RENEWAL AND COMPLETION PROBLEMS IN GEOGRAPHICAL DATABASES IN TURKEY AND A PROPOSAL MODEL

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ABSTRACT

Defence, security, public works, and many other branches of government require small-scale, current geographical databases. With this aim, small-scale geographical databases in Turkey were produced in the past and are still in use today. There are, however, problems in using the available geographical databases. These problems in forming, sharing, updating, and meeting requirements necessitate the reconfiguration of the present system. Classical approaches are preferred when updating the present geographical databases. Many errors and difficulties in recording new objects have occurred in the field, in scanning and collecting data from related institutions, and in recording and controlling nonstandard completion data. Thus it is difficult to achieve the desired high quality data with the present method. In this study, we introduce and discuss updating and completing small-scale maps of geographical bases. The Geographical Information System formation studies in Turkey are summarized, and a model is proposed for the formation, updating, and completion of systems of small-scale maps of significant databases.

Keywords: Geographical Information System (GIS), Data, Maps

1 INTRODUCTION

Today, information is needed to conduct even the slightest research in any given subject. It is imperative that this information meets the users’ needs and is up-to-date and accessible. The properties of the information obtained emerge as an important factor in the success of the services offered. Many institutions have been formed in Turkey to meet the various needs of the citizens. Usually, each institution gathers, assesses, and stores its own data. This effort on the part of each individual unit to obtain the data it needs creates various problems. Sharing of data among the units and integration of the data become difficult and sometimes even impossible. This study explores the institutional activities that deal with geographical databases and the institutional activities that are connected with them.

2 THE CURRENT SITUATION OF GEOGRAPHICAL DATABASES IN TURKEY

There are various institutional bodies in Turkey founded in accordance with the nature of the public service they give. Each institution individually gathers, processes, and endeavours to update the data it needs to fulfil the tasks that it was founded to deal with. The leading institutions that engage in geographical database activities are given in Figure 1.
Each institution given in Figure 1 was founded to serve a particular purpose. Because a centralized databank has not yet been established in Turkey, each institution has individually gathered, updated, and integrated the information that it needs.

Data groups have been established for special purposes within each institution in Turkey. The methods pursued in collecting, storing, updating and integrating the data in each data group that meets only for a particular institutional purpose exhibit differences. Figure 2 shows leading data groups in Turkey.

Each data group given in Figure 2 has its own system for data standards and method of collecting, archiving, and updating the data. Therefore, difficulties and even impossibilities are experienced in data sharing and hence data import. Efforts aimed at a common data standard for Turkey are also made with difficulty.

Integrating and updating activities in these databases specially created by institutions are implemented with difficulty. Since integrating and updating are required for some databases because of the joint efforts of various institutions, the diversity of the problems further increases. 1/25 000 and smaller scale geographic map bases that are used for security and public works can be given as an example of this situation.
3  EFFORTS TO INTEGRATE AND UPDATE GEOGRAPHICAL DATABASES

In Turkey, topographic maps covering the whole of the country have been completed for purposes of Regional Planning, Public Works, Natural Disasters, Defence, etc. Efforts are underway to digitalise these maps, which were completed using traditional methods. Topographic maps prepared at various times lose their currency over time because various public works such as roads, irrigation, bridges, land regulation etc. constantly change the landscape. Institutions keep records of these activities according to their own standards and use them accordingly. Current archiving and data saving efforts are mostly sufficient for their purposes since their works are often limited to a local area. Although the existence of a different recording system for each work does not pose a problem because there is no need for a total display of data, serious difficulties are experienced in special cases like natural disasters.

Great efforts are expended in incorporating these changes in landscape into the general geographical databases (topographic maps), and they are often completed with great difficulty. The authority to integrate and update data belongs to the institution that produces the basic topographic database, and it is responsible for the data. After the institution prepares the topographic database and puts it into service, it contacts the provincial units for integrating and updating and demands data to be used for the latest updating. Data information exchange is performed with the method given Figure 3. Each graphic piece of information that comes from provincial units is digitalised according to the steps in Figure 3, and non-graphic information is compiled and transferred to the GIS environment.

![Flow diagram for data exchange operations](image)

Figure 3. Flow diagram for data exchange operations
The data compiled from the executive public institutions can be grouped under 4 headings as in Figure 4.

Figure 4. Data compiled from executive public institutions

3.1 Roads and Road Structures

Data about roads and road structures are requested from the institutions given in Figure 5 and data integration and exchange operations are performed. [1]

Figure 5. Data sources for roads

Information about roads requested from public institutions given in Figure 5 is recorded in the attributes table given below with the number of attribute data stated next to them. Table 1. [2], [3]

Table 1. Road attributes data table

| Attributes Table                        | Data Area |
|----------------------------------------|-----------|
| Road                                   | 17        |
| Bridge/Overpass/Viaduct                | 26        |
| Tunnel/Underpass                       | 12        |
| Sharp Bend                             | 8         |
| Critical Point                         | 7         |
| Narrowing/Expanding                    | 7         |
| High Inclination Road                  | 6         |
| Road Maintenance Facility              | 15        |
| Shallow Passage                        | 10        |
| Waterway Passage by Ferry              | 10        |
Similarly, 16 pieces of attribute information are gathered from six different institutions given in Figure 6. [2]

Figure 6. Sources of Data about Water Resources

4 PROBLEMS EXPERIENCED IN DATA COLLECTION

- Few instances of data exchange between institutions existed in the past in Turkey.
- GIS activities for institutions are relatively recent in nature.
- There is reluctance on the part of the institutions to share data.
- Although by law, institutions are required to establish a data collection unit, in practice these units have not been formed. As a consequence, data is not sent from the institutions to the centre. The administration of the data integration centre has adopted the method of obtaining data from the central body of each institution.
- However, as most of the data are located in the provincial offices of the institutions, it has been impossible to obtain the data requested by the General Directorates.
- A different method has been used to obtain the existing data in the provincial branches of public institutions. In order to obtain information from the provinces, 762 staff members were given the necessary training, and thus the data were obtained from the source as in Table 2.
- During the data collection, no technical personnel were found in the provincial branches of some institutions to obtain information.
- Some data that were supposed to be included in the institutional documents could only be obtained orally.
- The process of data collection has taken 3.5 years.
5 PROBLEMS WITH THE DATA OBTAINED

Various problems are encountered with the formats, shortcomings, accuracy, and currency of the data to be incorporated into the system. The information to be incorporated can be grouped under the titles of graphic and non-graphic information. In many institutions these data are in the form of non-digital, traditional documents and printed forms.

In regard to the format of the data concerning roads, there is no information about the coordinates of details on roads in the printed inventory tables where institutional road data are entered. Instead of coordinate information, the positions of details are determined by measuring from the beginning of the road with a vehicular audiometer and are expressed in kilometres, see Table 3. The kilometres of road details obtained with this method do not coincide with the details on the map.

While graphic road data are marked approximately in the printed maps of General Directorate of Roads, they are prepared in the form of sketches in the roads of other institutions.
Not all the information has been accessed because the necessary information has not been entered in some of the columns in the inventory tables where institutional data properties exist. Most of the data in the institutions is preserved in traditional environments in the form that it was first collected without being updated. In some provincial branches of institutions, information on roads and water is 15 or 20 years old. Information about the same data exists with different information attributes in different public institutions. As there exist fundamental problems such as a lack of standardisation, shortcomings, currency, and accuracy due to the abovementioned reasons, attaining the set goals becomes very difficult.

6 NATIONAL AND INTERNATIONAL GIS ACTIVITIES ACROSS THE WORLD

In technologically advanced countries, activities about Geographical Information Systems are conducted by a “board of experts” appointed by law. These boards guide and coordinate GIS activities and prepare the technical and administrative regulations (laws, directives, and statutes) for these activities.[4],[5],[6] Examples of this are:

- American Federal Geographic Data Committee (FGDC)
- American Geospatial One-Stop Project (GOS)
- European Union Geographical Information Database

7 CONCLUSION AND SUGGESTIONS

Initially, the procedure for the Field Analysis System in Turkey was planned so that data would be sent to the centre by the institutions, and the data would then be presented to users after being turned into the required format. As a consequence of the problems encountered, the project’s section that was to perform data acquisition now does data collection. This situation led to an additional cost arising from data collection activities. Various problems arose in attaining the desired results in integrating and updating data.

For ideal GIS activities in Turkey, a board appointed by law and funded properly should be established. Under its guidance, the following steps should be taken:

- The country’s geographical data infrastructure and standards should be prepared.
- Geographical data should be collected with the joint efforts of public and private institutions.
- A geographical information system network that resembles a database should be set up.
Geographical data exchange between institutions that offer public services should be conducted according to standards to be determined.

Despite all the difficulties experienced, it can be said that, as a result of dedicated efforts, information that is needed in Turkey has been, to a great extent, put into digital systems, reviewed, and processed using Geographical Information Systems technology, and final products have been presented to the users, thereby setting the system going.

The data in the system should be kept up-to-date so that the system can survive. To this end, the programme will be sent to public institutions, and they will be asked to inform the headquarters at regular intervals of any changes that have occurred in their data. It is believed that if the system is implemented successfully, public institutions will be able to utilise the system to their advantage in matters of GIS activities, disaster management, emergency management, and national defence. In addition, it has been assessed that the feasibility of scale 1/25,000 topographic map integration activities using the institution’s data is possible only if:

- A standard format is prepared for data produced on similar subjects between institutions.
- Regulations are made that will ensure the sharing and use of the data produced between all institutions.
- Institutions’ areas of responsibility are determined for data produced by different institutions.
- Data updating is performed by establishing coordination between institutions and setting standards for the country, thus avoiding wasting time, personnel, and resources originating from the reproduction of data by different institutions.
- Data security is ensured and legal regulations are made that will entitle access to the existing data.

In this way, maps of scale 1/25,000, which are our country’s basic topographic maps, will be prepared faster and in a more up-to-date manner. Figure 7-8. [7]
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