Automated Generalization at BEV – From Base Models to 1:50k Map

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Abstract. In 2014, the Austrian Federal Office for Metrology and Surveying (BEV) started a feasibility study on automated generalization for deriving the topographic map in scale 1:50.000 from the digital landscape model. The key task is to provide tools which are capable of creating a map which is derived from the digital landscape model and has no significant loss in quality and accuracy compared to traditional generalized maps from BEV. In a first step, work packages have been established within BEV to analyse available technologies and gain expertise and answers in order to find a modern and geoinformation system (GIS) based approach of cartographic generalization without losing individual cartographic knowledge and quality of highly distinguished topographic maps.

The basic scale for topographic maps produced by BEV is 1:50.000. The other products in the BEV series of scales (1:250.000, 1:500.000) are derived from this scale. It is important that the basic scale is a fundamental cartographic model with high standards regarding actuality, accuracy, reliability and assured continuous revision. There are several motivations for a new GIS based solution for map production. Advantages of vector data contrary to raster data should allow faster and simpler map revision combined with the possibilities of automation. Another aspect is to provide more diverse and flexible products from a vector based cartographic model (print on demand, web map service, web feature service, spatial analysis capabilities, etc.) A more long term goal is to achieve multiple scale map products additional to the conventional BEV map scales.

Until the year 2014, topographers delivered field mapping and topographic surveying results for two different models: The object based digital landscape model (digital object model) and the raster based digital cartographic

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model (DCM). So topographers provided already generalized correction and revision advice to the DCM where the cartographers did final editing based on common generalization rules. The topographers department at BEV (department of landscape information) made some amendments and reorganization within the processes of topographic survey. There was a change from a CAD system with GIS functionalities to a real and modern GIS. Topographers will soon maintain the digital landscape model only; revisions and corrections in the DCM are therefore not much longer available.

A group of cartographers and GIS experts within the department of cartography started the development of a generalization procedure in the framework of ESRI ArcGIS. ArcGIS Model Builder is the main developing platform to create generalization models where geoprocessing tools deliver a wide range of possibilities. The challenge is to create models which are capable of imitating various skills and intuitive actions of a cartographer. To assure that it is important to have a “thinking outside the box” mentality without losing traditional requirements and generalization rules out of sight.

In a first phase the development team had its first findings regarding methods for automated model generalization (semantic and geometric) from the DLM base model to a DLM model with lower resolution for a specific map scale (e.g. 1:50.000). In a second phase findings about resolving graphic conflicts and partitioning of data were made. The ongoing work of the third phase is about resolving open issues and establishing a first prototype procedure with proof of concept. Thereby very complex and sophisticated models for model generalization of roads, railways, hydrography and buildings as well as models for cartographic generalization were set up. The current status of development brought up a first awareness about future procedures. Among these the enhancement of the DLM with other data such as land cover and cadastral information is crucial. This should be followed by partitioning which splits the DLM into smaller subsets of data with pre-generalization of specific features. Thereafter model generalization will be applied for each partition and further procedures like conflict resolving and cartographic generalization are going to follow before the cartographic partitions will be reassembled. This work is still in progress and will consider other map elements than the ones mentioned before too.

Automated Generalization is a difficult but necessary task for BEV. The development process already showed good and promising results. Development reveals that traditional cartographic knowledge is important but a GIS based approach requires more than that. Expertise and experience in programming, mathematics, trigonometry, geometry, IT, geoinformation and database structures as well as the already mentioned “think outside the

box" mentality are essential. Although it is the idea to have one hundred percent automation, it is not a compulsory requirement which means that there is a possibility of keeping manual intervention in a future digital cartographic production process. The only difference will be that cartographers will maintain a vector based data model instead of raster and that they will do more work in a geoinformation context rather than in a cartographic one.

Keywords. Automated generalization, cartography, GIS, map revision, digital landscape model, digital cartographic model