

TURKEY DISASTER INFORMATION SYSTEM: A CASE STUDY FOR ISTANBUL

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Abstract

1999 Marmara Earthquakes caused 20000 casualties, many injuries, more than 30000 building damages, according to the official records. Especially the earthquakes and the other natural disasters still threaten the Turkey. Ministry of Interior of Republic of Turkey and Istanbul Technical University initiated project on May 2001, called Turkey Disaster Information System (TABIS). In TABIS project, GIS standards based on disaster management were created on December 2002 and announced to the central and local governors by the Ministry of Interior. The results of the many earth sciences research declare that Istanbul is waiting for her earthquake in the near future.

The aim of this study is to create and conduct a GIS based information and management system for Istanbul, which uses satellite technologies and information systems for planning emergency preparation and application, disaster management and loss estimation in a natural disaster situation and for the ordinary times a decision support system for the central and local governments.

In this study, the southern costs of the Istanbul City will be taken into consideration because of the scientific reports which were published on this matter. All the scientific reports announce that the most risky areas of Istanbul are the southern costs of the metropolitan city.

The main processes that will take most of the attention on this study are;

- Studies for modeling the space
- Configuring the data (whether spatially referenced or not) related to disaster management
- Creating the principles for institutional structuring to keep the system up to date
- Installing the system and determining the software and hardware for service
- Acquiring the different characteristic data (geometric, attribute, meta) for different scale
- Determining the integration way of data which were acquired from different sources
- Determining the presentation standard of data (cartographic of text document)

Creating the communication and distribution ways of data.

Introduction

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The aim of the project is to create an information system which has the capability to help the decision makers, ministries, governments and municipalities to conduct the planning, mitigation, response and recovery phases of the emergency management, by using modern satellite techniques and information systems, before, during and after the disaster occurs. This project will be an application for the city of Istanbul for an example to GIS based information and management system standard for the whole similar applications in Turkey.

By this way it is planned to constitute a management and information system that settles the coordination between the administrative districts of Istanbul and the other cities on disaster planning and management standard of Istanbul.

This system will be supported by the current satellite technologies like GPS and remote sensing and public improvement, cadastre, infrastructure, ground and superstructure and population data. Those data will have very detailed attributes for the reliable use in analysis, planning, decision support and response operations.

Thus, during a potential disaster, the first aim of the emergency and disaster management and also the mentioned system, reducing the number of the casualties will be provided, and after that the loss of goods and loss of the country's economy will be minimized.

For the Turkey and especially for the Istanbul there are no GIS which have standardization and the data structure that provides all the required processes for a city even though the popular technology of GIS is used widely for the city management and planning.

Background of the Project

1. Training on Emergency Management
2. Just after the catastrophic disasters in 1999 there have been an agreement between FEMA (Federal Emergency Management Agency) and ITU (Istanbul Technical University) in 2000.
3. Development of Turkish Fire Brigades
4. Development of Emergency Management System
5. GIS standards based on Emergency Management (TABIS)
6. To develop GIS standards for emergency planning & administration, disaster management & damage estimation, and as a decision support system for central & local authorities (ministries and local administrative units) at other times.

The outputs of the fourth project are;

- Workshop with local authorities in Turkey, April 2002
- Workshop with private sector in Turkey, June 2002
- International Symposium on GIS, September 2002

Final Report was submitted to the Ministry in November 2002 as;

- Guidelines for Managers
- Fundamentals of TABIS
- TABIS Object Catalogue.

What is TABIS

Turkey Disaster Information System (TABiS) was developed in the scope of "Development of a National Database Using Geographical Information Systems (GIS) and Remote Sensing System and Standards for a Disaster Management Decision Support System" in the Istanbul Technical University. (Karaman H., et al, 2002)



The heart of the Turkey Disaster Information System is the spatial database. The reference model of the TABiS system constitutes of two vector components.

These components are named as;

- Digital Spatial Model (SMM), and
- Digital Disaster Model (SAFM).

Both digital models constitute the space on a basis based on the object by separating the place one by one to its components. (Karaman and Sahin, 2004)

TABiS Object Catalogue

Both digital models form the space by separating it to its components based on object oriented basis. This process is called as atomizing of the space in the database modeling. The atomized data of the both digital models prepared as an object catalog. These catalogs are;

- TABiS-Basic Topographic-Spatial Object Domains Catalog (TABiS-TOK)
- TABiS-Disaster Management Object Domains Catalog (TABiS-AOK)

The aim of the TABiS-TOK is the modeling of the concrete objects which are the characteristic parts of the topography of the region where the system will be constructed. Parallel to this aim, the components of the TABiS-TOK are named as “Basic Topographic-Spatial Object Domains”. TABiS-TOK is also has the quality of being a data standard for the country wide public and private institutions who want to set up a detailed spatial information system for their own purposes. Because of the object modeling, object definitions, attribute definitions, data types for the attributes and attribute values can be matched with analog topographic map contents, a disaster management based GIS which is constituted convenient to the TABiS-TOK model can work totally harmoniously with the other GISs of the same region. Even if the aims of the systems are different. (Karaman and Sahin, 2005)

A virtual map which was modeled according to the TABiS-TOK is named as “Digital Spatial Model” (SMM), and a virtual map which was modeled according to the TABiS-AOK is named as “Digital Disaster Model” (SAFM). (Karaman and Sahin, 2005)

Proposed System Features

The system will have a plan and preparedness for every kind of disaster and this will help to orientate the response and logistic support works faster than before and as accurate as it can be. The response centers and support stokes can be located to the places that the system offers. These offers will be the results of the analysis of the system according to the transportation to the emergency region and amount of the loss. After the disaster occurs, the system will be decision support unit for the mitigation efforts in determination of the temporary settlements and gathering places and distribution places for the aid and support, determination of the amount and the possessor of the aid for the citizens and institutions.

It will be able to seen from the system that;

- What kind of and how much help is needed from which disaster region and
- From where can this help be there in the shortest time?
- Which kind of specifications needed for the staff that will be charged?

Optimizing and planning the response, help and logistic support will reduce the loss of disaster and response and recovery costs. This will minimize the economic catastrophe that follows the disaster at the city of Istanbul. Announcing the publicity the emergency plans and



these kinds of studies are exists will minimize the panic that could happen during and after the disaster. This will also help to apply the plans in order with the participation of the public. The system will provide current, correct, standardized and consistent data for its users. The system will prevent the complexity of transmitting of the unnecessary information.

Parameters to be applied in the proposed study are: studies related to the spatial reference of the geographic information system, configuration of the spatial and non-spatial data related to emergency management, formation of the principles of the institutional structure to keep the system up-to-date, formation of the system and determination of the hardware and software to be used, acquisition of different types of data according to the prescribed scales, determination of the integration of the data coming from different sources, determination of the presentation formats, formation of access and distribution of the data. As it can be understood from the listing, the subject requires a multi-dimensional expertise. It can't be possible to generate solutions to the listed tasks at a single phase.

In the determination of the data related to either emergency management or physical world or in the organization and interrelation of these data, land use plans are very important data resources. When the urbanization rates are taken into account for our country, it can be seen that even the most recent land use plans have insufficient data to show the real state. New land use, land cover and water classes will be formed by using remotely sensed data carrying relevant information gathered from observation satellites. By this method which provides homogeneous evaluation possibility, datasets that are economical to update will be formed. High resolution satellite imagery will be used in the study for obtaining up-to-date data. The study, which is out of scope of the classical data gathering methods, will be presented as a sample study of satellite remote sensing, GPS and integrated GIS. The study, designed with this scope, is hoped to make great contributions to emergency management studies in Turkey.

All actions in the scope of the study will be carried out with cooperation between Istanbul Metropolitan Municipality and Istanbul Technical University. The relevant paper by Istanbul Metropolitan Municipality is presented as an attachment.

Standards regarding the staff that will work in the emergency management focusing GIS center during and after the study are determined. Responsibilities and working areas of the staff in the system are defined by making the job definitions.

Different Studies for Istanbul Disaster Information System

There are four different institutes with the four independent studies for Istanbul:

- a. State Planning Department of Turkey
- b. Istanbul Governorship (ISMEP)
- c. Istanbul Metropolitan Municipality
- d. Turkish Emergency Management Agency (TEMA)

State Planning Department of Turkey

This project will unite those studies and the system will be conducted from one hand. The aim of the Istanbul Disaster Information System is to establish a GIS based information system for;

- emergency planning & administration
- disaster management & damage estimation, and
- as a decision support system for central & local authorities (ministries and local administrative units) at other times.

Istanbul Seismic Risk Mitigation & Emergency Preparedness Project (ISMEP)



The proposed project will initiate a process that aims at transforming Istanbul in the next 10-20 years into a city resilient to major earthquake. The overall goal of the proposed project is to save lives and reduce the social, economic and financial impacts in the event of future earthquakes.

The specific objective of the project is to improve the city of Istanbul's preparedness for a potential earthquake through enhancing the institutional and technical capacity for disaster management and emergency response, strengthening critical public facilities for earthquake resistance, and supporting measures for better enforcement of building codes and land use plans. (Sahin, 2006)

Components of ISMEP

Component A: Enhancing Emergency Preparedness

This component will enhance the effectiveness and capacity of the provincial and municipal public safety organizations in Istanbul to prepare for, respond to and recover from significant emergencies, especially those arising from earthquakes.

Component B: Seismic Risk Mitigation for Public Facilities

This component will reduce the risk of future earthquake damage to critical facilities in order to save lives and ensure their continued functioning in the event of an earthquake, through retrofitting of hospitals, schools and other priority public facilities.

Component C: Enforcement of Building Codes

This component will support innovative approaches to better enforcement of building code and compliance with land use plans.

Component D: Project Management

This component will support the Istanbul Provincial Administration to implement the project in efficient and transparent manner, and build the institutional capacity to sustain the implementation of Seismic Risk Mitigation and Preparedness program beyond the life of the project.

Feasibility studies were initiated last year.

- Emergency Communication systems
- Disaster Management Information Systems
- Improvement of Emergency Response Capability
- Pilot Project for Strengthening Public Buildings (39 schools, 12 University Hospitals, 1 Student Dormitory, 2 Search & Rescue Buildings)
- Bakırköy Province Pilot Project for Strengthening Residences (350 buildings)
- Social Tendency Survey for Residence Strengthening. (Sahin, 2006)

Main Projects for Istanbul

- JICA Report, 2003
- Istanbul Earthquake Master Plan, 2004
- ISMEP, 2005
- Turkish Emergency Management Agency
- ITU

How to Use GIS in Disaster Mitigation

Using GIS for disaster management is the easiest and the quickest way for these days. While the technology is developing for the information systems it is getting faster to use more complicated systems. (Karaman and Sahin, 2005) Disaster decision support tools, frequently



including GIS, remote sensing and GPS, necessitate the inclusion of elements that give disaster managers relevant information for mitigation and preparedness planning without burdening them with the mathematical equations and models that produce damage, death, and injury calculations based on hazard event parameters. GIS-based technologies are essential for conducting place-based hazard & vulnerability assessments. (Thomas, 2005)

Conclusion

After completing the project, every kind of national information system studies will be constituted according to a standard and it will be able to relate those national information system studies to the system that will be created with this project. The project will unite all independent studies and will help to exchange and manage the valuable data for disaster management of Istanbul.

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Muhammed Şahin is a professor of Surveying in the Faculty of Civil Engineering, Istanbul Technical University. He has been the head of Surveying Technique Division since September 2004. He was born in Pazar, a town of Rize where he finished his primary, secondary and high schools. He graduated from the Department of Geodesy & Photogrammetry, Istanbul Technical University in 1987. He received MSc & PhD from University College London and University of Newcastle Upon Tyne, UK, respectively. He became an assistant professor in 1994, an associate professor in 1996 and professor in 2002. His research interests include satellite positioning techniques, monitoring of earth crust using GPS, emergency management, disaster information systems, GIS based on emergency management.

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