačová podpora evakuace osob" makes possible to minimize the time needed for preparation and planning of the course of evacuation while respecting the binding conditions.

SUMMARY

This is a software product intended for evacuations of persons by using road transport while keeping to all the binding conditions. This software displays all the points important for the evacuation and its process by means of digital maps; it puts out routes in dependence on extraordinary event. It is possible to manually control inputs, parameters, and the process of the solution.