

## **Cartographic Data Capture and Map Production – Topo25**

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### **Abstract**

Topo25 is a map production system, containing data capture, organization, structuring and publishing processes. It is based on 1 / 25 000 scaled topographic maps. The system is an in-house system prepared using ARC/INFO software. All the system is based on Turkish language.

The system is built upon five steps. The first step is collecting the data using the input material. The second phase is quality control of the output digital map. The third step is preparing the hardcopy map including marginal information. The fourth step is printing the digital files with imagesetters and printing machines. The last step is transferring the data to the database.

As input to system, revision plate, vegetation plate, annotation plate and printed maps are used. The basic input of the project is the revision plate, which includes all the details in a map except unchanged contours and annotation. The photogrammetry department working with aerial photographs prepares this plate. First of all this plate is scanned in color and used for heads-up digitizing. All the other inputs are used for raster to vector conversion and feature recognition.

The outputs can be grouped as digital and hardcopy. The digital outputs are 36 layers, which are the results of all editing processes. Moreover the postscript files, necessary for hardcopy output and color separates, resides in this group. For hardcopy outputs, they are draft plotter outputs for control and color separate films.

As a result of this system, future revision studies and smaller scale map production will be handled easily using the cartographic database.

TOPO25 project is applied in a range covering whole Turkey. The geographic details of the more than 5000 topographic maps at a scale of 1 / 25000 will be gathered using this system and they are at the end will be printed.

## **1. Introduction**

Studies about digital map production in Turkey has begun during in the beginning of 1980s. At that time, The objective was to establish a Multi-Product Geographic Database of Turkey containing lots of details and attributes corresponding to them. The first formal digital product was the elevation data. The data was digitized using printed map plates (mylars and films) using heads-on digitizing method. Since most governmental bodies needed that kind of data, it was actually a very effective choice. Since the base map scale is 25 K, the beginning of 1990s saw the attempts to put those map data into a digital environment that a database and geographic objects can interact. The restrictions on the software used that time and the objectives put more behind the reasonable ones, caused delay to produce digital topographic maps.

Topo25, in this sense is the first complete map production system aiming a definite scale. Its objective is to produce 25 K scale topographic maps in digital form. Map production phases include heavy photogrammetry works. Since Photogrammetry Department is in the middle of a transformation to full digital production methods, Cartography Department is responsible for producing 25 K scale topographic maps. Photogrammetry Department provides input data to Topo25 system in digital or analog form. Digital form is in Microstation DGN format and analog form is a stable material on which details are drawn and revised in the land. The details that can not be identified or can not be seen on the aerial photographs, some information about roads (type), vegetation (type, height) are also provided by the topographers in the land survey. This information also comes in two ways. If the base material they use is analog, then it was drawn on that material, otherwise, the data is collected using GPS related digital methods. After a study done at the office, the revised data comes to the Cartography Department.

## 2. System Overview

Topo25 system mainly aims five objectives. These are:

1. Data collection for digital revision,
2. Building a Topographic Database,
3. Building a Cartographic Database,
4. Production of 1 / 25 000 scale topographic maps.
5. Building a base for Generalization studies.

The system is built using ARC/INFO software. Topo25 is in-house system that was developed regarding the needs of our organization and the cartographers who collect data. The operators mostly have cartographic background. It is plus for the system because they have necessary experience to evaluate the features on the map.

The system is in Turkish Language. All the programs and forms and menus are designed to provide a stable way of map production system regarding to prevent mistakes and errors that can be made by the operators. ARC/INFO software is the main and only software for this production environment. From the beginning to the end of production steps, it is effectively used. For hardware, Windows NT based machines having average properties as hardware and memory are used.

Topo25 production system focuses upon producing one map sheet at a time. In this system, first of all, the data coming from Photogrammetry Department passes a QA/QC check. Pre-provided programs including forms and menus help the operator to collect the data with every tool that makes editing steps very easy. A major approach for edge matching of the sheets is done on the fly. It can be performed using ARC/INFO and networking capabilities of the Windows operating system. Every operator can see the others' data and whenever necessary edit them it was permitted. With the ability provided by the operating system, production activities are mostly automatically managed with the centralized programs, user forms and menus. A production management control system is used to monitor the progress of the map sheets which are in production.

The base material for data collection is revision plate, which is prepared in the Photogrammetry department at the office using aerial photographs. It includes all the detail (features) that will be digitized excluding the contour lines and annotation. Vegetation plate showing the type of vegetation areas and the heights and also including the types of roads is also an important source of data. It is produced in the land by the topographers. A printed map for checking the names of the features is also used for gathering names as attributes for the features.

### **3. Data Collecting**

The guidelines are clearly defined for data collection purposes in Topo25 system. Since the data comes from photogrammetry in two different ways, Topo25 is designed to handle both of these instances. The base plates are scanned for hand-on digitizing. These are:

- Revision plate,
- Vegetation plate,
- Annotation plate.

Every base material is scanned at a resolution of 300 dpi for easy data collection. If the data is not in digital form, all the features are collected one by one using predefined rules. First of all the job begins by the control of contour lines and rivers. The intermittent and permanent rivers and are used for this operation.

The relationships between details are very important. Rivers, bridges, roads, boundary lines between roads, lakes and population areas are taken into consideration while collecting data. The system is based on the concept “WSYWIG” what you see is what you get. So rather than collecting features with simple lines, they are seen on the screen at the same scale and symbol as if they are printed. Four different types of color schemas used in the system. One is for data collection on the screen. This makes data collection easy and the operators can control the details they collect. The features seem in this mode in different colors from their original symbols. For

example trees are seen in red and rivers in magenta in collecting phase. So they can be easily distinguished from the features in the revision plate. For the control output, there is another color schema used.

For the annotation, since the fonts provided by the ARC/INFO software is not enough for a quality annotation collection, True type fonts are used. So the same of standard Windows fonts are used in the system.

There are mainly nine classes in Topo25 system for data collection. These are:

- Boundary,
- Elevation
- Hidrography,
- Population
- Transportation,
- Physography,
- Vegetation,
- Utilities,
- Industry.

Every feature class has three coverages for collecting point, line and polygon data. Another coverage is used for annotation collection. So at the end, the system produces 28 coverages as a result. Some coverages are combined together to make data collection easy. For example all the point data of a sheet is gathered in a point coverage. Later they are separated to their original coverages.

The attributes are also gain importance while collecting data. There are four main attributes which are valid for every feature in Topo25 system. Tehse are:

- F\_name
- F\_code
- Symbol

- P\_name

#### **4. Quality Control**

Quality control is done in two ways. One is to use manual methods like getting a draft output from a plotter and to control it by eyes. The other is to use QA programs. These programs control many sides of digital data collection activities.

Manual control is made by the experienced cartographers. On the screen and using the hardcopy draft output, they make a check-up on the data collected. The QA programs control the integrity of the features and coverages and the data structures. They also find and correct editing errors done on the sheet. They try to build topological consistency and clean data for topographic and cartographic databases.

#### **5. Printing and Archiving**

Every sheet produced using Topo25 system, enters a phase in which the layers where the data resides are prepared for printing. At this stage, the data is used and marginal information is added including legend and supporting elements like scale and so on for printing purposes. Again all this studies are done using ARC/INFO software.

At the end a EPS (Encapsulated Postscript Format) file is produced for exposing in Imagesetter Dolev 800. The four films in colors CMYK are sent to corresponding branches for exposing on plates and printing. Later the data is archived and put to the databases.

#### **6. Results**

Topo25 system is a native, in-house system for producing topographic maps in 25 K scale. By using this system, it is aimed to produce more than 5000 map sheets of Turkey. Now around 1000

map sheets are produced using this system. It is a complete one considering the sub-systems in it like production preparation unit, data collection unit, quality control unit, production monitoring system, statistical unit, system management unit and prepress unit.

The system will be richer in near future adding more capabilities and powering the features with different attributes the features.