

REDESIGN OF THE SWISS NATIONAL MAP SERIES

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Abstract: The Swiss National Spatial Infrastructure will get significantly enhanced in the near future. swisstopo is preparing for the future with its topographical landscape model (TLM). The TLM will become the base landscape model for Switzerland. On the one hand, the TLM should be used to prepare the data for map production. On the other hand, consistent data sets should be built up for use and processing in Geographic Information Systems.

Along with establishing the TLM, a technology change will take place in cartographic data processing. The prerequisite for efficient map revisions and more flexible data is a shift from raster to vector data. The redesign of the Swiss national maps involves a technology change in cartographic data processing. In a few years, updating national maps will be a quicker, more flexible process. At the same time, the cartographic data will become significantly easier to use and far more versatile.

1 BASIS OF FUTURE MAP PRODUCTION: THE TOPOGRAPHIC LANDSCAPE MODEL

Object geometry, unlike at present in the map-based landscape model VECTOR25, will not be cartographically generalised. Well-defined objects such as roads and buildings will be defined to within an accuracy of max.1 metre. The TLM will contain an area-wide, homogenous, 2.5-D reproduction of Switzerland. The TLM object catalogue is aligned to national map production as well as to requirements of partners and customers. The TLM data model will be built up in such a way that expansions (in terms of its contents) can be carried out in the middle-term to accommodate the continuously growing demands.

As far as possible, the TLM will be made from the existing data set of VECTOR25, which will be transferred over to the TLM. This guarantees the reverse compatibility of TLM to VECTOR25. The Digital Terrain Model (DTM), which is part of the TLM, will also be created using existing data sets.

A high-performance infrastructure for the capture and administration of the TLM will be built up using the Topographic Geographic Information System (TOPGIS). It will have to support not only the integrated, direct recording of aerial image data, but also additional data capture in the field and the efficient integration of the data provided by our partners in the TLM.

Both the TLM and its ancillary DTM will be updated. The principle of overall revisions, i.e. the present method for map production, will be retained for the TLM and DTM. In this way, the TLM and DTM will be revised for a section of Switzerland based on aerial image data. In addition, the TLM will be updated at least annually using so-called top up-to-dateness. For the time being, top up-to-dateness will be introduced for roads and buildings. Top up-to-dateness can only be achieved with the help of reference partners and with the inclusion of a registration process. In the future, other federal departments, cantonal offices and the Cadastral Survey should be the reference partners (certified data producers, as it were) for the TLM. They will provide swisstopo with relevant data for integration in the TLM which they collect in the course of their usual activities.

The aim is to begin TLM production in 2007.

2 PRODUCTION OF DIGITAL CARTOGRAPHIC MODELS

2.1 Current map production at swisstopo

The switch in the nineties from engraving to digital graphic processing proved to be a significant milestone for cartography at swisstopo. Since 2000, the revision (updating) of the national maps has been entirely digital.

Raster data from the scanned glass plates are used as a basis for graphic processing. Many of the fundamental working steps have been retained and adapted for digital processing. The cartographic work remains comparable but the tools of the trade have changed greatly. A cartographic CAD is being used to perform the updating of vector map elements. At the end of the process, all vectors are converted to raster and merged with the background. A major shortcoming of graphic processing today is the very limited flexibility of the map data currently available in raster format. This inflexibility has a negative effect on the following aspects: a) Complicated, time-consuming revisions with no decisive potential for further development; b) Alternative presentations (e.g. for thematic maps) are almost impossible (only complete colours can be selected and adapted).

2.2 Redesign of map production at swisstopo

Databank-based cartography: The prerequisite for efficient revisions and more flexible data is a shift from raster to vector data. The two map-based landscape models VECTOR25 and VECTOR200 provide the necessary vector data basis. Due to the fact that both VECTOR200 and the TLM were conceived for use in geographic information systems, they do not fully meet the requirements for cartographic vector data. By complying with complex structural rules and using automated and interactive methods, Digital Cartographic Models (DCM) can be derived from these landscape models in the various scales used by the national cartographers.

The OPTINA-LK project will establish both the Genius-DB system and the DCM. As both TLM / VECTOR200 and DCM25-DCM1M are managed and revised using databank-based systems, it will be possible to link the data models. Henceforth, many changes registered, for example in the TLM, will no longer have to be interactively converted for each DCM.

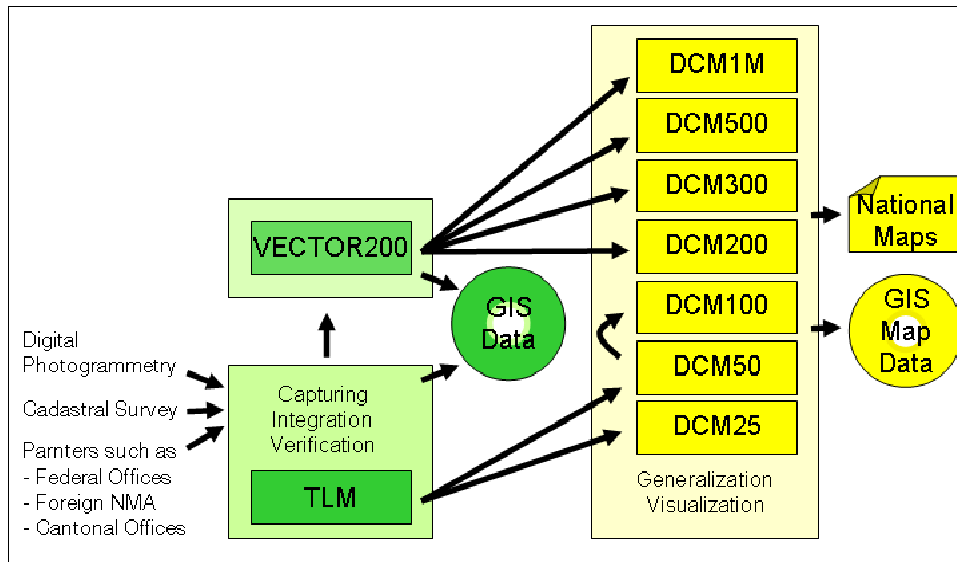


Figure 1: Dataflow from landscape models to cartographic output

Digital Cartographic Models: Landscape models may be simplified for use in smaller scales. Nevertheless, the geometries should be as positionally precise as possible. Positional precision is achieved if an object is as close to its true position as possible [SGK 2005]. A DCM has a different aim than representing the landscape as precisely as possible. Clear map graphics and a good legibility of the content are much more important. Objects in DCM are not only simplified, but also selected, enlarged and displaced. For a DCM the positional precision is not as significant as the positional accuracy. Positional accuracy is achieved if the relative position of objects towards its neighbours is correct.

The structure of DCM data can be compared to the data of landscape models. In order to perform automated generalization, the data need to be topologically correct. The vector data of a DCM can be visualized with different symbol sets. A limitation to the freedom of symbolization is the displacement, since it is performed with respect to a specific symbol with or size.

Automated Generalization: Automated Generalization will be used in future map production. First of all, the landscape model data that is relevant for the maps will be generalized fully automatically. Many national mapping organisations that have experience with automated generalization state that today's results require interactive post-processing [Stoter 2005]. The possibility of partial automation increases the efficiency of revision processing and opens the way for significant development potential.

The new workflow using databank-based cartography and automated generalization is expected to become operational in 2008.

2.3 Redesign of map graphics

The establishment of the TLM and derivation of the DCM allows not only a change in the map content, but also in its graphics. The majority of today's Swiss map graphics was defined about 70 years ago. Some symbols are even from the times when a map was printed in one colour only. Now the opportunity is taken to enhance the legibility and modernize the map graphics.

The traditional graphics of the Swiss national map series are highly esteemed by the international cartographic community. Therefore, the goal of the redesign is to retain well-established elements while adapting the content and the graphics to current demands. The two most obvious changes are the use of more colours and a modern text font.



Figure 2: Experimental map 1:25'000 of suburban area (2x enlarged)

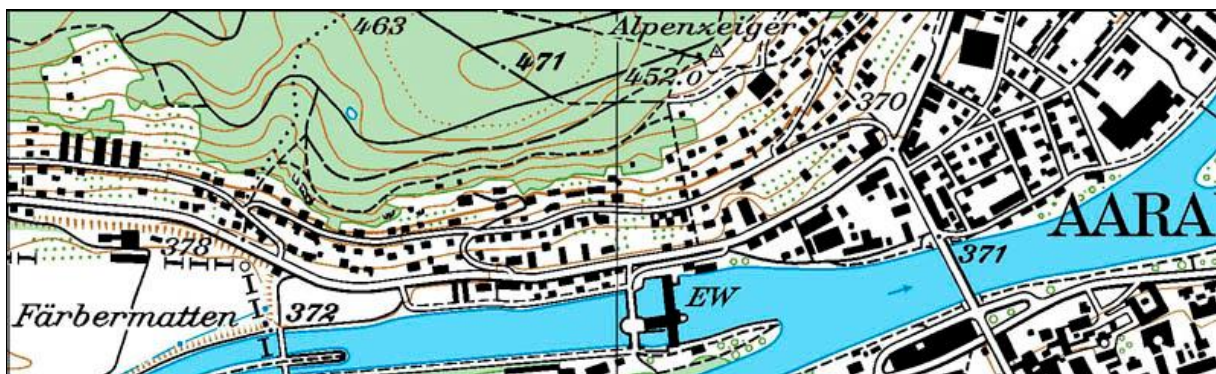


Figure 3: Today's raster map 1:25'000 of suburban area (without hill shading, 2x enlarged)

Rock hachure is probably the one graphic element that has given the Swiss national maps its typical character. Even though the update of this kind of rock display is very time consuming, the available alternatives were not satisfactory. For this reason the vector data of the DCM will be complemented with the traditional rock hachure as raster data. The hand-made scree dots will be replaced by an automated derivation of dots from the hill shading.



Figure 4: Experimental map 1:25'000 of an Alpine area (2x enlarged)



Figure 5: Today's raster map 1:25'000 of an Alpine area (without hill shading, 2x enlarged)

3 REFERENCES

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4 BIOGRAPHY

Novit Kreiter studied survey engineering at the Federal Institute of Technology Zurich, Switzerland. He focused on cartography, GIS and database design. His diploma thesis "Multirepräsentationsdatenbank für Topografische Karten" (multi representation database for topographic maps) was written in cooperation with swisstopo. After graduating in 2002 he was employed by swisstopo, where he is responsible for the establishment of a databank-based cartographic production system.