# 4.10.3. DESIGN OF ISTANBUL DISASTER INFORMATION SYSTEM

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## 4.10.3.1. Overview

**Natural disasters are supernatural facts that can not be prevented but before occurring, taking precautions reduces damages. Depending on occurred places physical and economical conditions, applying "Disaster Management System" can make possible natural disease losses with modern technology. The last natural disasters occurred in Turkey, August 1999 Kocaeli and November 1999 Duzce earthquakes. The effects can be seen as human dead, economical losses and people's psychological states. Whole conditions discussed that it is indispensable to manage Istanbul Disaster Information System for a possible natural disaster loss reduction because of Istanbul's specialty of Turkey's economical and cultural center and World's important metropolitan city. This Disaster Information System is based on Geographical Information System (GIS) and includes spatial information and management system. It is necessary to supply required quality and accurate data before the disaster, at the moment of the disaster and after the disaster for the Disaster Management System. And these data must be updated, fast, harmonious format reach users urgently. Thus, coordinated Disaster Management System can be realized.**

**In this Project, information resources, spatial and non-spatial information sources, sort of data supplied from corporations, pre-disaster, while disaster and after disaster, corporations' role, duty and responsibilities for database system are discussed in the aim of designing effective Istanbul Disaster Information System model with similar model applications in the World.**

## 4.10.3.2. Introduction

**To create a disaster plan too many kinds of data are needed. Those data must have been stored in databases and these databases must have been connected to each other according to the aim of the plan. Those connections are called as relations and those database objects are called as entities. When those entities connected to each other according to an aim, this newly generated formation is called as data model. The objective of this study is to design an emergency management based information system using the TABIS Object Catalogue. (Karaman, H., Sahin, M., 2004)**

**The study area is Istanbul, northwest of Turkey which has 5.712 km$^2$ of area and 10.018.735 population from the data of 2000 (Fig. 4.10.3.1.). The increase of the population in Istanbul for last 15 years is 3,9% *(*www.istanbul.net.tr*)*.**

**According to the feasibility report on requirement analysis and current issue evaluation made for Istanbul in 2005 by the Yalcin Teknik Orgakom Group, there are too many institutions and organizations in Istanbul for disaster response and management**

**situation. Those are the institutions and the projects of the institutions where the information will be acquired. Those institutions are listed below:**


**Fig. 4.10.3.1. City of Istanbul and Districts (www.ibb.gov.tr)**

- **Governorship of Istanbul Disaster Management Center (AYM)**
- **Istanbul Metropolitan Municipality Disaster Coordination Center (AKOM)**
- **City Health Directorate and 112 Immediate Call Center (T.C Ministry of Health)**
- **City Directorate of Security and Call Centers (T.C Ministry of Interior)**
- **Fire Department (Istanbul Metropolitan Municipality)**
- **City Civil Defense Directorate**
- **City Garrison Commander**
- **City Commander of Gendarme**
- **Administrative Districts and District Crisis Centers or Units**
  - **District Municipality**
  - **District Directorate of Security**
  - **District Civil Defense Directorate**
  - **District Health Units and Hospitals**
- **European Side of Istanbul City Directorate of Telekom**
- **Telecommunication Institute Istanbul Region Directorate**
- **Highways 1.Zone and 17.Zone Directorates**
- **Red Crescent Disaster Response and Logistics Center**
- **Istanbul Meteorology Directorate of Region**
- **Kantilla Observatory and Earthquake Research Institute Directorate**
- **Republic of Turkey Ministry of Environment and Forestry**
- **Turkish Red crescent Society Istanbul Region**
- **Istanbul Population and Citizenship Directorate (Republic of Turkey Ministry of Internal Affairs)**
- **General Directorate of State Airports Authority (DHMİ)**
- **General 14. Regional Directorate of State Hydraulic Works Istanbul**
- **Financial Office of Istanbul (Republic of Turkey Ministry of Finance)**
- **Istanbul the Ministry of Public Works and Settlement**
- **Çekmece Nuclear Research and Education Directorate**
- **General 1st and 17th Regional Directorate of Highways.**

- **Social Security Organization (SSK) Estate Directorate**
- **Commerce and Industry Provincial Directorate**
- **Search and Rescue Service Association Directorate**
- **Ministry of Education Provincial Directorate**
- **Agriculture Provincial Directorate**
- **Provincial Department of Religious Affairs**
- **General Directorate of Coastal Safety and Salvage Administration**
- **Istanbul Metropolitan Municipality Units (İSKİ, İGDAŞ)**
- **BEDAŞ (The Bosphorus Corporation Distributor of Electricity)**
- **AYEDAŞ(Anatolian Side of Istanbul Corporation Distributor of Electricity)**

**(Orgakom, 2005)**

## 4.10.3.3. Governorship of Istanbul Disaster Management Center (AYM)

**Established in January 1st of 2000, with the order of the President of the Republic to maintain the coordination and cooperation between the institutions and organizations by the Governorship of Istanbul. AYM have 32 Administrative Districts, 73 municipality organizations, 151 village self governments, 902 ward self governments in its responsibility. Principality of the AYM's organization is conducting the avoidance, preparedness, rapid response and recovery works.**

**The main projects on disaster management that AYM is conducting are;**

- **JICA Project (Disaster avoidance and reducing basic work project including Microzonation in Istanbul).**
- **Warning and Rapid Response Aimed Record Network Project.**
- **City Geology and Land Use Mapping Work.**
- **Education Project for Being Prepared for the Disaster.**
- **Assurance and Education Project for Rescue Materials from the International Institutions.**
- **Project of Disaster Station for Every Ward (AFİS)**
- **Earthquake Park Project.**
- **Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP)**
- **Ward Disaster Volunteers Support Project (MAG).**

- ### ISMEP Project

**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)**
- **Bakırkoy Province Pilot Project for Strengthening Residences (350 buildings)**
- **Social Tendency Survey for Residence Strengthening (Sahin, 2006).**

## 4.10.3.4. Istanbul Metropolitan Municipality Disaster Coordination Center (AKOM)

**AKOM is established just after the 1999 earthquakes with the order of Governorship of Istanbul to provide the coordination and cooperation of all the units depended to Istanbul Metropolitan Municipality before, at the moment and after a disaster in Istanbul. In 2002, AKOM moved to its own facility which is constructed on a rock soil and earthquake resistant last technology equipped building. The president of the AKOM is the co-general secretary of the IMM, and the co-president is the Director of the Fire Brigades (Fig. 4.10.3.2.) (Yalin, 2003).**


**Fig. 4.10.3.2. AKOM Organization Scheme (Yalin, 2003)**

- **JICA Project**

**In response to a request from the Government of the Republic of Turkey, the Government of Japan decided to conduct "The Study on A Disaster Prevention / Mitigation Basic Plan in Istanbul including Seismic Microzonation in the Republic of Turkey" and entrusted the Study to the Japan International Cooperation Agency (JICA) (JICA-Final Report, 2002).**

**As the acting Counterpart Agency representing IMM, the Directorate of Soil and Earthquake Research (hereinafter referred to as "Counterpart Agency"), under the Directorate of Planning and Construction, will coordinate with the organizations of IMM and other relevant agencies and organizations (JICA-Final Report, 2002).**

**The Study Team organized by JICA arrived in Istanbul on March 13, 2001 to conduct the Study in the following steps. The Study took approximately 19 months up to the official submission of the Final Report in December 2002 (JICA-Final Report, 2002).**

**Step 1: Existing data collection, analysis and evaluation to identify the study issue**
**Step 2: Site investigation on ground condition, population, building conditions, and others**
**Step 3: GIS database development and analysis of data**
**Step 4: Analysis of earthquake motion**
**Step 5: Estimation of seismic hazard and damage**
**Step 6: Compilation of hazard maps, seismic microzoning maps**
**Step 7: Detail examination on urban disaster prevention and mitigation plan (JICA-Final Report, 2002).**

## 4.10.3.5. Istanbul Disaster Information System (ISABIS)

**According to the sources of informations and data given above, the creation of Istanbul Disaster Information System (ISABIS) is planned. The heart of the Turkey Disaster Information System is the spatial database. The reference model of the TABIS system constitutes of two vector components (Sahin et. Al., 2002).**

**These components are named as:**

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

**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, 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, 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 (Sahin et.al., 2006).**

**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 (Sahin et.al., 2006).**

**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 (Sahin et.al., 2006).**

**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 (Sahin et.al., 2006).**

**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 (Sahin et.al., 2006).**

**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 (Sahin et.al., 2006).**

- ## The Scenario Earthquake Which Will be Used in ISABIS

**From the beginning of the study, many extensive discussions have occurred with relevant institutes/researchers in order to determine the scenario earthquakes. Based on these discussions and the recent amount of research work on the North Anatolian Fault (NAF), the scenario earthquakes were identified so that the appropriate damage estimation is taken into consideration in disaster prevention planning. The location of the NAF, in the Marmara Sea, was determined based on the most recent study result by CNRS-INSU, ITU, TÜBİTAK (JICA-Final Report, 2002).**

**Model A: This section is about 120 km long from west of 1999 Izmit earthquake fault to Silivli. This model is the most probable model of these four scenario earthquakes because the seismic activity is progressing to the west. The moment magnitude (Mw) is assumed to be 7.5 in figure 3 (JICA-Final Report, 2002).**

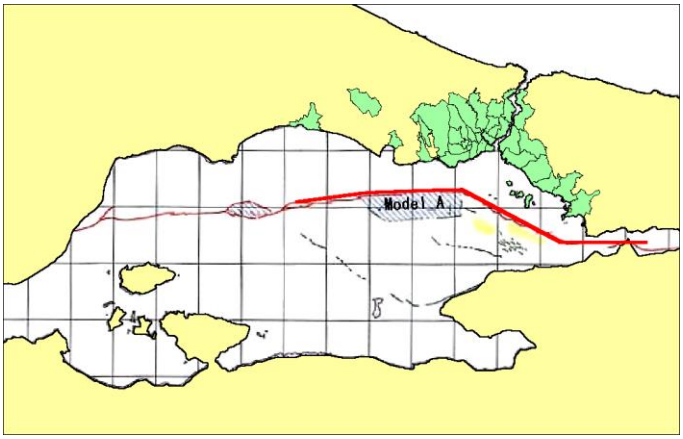


**Fig. 4.10.3.3. Model A**

**Model B: This section is about 110 km long from the eastern end of 1912 Murefte-Sarkoy earthquake fault to Bakırköy. The moment magnitude is assumed to be 7.4 in figure 4 (JICA-Final Report, 2002).**

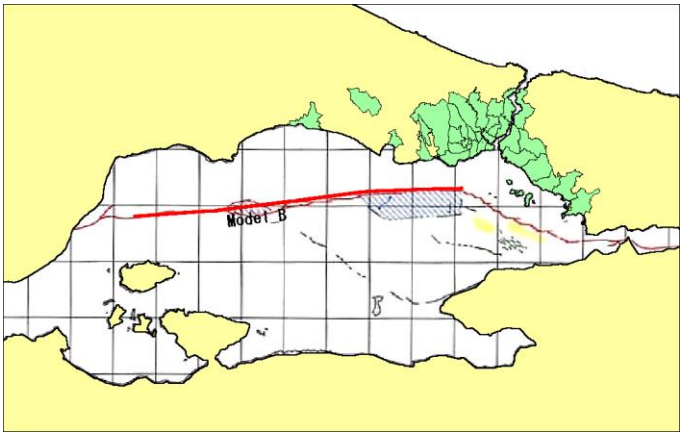


**Fig. 4.10.3.4. Model B**

**Model C: This model supposes a simultaneous break of the entire 170 km section of the NAF in the Marmara Sea. The moment magnitude is assumed to be 7.7. This is the largest magnitude that this area has ever experienced, as the maximum magnitude of historical earthquakes in the Marmara Sea area is 7.6. There is no evidence of a simultaneous break of the entire section in the past, though the eastern one-third did rupture on May 1766 and the rest on August 1766. If a rupture of the maximum length of the faults is assumed, this is the worst case within reason in figure 5 (JICA-Final Report, 2002).**

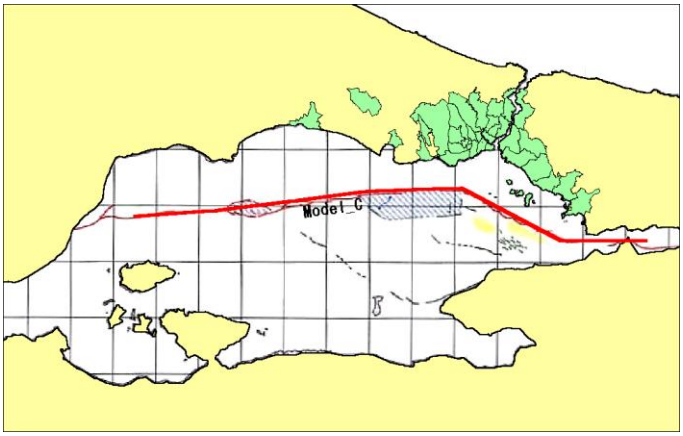


**Fig. 4.10.3.5. Model C**

**Model D: The continuous fault that was found in the north of the Marmara Sea follows the base of the northern steep slope of the Çinarcık Basin. A normal fault model was developed, which follows the northern slope of the Çinarcık Basin with reference to many recent researched works. The moment magnitude (Mw) was assumed to be 6.9 with the empirical formula for a normal fault in Fig. 4.10.3.6. (JICA-Final Report, 2002).**

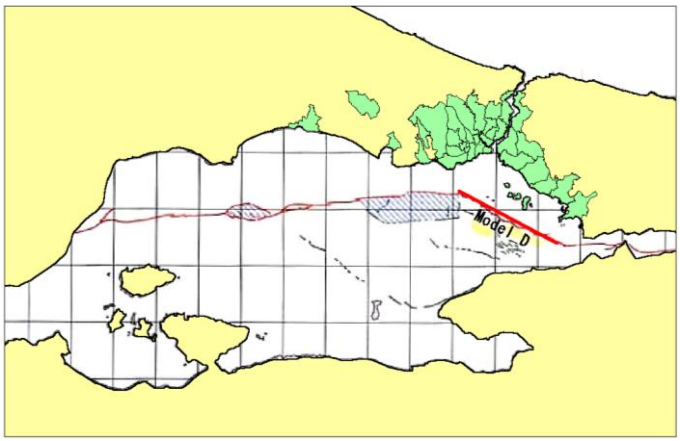


**Fig. 4.10.3.6. Model D**

## 4.10.3.6. Conclusions

**In this study, a GIS based Disaster Information System model was designed for disasters which cause risk for Istanbul. To achieve the success in the aim of this study, the system must be used and operated in coordination and cooperation with all the current institutes which have duties on disaster management and mitigation of Istanbul. The administrators and the user must cooperate each others and keep the data current on the system. The most important issue on working this kind of system is the used data. The quality of the data decides the quality of the system.**

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