# 1:50.000 AND 1:100.000 SCALED TOPOGRAPHIC MAP PRODUCTION SYSTEM BY DIGITAL AUTOMATED GENERALIZATION METHOD

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## Abstract

Due to the requirement of information and analysis in several levels in different subjects (especially in engineering applications), maps and geographic information systems at various scales and resolution are needed. Geographic data depends on scale. Spatial and attribute information of the geographic features and the relations between these features can elaborately be stored in high resolution geographic databases. However, these databases can be insufficient for minor scaled application. Thus, models that contain less information and convenient for the different purposes must be derived by generalization. 1:50.000 and 1:100.000 scaled topographic maps had been produced by classical method until 2005 in General Command of Mapping (GCM Turkey). This method is time consuming and expensive. Since 2005, digital automatic generalization has been applied using KartoGen software developed in GCM to achive standardization and high quality in map production.

## Introductıon

Because of the high production costs, updating problems, increasing geographical information and map requirements of the people and the associations, the thought of constructinon of a basic geographical database and production of other outputs from this database by generalization method has been adopted by many map production associations any more. Generalization is a derivation process of minor scaled dataset, less detailed and appropriate for other purposes, from more detailed and major scaled dataset. Basically, there are two methods which are called classic and digital generalization. Classical generalization is subjective approach and production method that depends on the cartographers interpretation, background, ability of making decision and sensing capacity of the real world. Moreover, this production method is time consuming and expensive. The steps of the method applied until 2005 in GCM are generalization, mosaic process, photomechanical downsizing and pressing. However in digital generalization, standardization and accuracy are higher than the classic one. The important point in digital generalization is to determine the right method and processing steps with the best algorithms and parameters.

## Objectıves

Thanks to researcher's huge efforts and improvements of GIS softwares, detailed studies have been done about the applicability of the automatic/semi automatic generalization in digital environment and noteworthy results have been acquired. At present, automatic generalization is inevitable reality for both cartography and GIS. Along with the digital production of the 1:25.000 scaled topographic maps in GCM, research activities were initiated about the digital generalization and KartoGen map production system has been developed by using the advantages of GIS softwares. It was aimed to realize the automatic and interactive production of the 1:50.000 and 1:100.000 scaled standart topographic maps at an optimum time, high standardization and the highest automation rate as much as possible by means of this system.

## Metodology

Digital vector maps are constituted from 9 different feature classes in GCM. Each class is divided into 3 coverages as point, line and polygon, while annotation features are stored in a different class. Table 1 shows 10 classes which form the digital map. KartoGen software has been developed with visual basic programming language by using the objects at ArcObjects software components library of the ArcGIS Desktop software. KartoGen production system is an integrated generalization software which consists of exe. and dll. programs. 1:25.000 scaled digital cartographic vector data in Esri geodatabase format is used as input data in this system (Figure 1) for production of 1:50.000 and 1:100.000 scaled topographic maps. It is aimed to increase the accuracy of the map and save time with the opinion of derivation of the target scale from the master data.

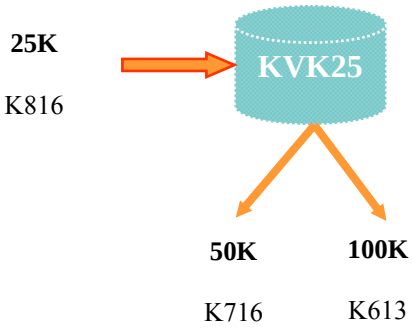


Figure 1. Generalization work flow

Those processing steps are performed in the production band;

- 1:25.000 scaled digital data must have some standarts to execute the KartoGen programs with no error. That's why, digital data are processed in quality control program integrated with the software (Figure 2). So, data become purified from the errors and become standardize.

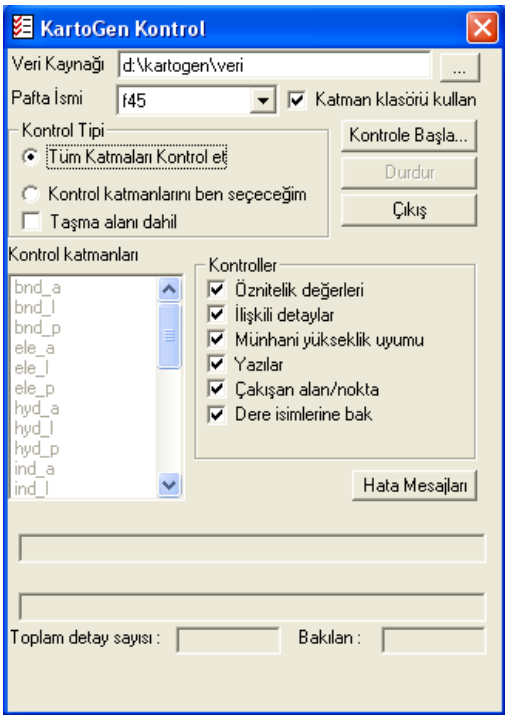


Figure 2. Quality control program

- Digital data are inserted in KartoGen Automatic Generalizer program (Figure 3). In this stage, some generalization processes that must be done certainly without cartographer's commend are done automatically. Data are enhanced automatically at the conceptual and semantic levels.


Figure 3. KartoGen automatic generalizer

- After automatic generalization, interactive generalization of the all feature classes and contextual generalization are made. Comments of the cartographer are important during this process (Figure 4).

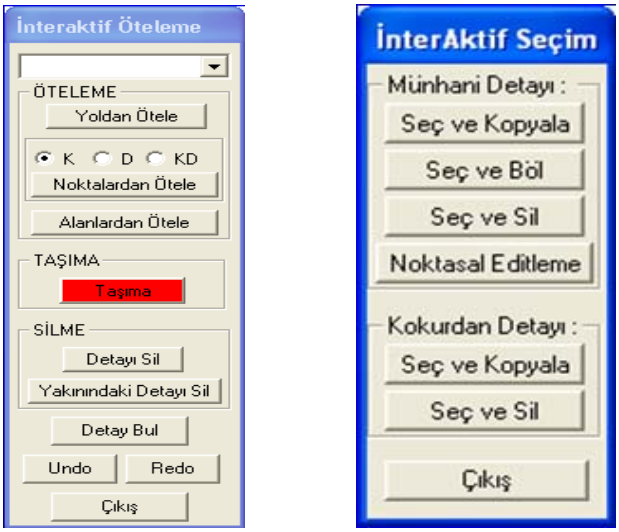


Figure 4. Two of interactive generalization tools.

- Edge matching is performed after automatic and interactive generalization processes (Figure5).

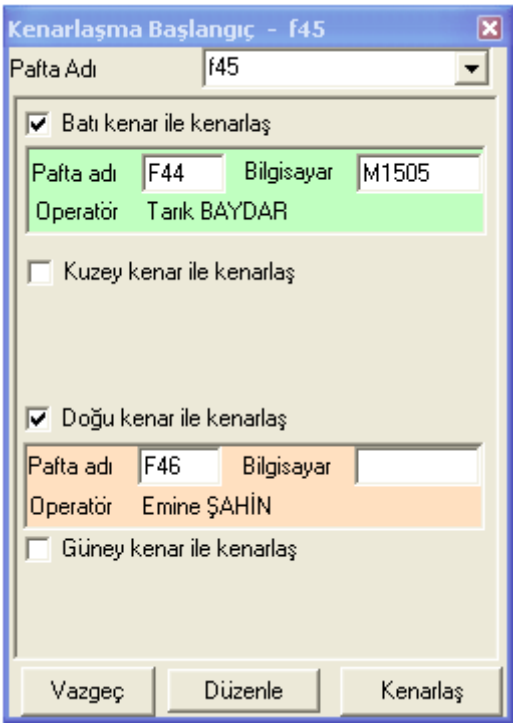

Figure 5. Edge matching tool.

- Inscription of the map is formed by the help of our automatic inscription program (Figure 6).

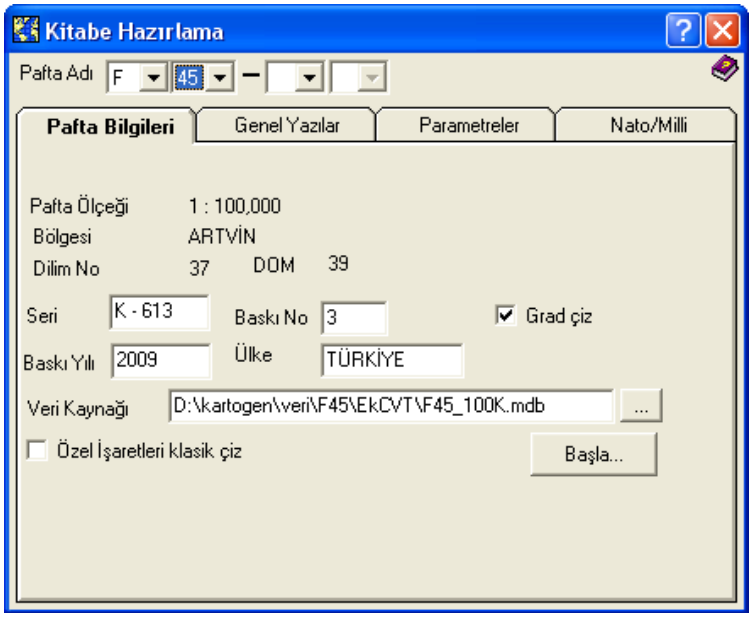

Figure 6. Automatic inscription program.

- The map is printed after all processes and controls are performed.

| CLASS (English) | CLASS (Turkish) | Abbreviation |
|---|---|---|
| Annotation | Yazı | yazi |
| Boundary | Sınırlar | bnd |
| Elevation | Yükseklik | ele |
| Hydrography | Hidrografya | hyd |
| Industry | Endüstri | ind |
| Physiography | Fizyografya | phy |
| Population | Yerleşim | pop |
| Transportation | Ulaşım | tra |
| Utilities | Tesisler | uti |
| Vegetation | Bitki Örtüsü | veg |

Table 1 feature classes

**Result**

During the period of passing from classic to digital generalization, those developments are gained at map production;

- Target product's spatial accuracy and standardization has reached much better level.
- Time, personel and material expenses which are spent for the mozaic process, photomechanical downsizing, etc for classic generalization are eliminated.
- An important decline is occured in production time.
- Production of 1:25.000, 1:50.000 and 1:100.000 scaled maps can be realized in the same year.
- Dynamic legend is used instead of classic ones.

**Conclusıon**

By means of the KartoGen software, important possessions are gained from standardization of map production, personnel and time. This software is tried to improve much more by the cartographer's suggestions. Our basic purpose is increasing the automation rate as possible without making a concession from the quality.