Investigating possibilities to develop the BDT in Poland as a MRDB type database

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Introduction

Defining a generalisation process is connected with an assumption concerning a specific way of map understanding and modelling spatial data. Depending on the considered context, a map may be interpreted as a model, a system, an image, a language, an information transfer or as a graphical representation of spatial data, stored in a database. Similarly, the process of generalisation may be interpreted as model data generalisation, as geometric simplification, as a symptom of art, which cannot be reduced to a set of algorithms or as implementation of specified rules collected in a knowledge base. However, independently on the context considered, the process of generalisation (both, the analysis – oriented DLM model, as well as the display – oriented cartographic DCM model) should lead to generalisation of source data, which is uniform with respect to a conceptual model.

In Poland the development of the Topographic Database (BDT) was started a few years ago; its level of details is close to a topographic map at 1:10 000 scale. Basic information sources for TDB are orthophotomaps based on aerial photographs at the scale of 1:26 000. The Database consists of four components: the vector "TOPO" Database (DLM), the digital terrain model "DTM", the set of orthophotomaps „ORTO" and the set of numerical topographic maps, „KARTO" (DCM). The Topographic Database, developed at the voivodship (province) level, is one of elements of the National Spatial Information System (KSIP). Besides the Topographic Database, this System contains other, standardised Databases, such as (fig.1):

- At the national level: The Geographic Database "BDO" (scales of 1: 250 000 and smaller), based on military VMap Level 1 databases,
- At the national level: the military VMap L2 database (scales of 1: 50 000) and the High Information Resolution Database (1: 25 000),

- At the district ("Powiat") level: the Lands and Buildings Database (EGiB) and the Surveying Register of Utilities ("SM").

Topographic maps at the scale of 1:10 000 (TM10k) and 1:50 000 (TM50k) are producing from databases.

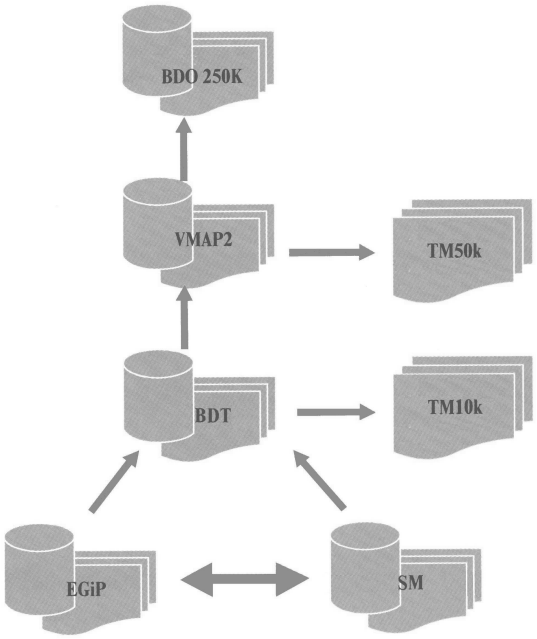

Fig. 1 The relation between main spatial databases and topographical maps in Poland

Presentation of the research

Besides the development of databases, which allow to perform spatial analysis, various maps are produced at each level. Therefore, it has been necessary to develop methodology of supplying civil and military databases – which are considerably different in a sense of a conceptual model and which are not uniform with respect to utilised source materials – with spatial data. It is also necessary to develop methodology of map generation within the entire scale ranges, basing on spatial data stored in the KSIP system databases. It is important in this case to assume an appropriate approach to the process of supplying and updating particular databases, as well as to generalisation – with respect to databases and maps. Development of a concept of information flow and data generalisation between those databases is possible with the use of mechanisms of MRDB type databases; however it is difficult due to diversification of data. The authors of the

presented solution propose another approach, concerning generalisation of homogenous BDT source data.

Development of such an approach is the subject of research works performed by the authors. Investigations and experiments have been focused on the possibility of utilisation of a concept of MRDB databases for implementation of the coherent Topographic Database in Poland. The conceptual model of BDT database, defined by appropriate Technical Guidelines, already allows to integrate data, which has been presented in maps at the scales of 1:10 000 and 1:50 000.

Four approaches to the process of generalisation, presented in Figure 2, have been analysed.

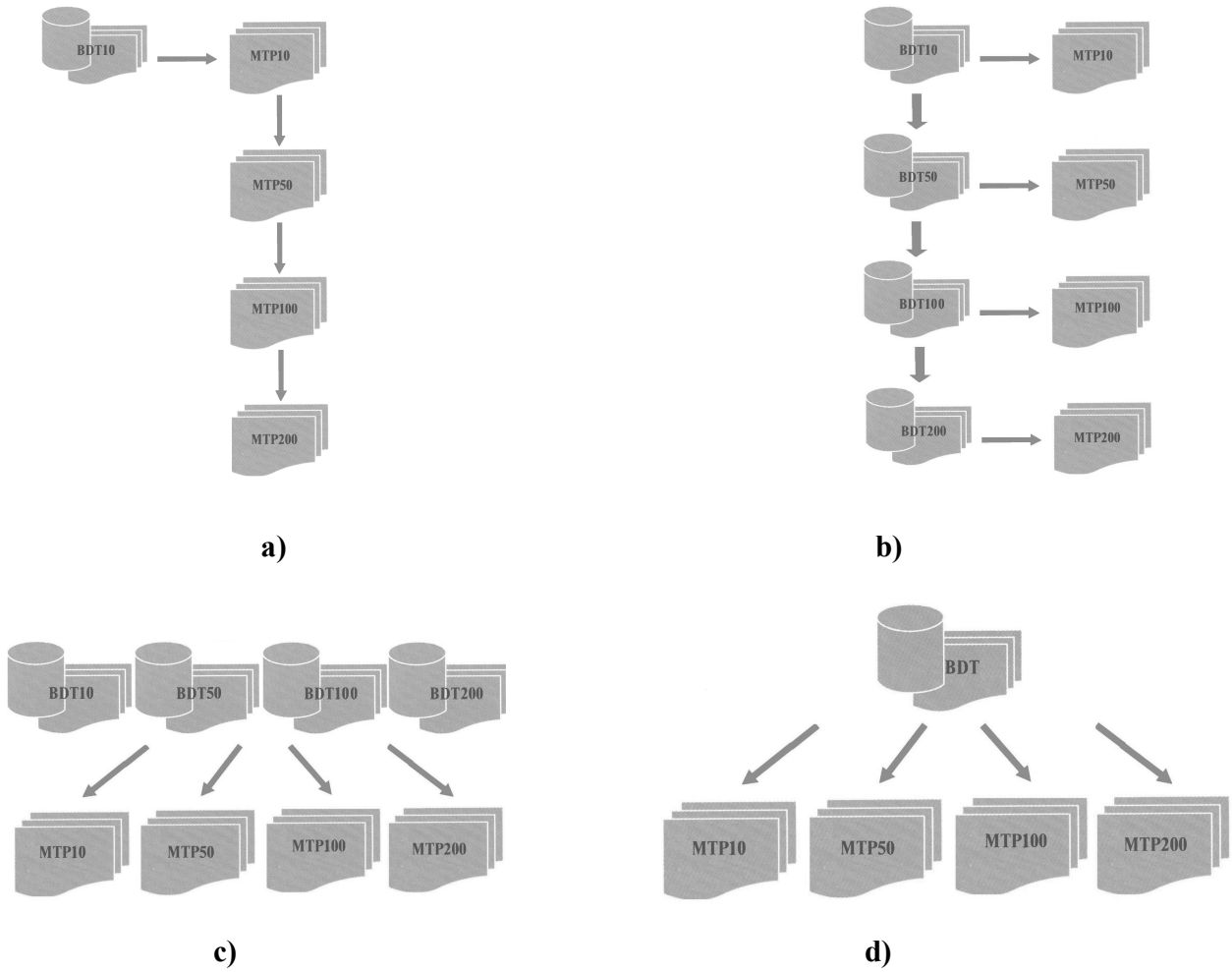

Fig. 2 Topographical maps and databases generalisation – four approach

The variant “d” presents an approach, which seems to be the most interesting for development of the Topographic Information System in Poland. This results, first of all, from the fact that the

Topographic Database in Poland is under the first stage of development, as well as from the accessibility of an updated orthophotomaps for the entire country. The discussed solution may be considered as the MRDB type approach. However, its characteristic feature is storing data corresponding to various scale levels in one database, at one level of accuracy. It is assumed that one Source Database is developed for the entire area of the project. This database is characterised by:

1) The same level of location accuracy for all objects stored in the database,
2) The information level, which comprises all objects visible in databases and on topographic maps in the entire scale range (for certain areas it is possible to neglect objects, which correspond to larger scales, in such locations where detailed works are not required).

Discussion

Such database contains all object classes, required for development of derivative databases and maps at smaller scales than the scale of the source database. In such a case the database should include objects of diversified generalisation level. This means, that one database may include, for example, objects from the class “Buildings” and objects from the class “Built-up areas”, as well as objects from the class “Forests”, objects from the class “Deciduous forest”, as well as objects from the class “Coniferous forest”. Borders of locations, borders of built-up areas, as well as a representative point of location, utilised for derivative works, will be stored in the source database.

It has been also assumed that each geometric object is referred to an appropriate term – a real object. For example, the object City and the object City Centre occur in the Source Database. Therefore, there is no need to establish additional links between different geometric representations of the same object in the MRDB. In each case one deals with the standard relation between two feature class. In the process of map or database creation at derivative, appropriate selection of represented objects should be performed. For a 1:10 000 map this will be the object City, and for a 1:500 000 – the City Centre object.

In this case, the process of map development concerns mainly generalisation of shapes, location, elimination of objects, which do not meet the criteria of size, and the map editing (generation and placing labels, shifting objects, assignment of symbols etc.).
Therefore, the concept assumes development of the source topographic database, uniform with respect to a conceptual model, and thus, a clear distinction between the process of model generalisation and the process of graphical generalisation. The proposed approach also concerns the concept and generalisation of the digital terrain model.

Conclusions

This approach has been proposed within the research Project financed by the Committee for Scientific Research (KBN). Experimental works are currently performed within successive investigations at the Warsaw University of Technology. The first implementation of this concept will be probably performed in 2005, when the Head Office of Geodesy and Cartography will present guidelines for development of the Topographic Database with the reduced information content. This will mean the necessity to manage the database which will contain objects from various levels of classification hierarchy, for example “built-up areas|” and “built-up, industrial areas”. The basis for such operations will be the introduction of an appropriate coding system. Objects at lower classification levels will obtain codes from the upper level, extended by additional elements. In some cases, it will be sufficient to expand the classification code in order to raise the level of details. If, full-detailed volume of data does not exist for a certain area, the “abbreviated” code may be introduced.

This approach originates not from scientific considerations only; it also results from high pressures of data users in Poland, claiming for faster data access for the entire country.
On of biggest challenges of this approach is the maintenance of the possibility to produce analog topographic maps and to perform special cartographic presentation of data. This requires the new approach to cartographic presentation methods.

Basing on performed investigations, it may be assumed, for example, that it is difficult to produce a military map at the scale of 1:50 000 (Vmap L2) through generalisation of the Topographic Database. The presented approach proposes to generalise the Topographic Databases to the form of a working database, which will be the base for development or updating of the Vmap database.