EARTHQUAKE LOSS ASSESSMENT FOR THE CITY OF DINAR

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Abstract

Natural disasters are placed as an important milestone turning point in human life. In previous century, destructive natural disasters have been caused fatal results and put on agenda of the world. Therefore, rationalist solutions related to this subject have been made. It was observed that processes of disasters were similar of disasters developed in certain period and eventually they demolish all kind of values made by humans. Dinar where located in the first grade earthquake zone has witnessed devastating earthquakes which magnitudes ranged between 4 and 6.9 for the period of 1900-2009. Various earthquakes (Burdur M=6.9 in 3 September 1914; Dinar M=6.8 in 7 august 1925; Çivril M=5.7 in 19 July 1933; Burdur M=5.9 in 1971 and Dinar M=6.1 in 1995) have caused thousands of human death and pecuniary losses over 30000 near surroundings of the Dinar city. In this study establishment of necessary systems for disaster management, defined as process comprising necessary pre cautions before, at the time and after disaster. In this purpose, institutions of planning system, main sources of implementations before and after disaster will be explained. Comparison of present situation with master, local and macro plans and future-aimed local development strategy will be made.

Keywords: *GIS, Loss estimation, Emergency management*

1. Introduction

Human being, despite the present level of knowledge and technology, has no control over the formation of natural events such as earthquakes, volcanic explosions, floods, and storms, which may lead to natural disasters. Especially humankind does not have much to do in terms of preventing all these. The natural, technological, or human related events are called natural disasters which cause physical, economical and social losses for people, which make daily living and activities stop; which affect crowds; and which those crowds can't overcome by using their own sources and facilities. Generally, the disaster is not the event itself but rather it is the result of the event. Today, the developed societies which own knowledge and technology and use these meticulously for the benefit of the society don't get as much affected as they used to from natural disasters, and they get over them with a very few losses. However, in the developing societies, which could not follow the developments in technology and knowledge or could not adapt them into their daily living, the natural disasters today still cause physical and moral losses as they used to. At the present time, the only and the most effective action to be done is to make researches in order to reduce their effects on society to minimum, to develop plans and to put those plans into action [1].

Our country is in one of the most active zones on the earth, seismically [2]. Thus, earthquake emerges as the biggest disaster it faces. The earthquakes in our country lead to greater number

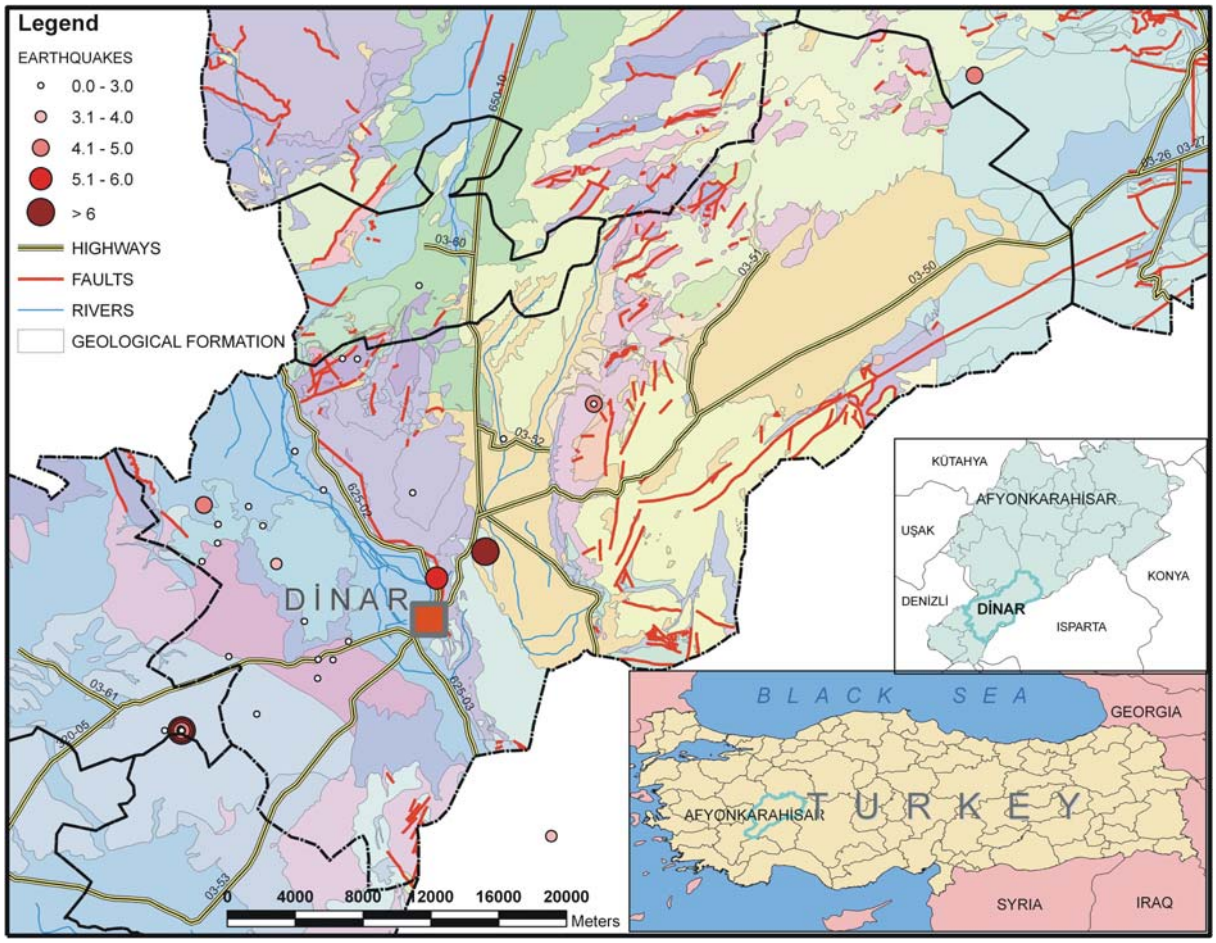
of destructions and deaths as compared to developed countries [3]. When the geographical locations of the cities in our country and urbanization ratios are taken into consideration, it is obvious that most of them are under high level of risk [2]. In this context, the city management approach which aims to improve urban quality by means of effective disaster management in order to serve the society better and to create cities resistant to disasters gains importance [4]. The duty that being ready for earthquakes puts on government officials can be regarded in two groups. First, called "disaster management", includes preparations in terms of training, equipments, and materials for various urgent aid and communication operations such as emergency rescue, treatment, sheltering, procurement of food, establishing network to record earth movements and putting out fire which have to be done at the same time during and just after the earthquake [3]. People learn what the degree of the natural disaster can be in the region they have been living, how this can influence them and the ways to get over those effects with minimum damage owing to effective disaster management. All necessary actions are possible through effective disaster management such as what has to be done during and after disaster, reducing the losses that exist to minimum and resetting social life in the shortest period possible by removing the hubbub the disaster cause, as well.

The second important mission that being ready for earthquake puts on government officials is the part that is called "risk management" which is made up of the actions that have to be performed in order to reduce losses to minimum in terms of casualties and goods during earthquakes [3]. Risk management is a process that includes phases of planning, risk reduction, and preparation. Planning is defining the earthquake problem and putting it forth. Risk reduction includes actions such as rules, prohibitions, careful planning, land usage controls, and construction audits, which reduce the possibilities that post-earthquake disasters may exist. The preparation phase is composed of all the activities that have been carried out before the earthquake, such as operational measures, early warning systems, estimates for losses, trainings, and exercises [4].

In this study, the gains that will be achieved through the application of "Risk Management" in Dinar district will be tried to be put forth against earthquakes, which are the most important of natural disasters that exist in our country.

Dinar, which stands in the first-degree earthquake zone, has faced major earthquakes throughout the ages (Figure 1). Around 25 earthquakes have occurred between years 1900-2008, instrumentally recorded and with magnitudes changing between 4.0 and 6.9. 94 people lost their lives, 250 people were wounded in the Dinar earthquake that occurred on 1 October 1995, and its degree of severity was VIII according to Mercalli scale and 6.1 according to Richter scale. 13.352 of approximately 24.000 housing were damaged in the Dinar earthquake. 4223 buildings were heavily damaged to the degree of not be living in, 2.813 buildings were damaged moderately and 6.316 buildings were lightly damaged. Economic losses that earthquake caused reached to an amount over 10 trillion in 1995 values [5].

Figure 1. Location of Dinar city



2. Risk management and study area

Risk has to be found with an integrated approach to reduce urban risk and minimize damage [2]. Risk, in the context of earthquake management, can be defined as losses that may occur as the result of a hazard. Population in urban areas, buildings, public services, systems and socio-economic effects constitute “Elements under Risk”. Risk Management is defined as a systematic process made up of risk definition, risk analysis, and determination of the amount of risk. Earthquake risk is defined as the estimation of the probability of the emergence of earthquake in a particular region rather than another or in a particular period in a certain region [6]. Risk-oriented disaster management approach has made risk estimation and probability of damage as the most sensitive elements of disaster management [7]. The earthquake risk estimations until today have been made up of those stages of seismic hazard calculation and determination of the buildings which can be severely damaged. However, the results that will come into being when earthquake risk comes true don’t only consist of demolition of buildings. Integrated risk models have been used widely in order to determine urban risk, which considers all the elements that constitute the city such as urban communities, urban economics, and infrastructure, cultural and historical works [2].

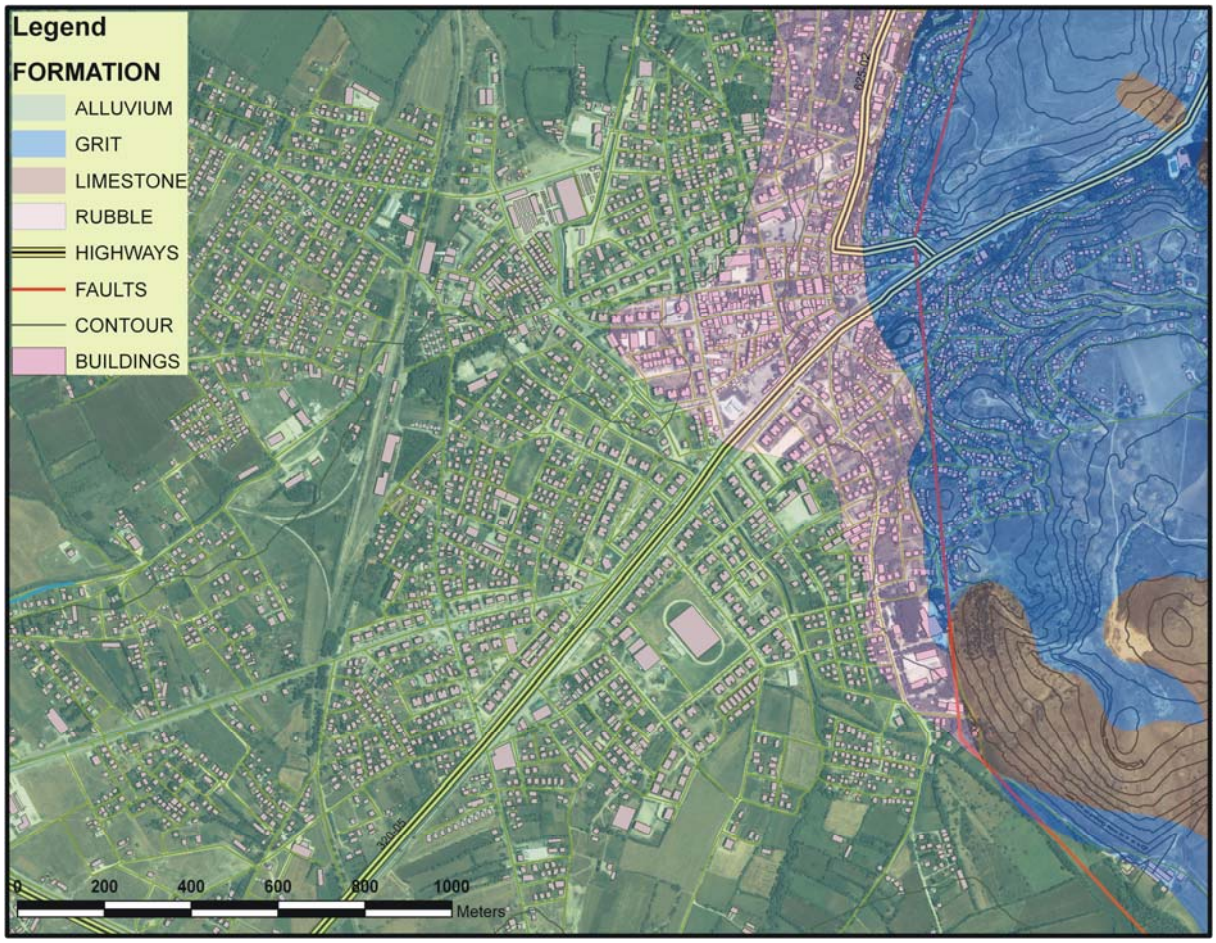
In this study, the factors that affect earthquake risk for Dinar district were examined under four headings as earthquake hazard, land-building usage, demographic structure and economic structure. Earthquake hazard, primarily the magnitude of the earthquake, has been evaluated as the spreading speeds of the seismic waves at different grounds. In addition, the soil liquefaction that earthquake triggered was examined in the context of earthquake hazard. Land structure and usage of buildings are represented by different textures (density of buildings, styles of structures, height of buildings, construction year, and damage state) of usage. By making use of the data that will be derived from the census based on the address system as demographic components, beside the total population under earthquake hazard, the information about the population who have no possibility of self-rescue and who require help from second persons will be used, as well. Economic structure component is one of the most effected components from the earthquake but whose effects are seen in the long run. During an earthquake, although direct physical losses that occur such as damages in buildings and casualties are intended to be determined in the first stage, economic contraction and limitation data that will show themselves in the long run will be used in the following stages [8].

A major disaster that will occur can mostly be a very big problem that has to be handled on a national scale rather than by local municipalities. It is required to bring a systems approach and an interdisciplinary viewpoint to the problem to minimize the losses in terms of emergency disaster management [9]. In parallel with developments in use of computers, geographic information systems (GIS) have found wide application areas and play a key role in solutions of problems that require spatial data analysis. GIS, by associating data obtained from various sectors with spatial data, enable knowledge to be visualized and by providing the necessary information at decision, support stages help administrators and decision makers. In addition, GIS, to reduce the disaster losses, provides effective solutions in the pre, during and after disaster phases in disaster management so far mentioned.

The study, which is planned to be carried out by using GIS, has been planned in three different scales. Macro scale includes all Dinar border, medium scale maps are studies at the neighborhood level, and micro scale studies are only on the parcel basis (Figure 2) [4].

In the context of earthquake hazard which constitutes the first step, definition of geological and seismic structure of residential areas of Dinar district with the geotechnical parameters of ground properties and a seismic micro zoning by using Geographical Information Systems and preparation of land security evaluation maps are planned. After this step, within the scope of the study, by digitalizing the municipal records held for each building including the exploration of land when necessary, the structural features such as style of structure, height of the buildings, year of construction, state of damage for every building will be identified and every building will be classified according to security level, respectively.

Figure 2. City center of Dinar city and geotechnical properties of city center



The system will take its place in risk management as a function that will lead decision makers for accurately results with its superposition, analysis, and synthesis features when the data are completely entered into the system. System, by linking the maps with information about core attributes, documents, and visual elements will establish spatial relationships so that queries can be made. Also, with the completion of the system, decision makers will be helped by establishing different scenarios for various disaster situations. Critical points and hazardous areas can be queried among interactive systems and data exchange can be maintained. The system can easily meet the spatial analyses that include many layers found within four main components.

In the next stage, the buildings, which do not have adequate security at the current situation, have to get strengthened with a certain rank of priority. In this project, the possibility of damage of the buildings will be determined, by taking into account the properties of each building that have been loginned into the system and strategic planning and strengthening implementation work will begin.

As a result of the study, urban use of land and depending on that, urban damageability effect of components related to population distribution will emerge. Also, what will be the studies regarding population distribution, equipment and function all around the city related to risk reduction will be determined.

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