Transport of Dangerous Chemical Substances and its Cartographic Visualisation

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1. INTRODUCTION

Industry still has a negative impact on the environment both in particular locations and in the vicinity of roads where raw materials and ready products are transported.

The crisis situations in the environment are the present reality. Their occurrence, course and impacts can be mitigated by a number of measures, and their benefits can be exploited in the phases of prophylaxis, rescue and remedy within the crisis situation. In all those phases, modern geoinformation technology, high-quality geographical information and formalized expert knowledge are applied.

In Brno, at the Masaryk University and the University of Defence, the research project called *„The Dynamic Geovisualisation in Crisis Management"(GEOKRIMA)* is solved. Because of above mentioned reasons, the pilot scenario has been designed within this project which is called *„Transport of dangerous chemical substances (DCS)"* and which is focused on verification of the dynamic geovisualisation procedures in the selected crisis situation.

2. ADAPTIVE CARTOGRAPHIC VISUALISATION

Today's electronic cartography can generate a huge quantity of cartographic representations of one cartographic data set in a short time. Nowadays, maps can be adapted to the requirements of a specific user so that the decision-making process of the user which is dependent upon the map information shall be facilitated as most as possible. The set of characteristics related to the user, the environment, and the purpose of maps is called *a context*, and the maps which can dynamically respond to the context are called *adaptable maps*.

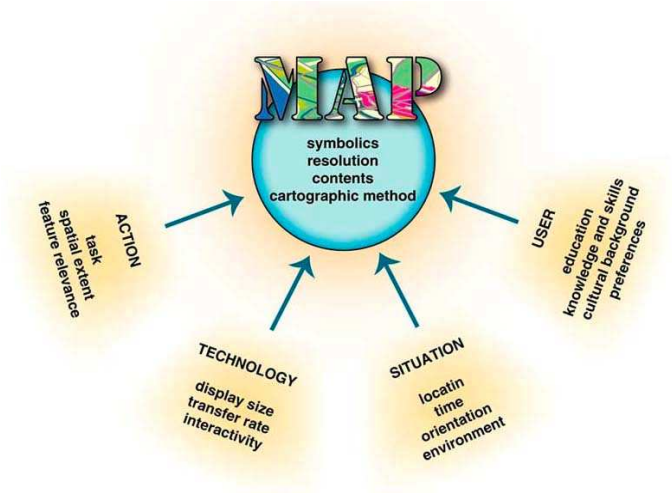

Figure* 1*: The cartographic contexts

A relatively typical example is *the crisis management area*. The cartographic visualisation plays the significant role in the decision-making process and the adaptable visualisation connection should speed up remarkably and improve the quality of the orientation of participants in the crisis situation. Visualisation in such case can be both *static* (printed on paper) and *dynamic* in the environment of communication and information systems.

3. CONTEXT VISUALISATION IN A DECISION-MAKING SYSTEM

The scenario was based upon the basic functionality with two initial blocks: „*Normal operation*" block and „*Accident*" block. Within these basic blocks, the following *functions* have been designed:

1) In case of „*Normal operation*" when the transport vehicle exhibits no emergency conditions, two basic functions have been proposed:
   - *Monitoring of vehicle motion* transporting DCS in the region on *the overview* with the basic topographic situation;
   - *Information about the surroundings of moving vehicle* where the possible elements of the critical infrastructure are highlighted according to the type and the quantity of transported DCS.
2) In case of „*Accident*", i.e. when non-standard behaviour of the transport vehicle is monitored, the following basic functions have been designed:
   - *Highlighted visualisation* of all objects and phenomena which can be potentially affected in the surroundings of the vehicle due to transported DCS (*the context visualisation* which relates to this substance);
   - *Automated information transfers* to *the* Integrated Rescue System (IRS) *control room* about the vehicle position, its accident, the type and quantity of DCS transported access route to the place of accident.

The method of visualisation was based upon the *context representation* where the visual spectacular objects were only those objects which were in a range of the vehicle monitored, and additionally, which related only to the given type of cargo and to the potential risk. The context was defined according to the type of accident and the thematic elements were assigned to each type of accident considering their risk. The grey scale was specified for topographic background (see ***Figure 2***) and colours were used for given thematic information (see ***Figure*** 3).

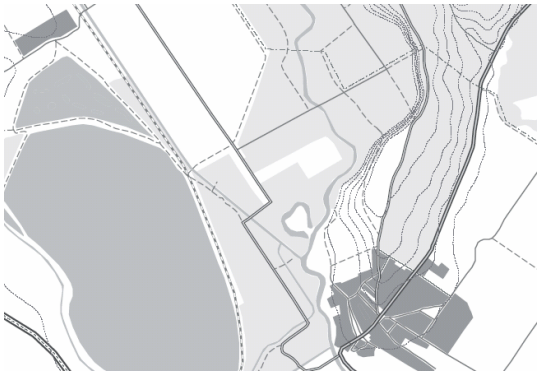

Figure 2: The visualisation of topographic background in grey scale

Within the pilot project, four context risk categories have been selected:

- B1 Water - Dangerous substance infiltration risk
- B2 Air -Air pollution risk
- B3 Fire - Fire risk
- B4 Blast - Explosion risk

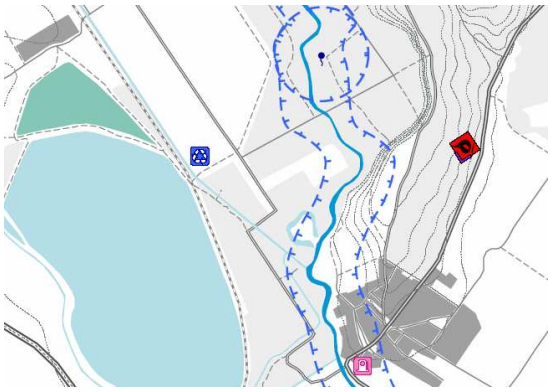

Figure 3***:*** The B1 context „Water“

The proposed cartographic symbols for DCS (***Figure 4***) are based upon the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) danger labels in these categories. The original ADR danger labels are simplified; however the maximum effort was exerted to retain their basic shape, structure and colour.

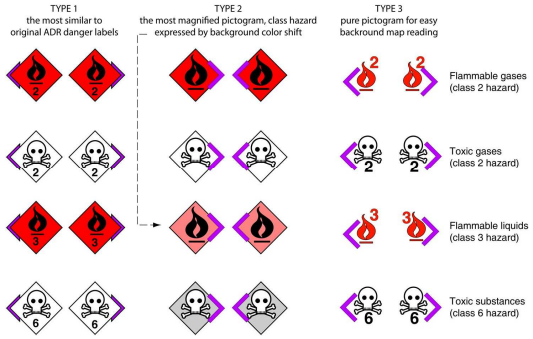

Figure 4: The proposed cartographic symbols of danger labels adopted from ADR

The communication and information systems were active over the complete time of the experiment. Not only the position of vehicle was monitored but also appropriate links with DCS database were maintained in the real time. In case of a simulated accident, information about the accident origin and its position which was received from the localization and communication module was automatically sent to the preset addresses. The cartographic data was available via Web Mapping Service (WMS) which due to its open interoperability provided the map resources for a wide scale of internet and even desktop applications.

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This contribution has been worked out as part of MSM0021622418 Research Project of Ministry of Education, Youth and Sports in the Czech Republic called „The Dynamic Geovisualisation in Crisis Management“-http://geokrima.geogr.muni.cz/