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M.Sc. Thesis in Civil Engineering

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HASAN KALYONCU UNIVERSITY

GRADUATE SCHOOL OF

NATURAL AND APPLIED SCIENCES

INVESTIGATION OF FEASIBILITY FOR GAZIANTEP EARTHQUAKE MASTER PLAN

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Investigation of feasibility for Gaziantep earthquake master plan

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Hasan Kalyoncu University

Supervisor

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By

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GRADUATE SCHOOL OF NATURAL & APPLIED SCIENCES INSTITUTE
M.Sc. ACCEPTANCE AND APPROVAL FORM

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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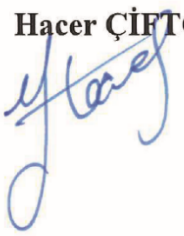

ABSTRACT

INVESTIGATION OF FEASIBILITY FOR GAZIANTEP EARTHQUAKE MASTER PLAN

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Disasters are natural and man-made events that cause physical, environmental, psychological and economic losses. It is very important to have effective disaster management in order not to stop human life after disaster or to return to normal life quickly. Although it is impossible to prevent disasters, it is possible to minimize the negative effects with precautions. High-level societies have achieved to reduce risks to manageable levels. When disasters in Turkey examined, it is seen that earthquake is the most common disaster that causes loss of life and property. When analyzed in terms of seismicity, Gaziantep is located in a place needs to take precautions against possible earthquake risks due to its proximity to active fault systems that can produce large earthquakes. It should be ensured that being feasible of earthquake master plan that will prepared by using effective project management methods. Within the scope of this thesis, current earthquake master plans in Turkey had been examined and especially their feasibility were investigated. In parallel with this, steps of applicable earthquake master plan for Gaziantep were determined. The master plan to be prepared should be kept up-to-date and used as a guide for any kind of zoning, infrastructure, transportation and energy planning for Gaziantep. It should not be forgotten that the most important stakeholder of the earthquake master plan is the society. The end point of the study is that to create a sustainable society with high level awareness and resistant to disasters.

Keywords: Disaster, Earthquake Master Plan, Project Management, Sustainable City

ÖZET

GAZIANTEP DEPREM MASTER PLANININ UYGULANABİLİRLİĞİNİN ARAŞTIRILMASI

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Afet doğal ya da insan kökenli, fiziksel, ekonomik ve sosyal kayıplara neden olan olayların tamamıdır. Afet sonrası insan yaşamının durmaması ya da normal yaşama hızlı dönülmesi için etkin bir afet yönetimine sahip olunması çok önemlidir. Afetleri önlemek imkânsız olsa da olumsuz etkilerini önceden alınan tedbirlerle en az indirmek mümkündür. Gelişmişlik düzeyi yüksek toplumlar riskleri yönetilebilir seviyeye indirmeyi başarabilmiş toplumlardır. Türkiye'de afetler incelendiği zaman, depremin en çok can ve mal kaybına sebep olan afet olduğu görülmüştür. Depremsellik açısından incelendiğinde, Gaziantep büyük deprem üretebilecek aktif fay sistemlerine yakınlığından ötürü olası deprem risklerine karşı önlem alması gereken bir konumdadır. Etkin proje yönetimi metotları kullanılarak hazırlanacak deprem master planının uygulanabilir olması sağlanmalıdır. Bu tez kapsamında Türkiye'deki mevcut deprem master planları incelenmiş olup, özellikle uygulanabilirlikleri araştırılmıştır. Buna paralel olarak, Gaziantep için uygulanabilir deprem master planı adımları belirlenmiştir. Hazırlanacak master planının güncelliğinin sağlanması ve Gaziantep için yapılacak her türlü imar, alt yapı, ulaşım, enerji gibi planlamalarda kılavuz olarak kullanılması gerekmektedir. Deprem master planının en önemli paydaşının toplum olduğu gerçeği unutulmamalıdır. Çalışmanın sonucunda ulaşılmak istenen hedef ise afetlere dirençli ve farkındalığı yüksek, sürdürülebilir bir toplum oluşturmaktır.

Anahtar Kelimeler: Afet, Deprem Master Planı, Proje Yönetimi, Sürdürülebilir Şehir

To my Mother…

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LIST OF ABBREVIATIONS

AADYM : Disaster and Emergency Management Centers

AFAD : Disaster and Emergency Management Administration

AKOM : Disaster Coordination System

AKUT : Search and Rescue Association

AYKOME : Infrastructure Coordination Center

CPT : Cone Penetration Test

DASK : Natural Disasters Insurances Authority

DSI : State Hydraulic Works

EMP : Earthquake Master Plan

EPC : Emergency Preparedness Canada

FEMA : Federal Emergency Management Administration

GASKI : Gaziantep Water and Sewerage Administration

GAZDAS : Gaziantep Natural Gas Distrubuting I.C.

GIS : Geographic Information System

ICORP : International Scientific Committee on Risk Preparedness

IDNDR : Decade of International Natural Disaster Reduction

IMO : Civil Engineering Chamber

ISDEBIS : Istanbul Earthquake Information System

JICA : Japan International Cooperation Agency

NGO : Non-Governmental Organization

NLA : National Land Agency

PSHA : Probabilistic Seismic Hazard Analysis

PTSD : Post Traumatic Stress Disorder

RADIUS : Risk Assessment Tools for Diagnostic of Urban Areas Againts Seismic Disasters

SAHKUT : Sahinbey Rescue Team

SPT : Standard Penetration Static

TEDAS : Turkish Electricity Distrubution Corparation

TOKI : Housing Development Administration of Turkey

TUJJB : Turkey National Geodesy and Geophysics Association

TURKSTAT :Turkish Statistical Institute

UMKE : Naional Medical Rescue Team

CHAPTER 1

INTRODUCTION

1.1 General

Disasters are natural and man-made events that cause physical, environmental, psychological and economic losses and affect societies by stopping the flow of normal life. The role of being a conscious society in the fight against disasters is very important. Earthquake is the most common disaster that causes loss of life and property.

Gaziantep is a rapidly developing city that carries the traces of history to the present day with its cultural heritage which has a serious contribution to the national economy. Gaziantep is in the risky region when the new earthquake regulations are taken into consideration. The presence of faults located near the city and the continuity of ground motions increases the probability of these faults creating earthquakes. The earthquake master plans are the studies of all the scenarios that will come out of before, during and after the earthquake and put forward precautions that are intrinsic to cities. The most important criteria of earthquake master plan is that to being applicable and up-to-date. The earthquake master plan is not only an engineering study but also the most important guide of the city where every individual in the society is seen as a stakeholder.

Sensitivity and awareness are the most important consciousness to hand down to the next generations. In recent years important steps have been taken in disaster awareness and resistance in Gaziantep. Today, disaster awareness can only be achieved through suitable disaster management. Considering the problems caused by the disaster, crisis management seems to be more active in Turkey. It is necessary to pass on crisis management to risk management and planning the city in this parallel. In this sense, the most important legacy to be handed down to the next generations on sustainability is to determine what needs to be done with the road map in line with the dynamics of

the city, to make the job descriptions of the stakeholders and to bring the applicable disaster risk and management to Gaziantep.

1.2 Objectives of Study

The purpose of this study is that to increase resistance of one of the fast growing cities of Turkey where is Gaziantep against disaster due to the fact that sustainability becomes more crucial day by day, also, to ensure the implementation of the Earthquake Master Plan (EMP), which is one of the most important steps to create a highly aware society.

CHAPTER 2

LITERATURE REVIEW

2.1 Causes and Effects of Earthquake

Disasters are defined as natural, technological or human events that cause physical, economic and environmental losses and affect communities by stopping normal life (Ergünay, 2002). This definition is schematized in Figure 2.1.

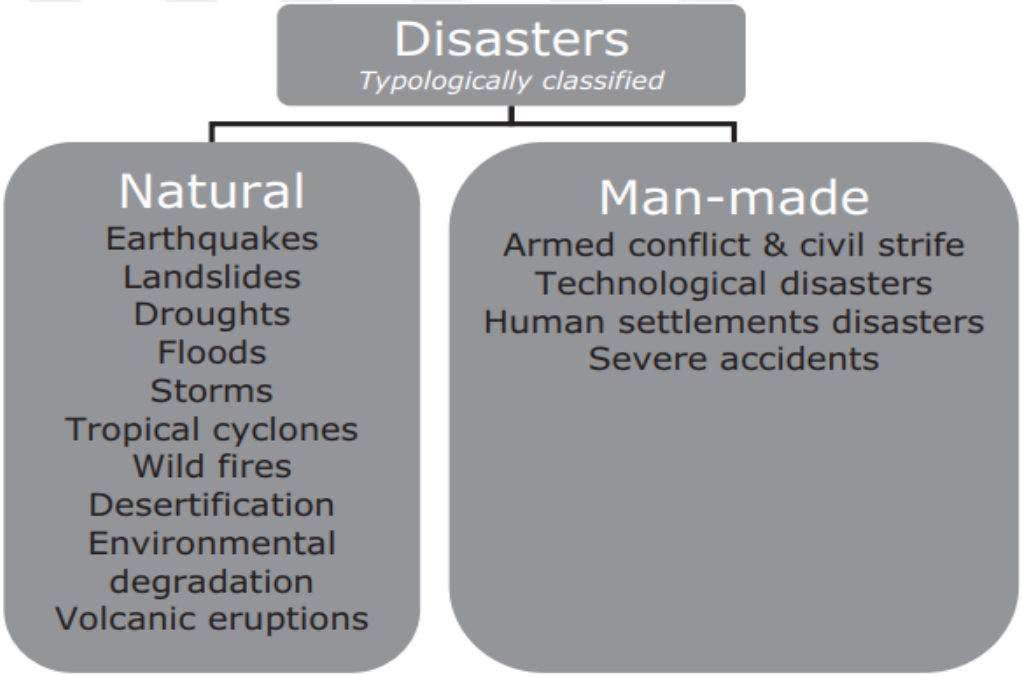

Figure 2.1: Schematic description of disasters (Abulnour, 2014)

Earthquake is one of the natural disasters that is resulted in the maximum loss of life and property in the world. Although the causes of the earthquakes are natural, they may occur depending on the human source factors such as the size of the damages they cause, the correct choice of the settlement, the durability of the buildings, the density of the population, the early warning system, depending on the effectiveness of the emergency aid and rescue work.

Natural disasters in Turkey between 2010 and 2017 has been shown in Figure 2.2 with colorful dots. According to the figure, purple dots symbolize tornadoes, white dots for avalanches, red dots for landslips, blue dots for floods and yellow dots for earthquakes.

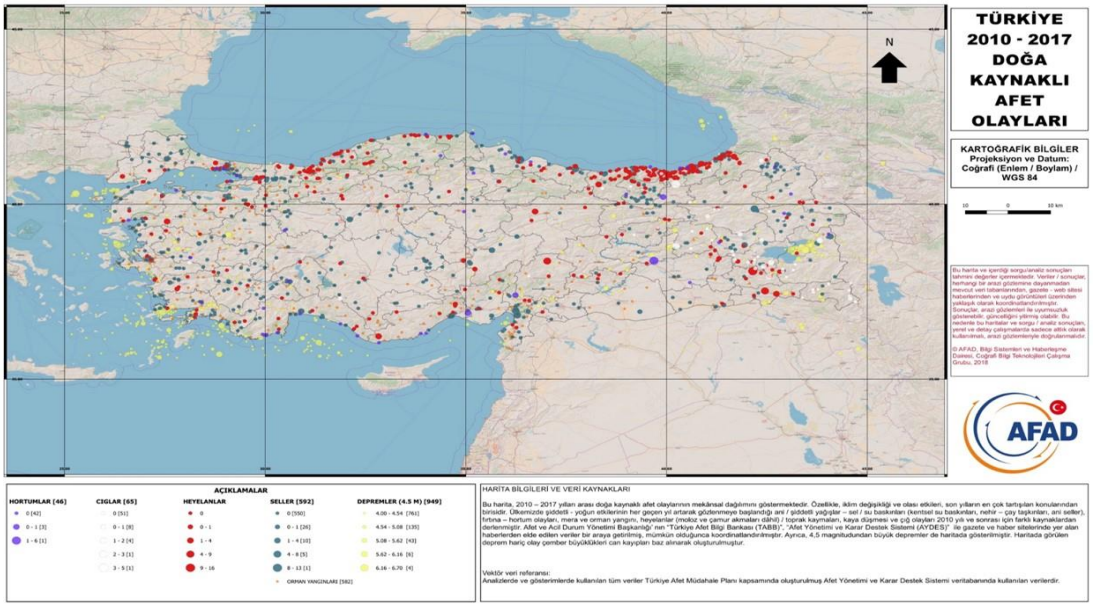

Figure 2.2: Natural disasters in Turkey between 2010 and 2017 (AFAD, 2018)

As it can be seen, earthquakes are extremely high. Not only earthquake but also lack of administrative, legal and technical conditions and lack of awareness increase these disasters. In Figure 2.3, it has shown that detrimental earthquakes that occurred in Turkey. Orange dots symbolize the earthquakes with great magnitudes (M≥6).

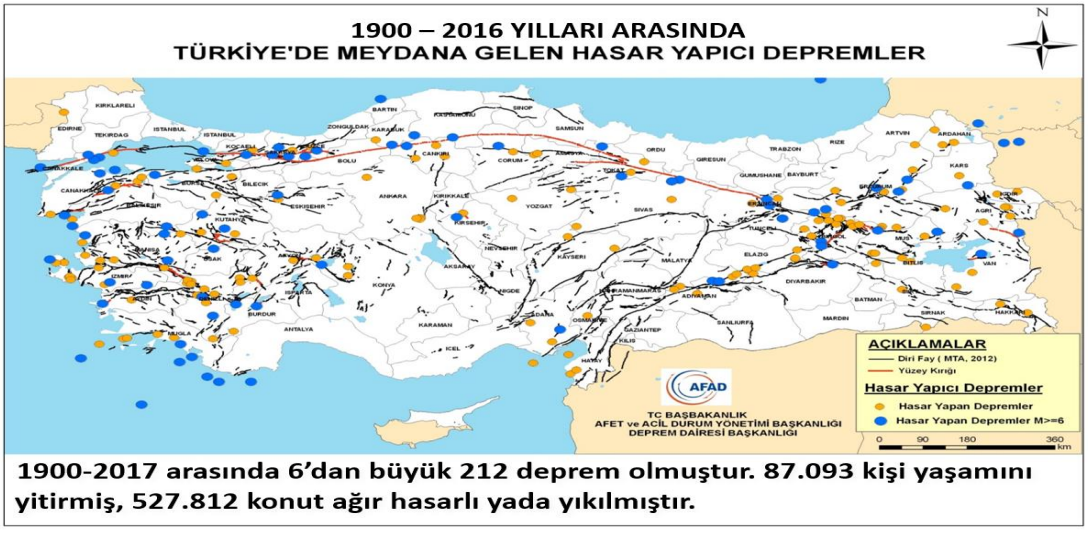

Figure 2.3: Detrimental earthquakes in Turkey between 1900 and 2016 (AFAD, 2018)

Gaziantep has a risky position in terms of earthquake zone that is 3rd grade in city center and 1st grade in Islahiye and Nurdagi. It means that earthquake has a great importance for Gaziantep. Figure 2.4 shows the Turkey's earthquake hazard map, and Figure 2.5 shows this seismicity with magnitudes.

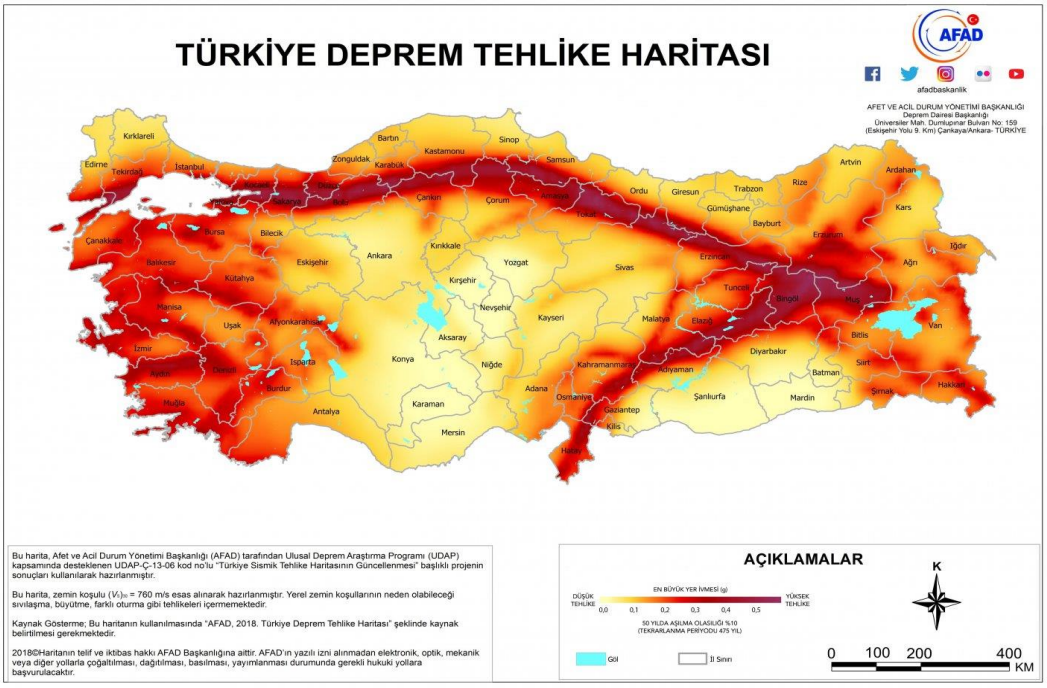

Figure 2.4: Turkey's earthquake hazard map (AFAD, 2019)

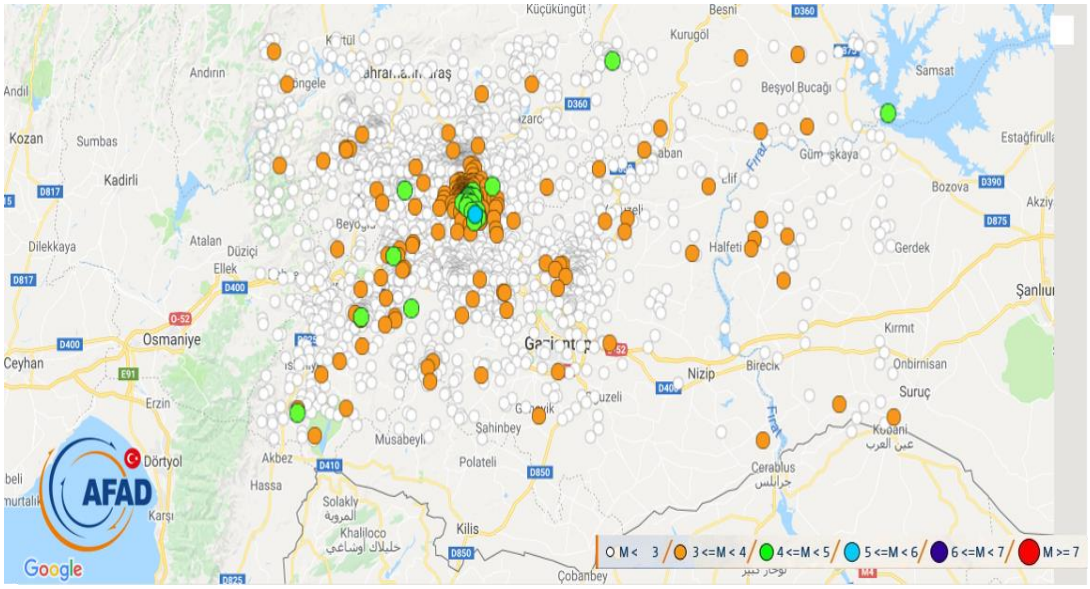

Figure 2.5: Seismicity of Gaziantep city with magnitudes (AFAD, 2018)

Besides the physical damages and loss of lives caused by earthquake, psychological losses of disaster victims are substantial. In a study conducted with the participation of earthquake victims in Naples, it has been found that the levels of psychological distress experienced by the victims tend to high even many years, 7 years in the current study, after the event (Bland et al., 1996). Earthquakes affect children and adolescents significantly. Rates of PTSD (Post-Traumatic Stress Disorder), depression and earthquake-related fears are found to be elevated in children and adolescent who experienced an earthquake. Feelings of loss of control and fear induced by the unpredictable and uncontrollable nature of the earthquakes are observed in this age group (Salcıoğlu and Başoğlu, 2008). Briefly, if disaster plans do not consider the psychological effects of trauma created by the event, the psychological consequences will significantly overwhelm the resources available and can exhaust the rescue workers as well as the victims.

Considering all these reasons which are physical, environmental and psychological, it is inevitable to prepare an Earthquake Master Plan (EMP) in order to minimize the damages caused by earthquake and to be prepared for it.

Earthquake management plan is advantageous in different aspects. It helps in reducing earthquake risks by making people and infrastructure less vulnerable to earthquake occurrence (Kearney, 2006). The masterplan make people cope with earthquake and also it helps in minimizing the loss of life and properties as a result of earthquake. The economic loss as a result of earthquake disaster would also be reduced by having an earthquake management masterplan. The masterplan is the basis through which earthquake management strategies are formulated (Galetzka et al., 2015). A proper study of the action plan, earthquake avoidance plan and based on workshop studies and focus group, national and local earthquake risk reduction strategies are easier to develop.

Structurally, the masterplan helps during enactment of construction standards and building codes. It helps in town planning and in identifying structures that require retrofitting and also in giving lifeline structures (Balamir, 2004). The masterplan can also help in advice on the removal of unsafe buildings and guiding people on their preparedness for disastrous earthquake occurrence. It can as well serve as a means of educating people and training them on how to keep safety in the event that an

earthquake occurs (Hosseini & Hosseini, 2008). More importantly, it serves as a general guide on the trend of earthquake, indicating the intensity, magnitude and prediction on the frequency of earthquake occurrence.

2.2 Disaster Management

The EMP is based on the concept of *Disaster Management*. In a virtue of systematic and continuously renewed disaster management system, a society which becomes organized quickly can be formed. Thus, chaos during the earthquake would be reduced. The stages of disaster management actions have been illustrated in Figure 2.6.

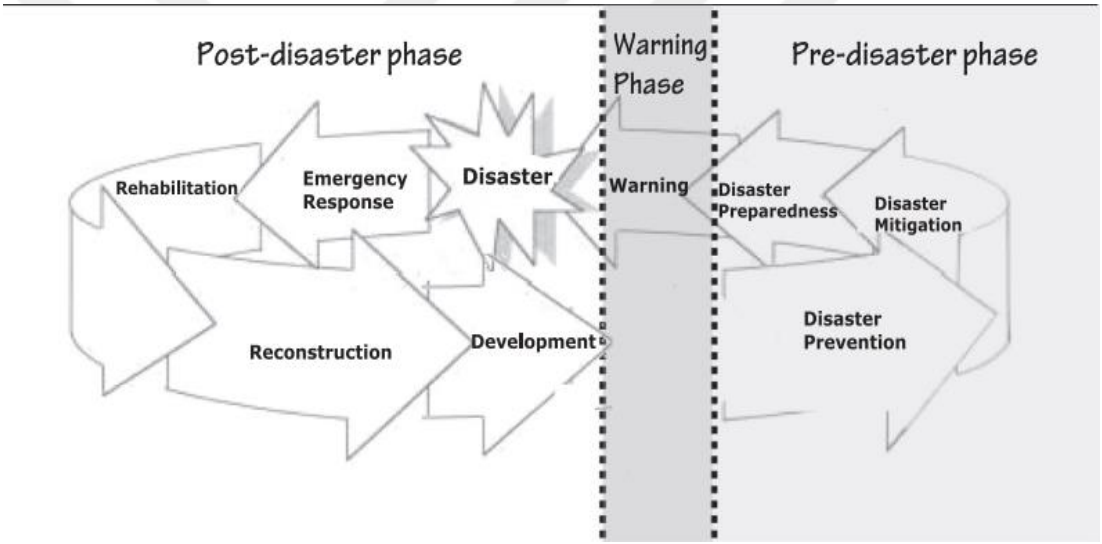

Figure 2.6: The phases of disaster management (Abulnour, 2014)

According to the diagram, pre-disaster phase is divided into 3 subgroups which are disaster prevention, disaster mitigation and disaster preparedness. Disaster prevention aims to prevent the disaster from occurring and includes precautions. The target of disaster mitigation is that to minimize damages like resistance of buildings against earthquake. Disaster preparedness addresses the limit effects of hazards by structuring response. In warning phase, disaster management officials must warn the public about risk when a disaster event is predicted and must be ready for it. On the other hand, post-disaster phase is divided into 4 subgroups as emergency response, rehabilitation, reconstruction and development. Emergency response includes basic activities such as search and rescue, first aid, medical assistance etc. After a disaster has occurred and

emergency response activities has done, rehabilitation step begins. At this point, it is aimed to help people for returning their normal lives. For example, temporary houses are given until the damaged buildings repaired. As it is seen, rehabilitation step brings with it reconstruction. Reconstruction step is related with the activities such as reordering the environment, reconstructing housing etc. Lastly, the development step includes planning for prevention of future disasters (Abulnour, 2014).

In literature, there are lots of studies on disaster management of various cities. For instance, in a study in Sri Lanka, researchers investigated the efficiency of Sri Lanka disaster management frameworks. Comprehensive disaster management program was prepared in 2014. According to them, Sendai Framework should be integrated into Sri Lanka National Disaster Management Framework. In addition, Sri Lanka National Disaster Management Policy can be developed by three technical actions which are upgrading national hazard profile, developing vulnerability profile and developing guidelines for the design and construction of infrastructure (Siriwardana et al., 2018).

In another study on disaster management, it was discussed whether the Nordic states which are known as the countries with high level of welfare have a Nordic model in disaster management (Rapeli et al., 2018). Accordingly, 5 Northern countries (Denmark, Finland, Iceland, Norway and Sweden) were examined to compare the roles of local social services related to disasters. However, they concluded that social services' role in disaster management differs from country to country. Yet, they stated that local social services play an important role in disaster management and might be improved disaster resilience in Scandinavian countries as a whole.

In the United States and Japan, which are at high risk of earthquake, the determination of causes of earthquake and the predetermination of the earthquake are carried out in a multidisciplinary and intensive manner. In this sense, Federal Emergency Management Administration (FEMA) was established in US in 1979 (Yavaş, 2005). The main target of FEMA is that to reduce damages, minimize the loss of life and property and protect the country from any disaster through a comprehensive emergency management program.

The disaster management of Japan is carried out by the 'Disaster Prevention Bureau' under the National Land Agency (NLA) title (Akdağ, 2002). This office is responsible

for the implementation of the ‘Basic Law of Measures against Disasters’ which includes disaster management responsibilities, disaster preparedness, emergency response and rehabilitation.

On the other hand, an institution that is called ‘Emergency Preparedness Canada (EPC) was established in order to prepare the public for disasters that may occur in Canada (Uzunçıbuk, 2005). Besides, “*Stratification Model*” is applied to protect public from emergency situations in Canada. According to this model, first layer is the layer where disaster-victims helped each other. The second layer which is also called ‘state level’ that intervenes at the local level. The state level supports the local community if the people cannot afford to take precaution on their own (Yavaş, 2005).

While "National Civil Protection Service" conducted by mayor protects the public and country against natural and technological disaster in Italy, disaster recovery in France is carried out by "The Ministry of Interior" (Akdağ, 2002; Yavaş, 2005).

In Turkey, it has been done two Earthquake Master Plans. First one is the Izmir Earthquake Master Plan which was done in 1999, the other one is the Istanbul Earthquake Master Plan that was completed in 2003. However, experts and the authorities are in agreement about updating the Izmir EMP. Another important project which is for determination of potential earthquake damages in Erzincan (TUJJB, 2015).

The Istanbul Earthquake Master Plan has been prepared as a road map for all operations to be carried out before and after the earthquake, including preparations for the earthquake in Istanbul. Studies of Istanbul EMP were prepared based on ‘Earthquake Scenario-A’ in JICA report (JICA, 2002).

The aims and objectives of Istanbul EMP can be listed as;

- Evaluation of existing building stock situation as well as all urban and public spaces,
- Determining all precautions, decisions and practices in short and long term related with Istanbul,
- Determining the strategies for the restructuring of Istanbul,

- Preparation of an Earthquake Master Plan which includes the development of legal, technical, financial, social and administrative tasks and enforcement programs of all parties is aimed.

The main headings of Istanbul EMP presented to the public opinion in August 2003;

- Current situation of Istanbul
- Investigating and strengthening the resistance of constructions against earthquake
- Settlements, law, administrative structure and resources
- Earthquake Information Infrastructure
- Education and social studies
- Risk and disaster management
- Results and recommendations (IBB, 2010).

2.3 Project Management

Project management is defined as the process of planning, organizing, leading and controlling (Buehring, 2018). It dominates purpose and direction to the project, thus helping focus on the strategic goals of project (Gido et al., 2014). It is critical for quality and assurance. Furthermore, proper project management makes concepts such as risk identification, management and mitigation easier. It also streamlines the project during the life of project.

2.3.1 Project Management Steps

1. Project initiation (the value and feasibility of the project) (Bisk, 2018).

2. Project planning (giving direction on procuring required materials, managing supplies, etc.).

3. Project execution (resources to satisfy the clients).

4. Project monitoring and control (Stark, 2015).

5. Project closure (delivering of project and assessment).

2.3.2 Advantages of Project Management

1. Reduction of risks in project.

2. Enhancing chances of achieving the desired results.

3. Helps to use project resources, appropriately.

4. Ensures that the needs of all project shareholders are supplied.

5. Maximum usage of resources and higher productivity (Aston, 2017).

2.3.3 Cases That Makes Project Management Succeed

First of all, correct definition of objectives is the main step for successful project management. Secondly, a proper planning must be done for selection of budget and resources. The third step is to communicate with project team, effectively. By this means, every team member knows their responsibilities and timeline (Larson et al., 2014). The forth step is tracking and reporting main project progress and comparing it with planned one (Buehring, 2018). The fifth step is changing management which is important because run of plan may not occur. And the last one is the risk management which can be helpful to make project successful.

An earthquake master plan aims at securing the lives and properties against a devastating earthquake. The master plan includes rehabilitation and reconstruction of damages caused by earthquakes. According to Maricle (2011), an EMP needs strategies. Important strategies include provision of earthquake information and education to the focus group, provision of disaster mitigation policy, identification of safe evacuation spaces, lifeline and infrastructure, emergency response and reconstruction, action plan and avoidance plan among other important strategies (Lu et al., 2008).

2.3.4 Earthquake Action Plan

Earthquake management requires planning which according to Jahangiri et al. (2010) comes in four different stages; *planning for emergency preparedness, planning for post-disaster reconstruction, mitigation planning and resilience planning.* Disaster preparedness plan for example has important elements that include; hazard identification, risk reduction and loss estimation, optimal mitigation strategy,

communication, training and education (Jang et al., 2016). By having an action plan like the one created for an earthquake prone Kathmandu Valley, the risk of an earthquake would be reduced over time. An action plan is also important because it improves an earthquake emergency response planning, awareness, improving seismic performance of buildings and utilities, long-term recovery following disastrous earthquake and estimation of the vulnerability consequences and mitigation techniques (Dixit et al., 2013).

An action plan should also cater for people with disability. There should be written or visual checklist with easy steps for people with cognitive disabilities. There should be more than one methods of receiving evacuation information and warnings so that the deaf and those with hearing problems are able to get the notifications (De Hoop & Ruben, 2010). Blind and visually impaired people should be provided with ways of hibernating during an earthquake; especially by practicing drop, cover and hold on techniques (Greer, 2012).

Earthquake occurrence is estimated and cannot be precisely predicted, therefore, an action plan is critical in outlining appropriate actions that workers and other building users take *before, during and after an earthquake*.

The action plan before an earthquake are the earthquake preparedness means and strategies. Firstly, it is important to consider supplying emergency kits alongside participating in earthquake drill to learn how to drop, cover and hold on, and how to use the emergency kits and exits appropriately (Margolin et al., 2010). Again it is important to identify hazards and secure movable items for instance storing heavy and breakable objects as low as possible and if possible in closed cabinets or wall studs to prevent them from falling in case of an earthquake (Tie-min, 2010). It is advisable to plan safety and create a disaster plan that include how to communicate during emergency besides having an evacuation plan. Important supplies should also be availed in convenient locations and the supplies include food, water, medication, communication supplies, emergency contact information, face mask, first aid kit, heavy gloves etc. (Ainuddin & Routray, 2012).

The action plan during an earthquake, the main thing needs to do is that to protect the head, curl up and hold on, if earthquake starts while inside. It must be kept away

from windows and stayed indoor until it is safe to exit (Paton et al., 2010). Stairs must be used to exit the structure. If shaking starts while outside, it must be found a safe place away from power lines, buildings, streetlights and trees; if in a vehicle, must be moved and stopped at a clear location away from bridges, power lines, overpasses and ramps (Neupane, 2015).

The action plan after an earthquake, it must be left the building by using stairs and moved to a designated emergency assembly point. If it becomes difficult to navigate through the exits, emergency number for assistance needs to be called (Ainuddin et al., 2014). It is advisable not to re-enter the building until it is declared safe with no structural damages and entry allowed.

2.3.5 Earthquake Avoidance Plan

It is important to have a disaster cycle for being prepared. A typical disaster cycle has been shown in Figure 2.7;

Figure 2.7: A typical disaster cycle

Appropriate earthquake avoidance plan should have mitigation and preparedness actions. The planning according to Saunders & Becker (2015) should include availing emergency response activities, recommendation of policy matters that relate to disaster management, training professional engineers, designers, scientists and planners to

consider earthquake occurrence in their designs and construction by providing damping mechanisms that dissipates the earthquake energy and reduces its magnitude (Walters et al., 2015). It is also important to raise awareness and provide education about earthquake avoidance. Consistent and periodic assessment of vulnerable residents and government buildings should be done and retrofitting the most vulnerable buildings is appropriate (Alexander, 2014). Moreover, research should be done on earthquake phenomenon, earthquake prediction based occurrence, intensity and magnitude. The avoidance plan should also include a team that test the buildings that are safe to occupy and the unsafe ones that needs demolition. A plan to build in a seismically safe way should also be initiated. An earthquake epicenter or an area prone to earthquake of high intensity should have no residential buildings and families residing in such areas should be evacuated to a safer place (Oliveira et al., 2014). Urban planning should also be done in a way that earth prone areas are avoided.

2.3.6 Focus Group Action

Focus group helps to capture understanding of hazards and preparedness in case of earthquake occurrence. According to Dixit et al. (2013), focus group usually gives an open discussion through interview by asking specific questions in line with the required research questions. For an earthquake study, it is important to have the focus group come around and within the local residents (Hu et al., 2014). The reports that the focus group gives is important in improving future research in earthquake management. In identifying the correct focus group for interview and analysis, it is important to follow certain steps; first is to select two regions associated with earthquake occurrence (Bommer et al., 2015). Then, from the two regions, identify interested study participants by use of screening questionnaire and select the eligible ones. Avail the focus group date to the participants and make them sign-up for the dates. Provide participants with consent forms and allow them to sign, exclude those who fail to sign the consent form (Kenney & Phibbs, 2015). This is then followed by conducting the research briefing and afterwards conducting the main research on earthquake preparedness and management plan.

An interview conducted on the focus group is a critical one and gives the primary information about the level of earthquake preparedness in a community. According to Bhakta (2014), it also serves as an important aspect through which more training and

education on earthquake preparedness is provided. The focus group would also give different situations and factors that affect the level of preparedness (Tucker et al., 2013). Focus group therefore serves a critical role in earthquake management masterplan especially in building knowledge about preparedness and implementing preparedness measures.

2.3.7 Sustainability

In a study by Ahvenniemi et al. (2017), it was investigated that the differences between the terms of sustainable and smart cities. In this study, they analyzed 8 smart and 8 sustainability frameworks. These frameworks include 958 indicators by dividing 3 subcategories. According to results, there is a bigger focus on modern technologies, social and economic aspects in smart city framework when compared with sustainability framework. However it was observed that sustainability frameworks have more indicators measuring environmental sustainability. For this reason, they offered a term which includes all indicators, smart sustainable cities.

"Egan Wheel" (Figure 2.8) was proposed by Sir John Egan to describe sustainable communities (ASC, 2006). This circle, which is a sustainable community at its center, has been the basis for sustainable urban planning and urban transformation projects (Arayıcı and Çiftçi,2018). In addition, referring to Egan wheel, it can be established whether a city or street is an example of a sustainable society and a comprehensive assessment can be made accordingly. Egan circle aims to create a society with a high life quality in 8 main steps from the managerial perspective that it provides for sustainable communities.

The target of the sustainable cities is to ensure the durability and continuity of cities. ‘Being sustainable’ means that every citizen has a life quality, utilizing productive dynamics of the city, producing common prosperity and ensuring social stability without harming the environment (Arayıcı and Çiftçi, 2018).

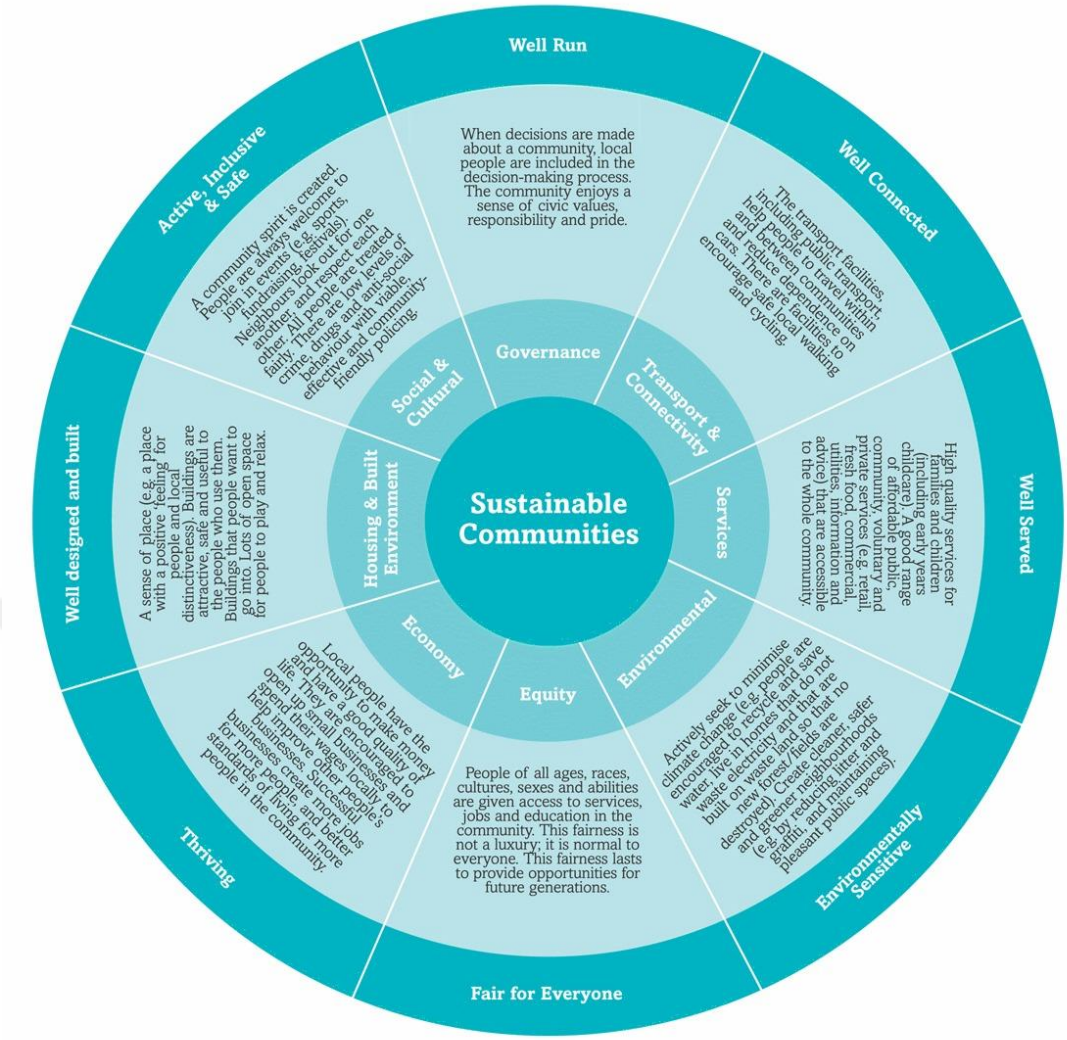

Figure 2.8: Egan Wheel (ASC, 2006)

CHAPTER 3

METHODOLOGY

Reducing damages and losses caused by earthquakes can only be achieved by applying the correct engineering calculations. Earthquake Master Plan (EMP) is the most important guide to be gained to a city to minimize the negative effects of earthquake. The ability to mitigate the negative effects of this guide will be ensured by its feasibility. Many studies have been conducted in Turkey under the name of the earthquake master plan or as a basis for the earthquake master plan by this time. These are Izmir Earthquake Master Plan, Istanbul Disaster Prevention/Mitigation Basic Plan Including Seismic Micro-Zonation Study: JICA Report, Istanbul Earthquake Master Plan, and Determination of Potential Earthquake Damages in Erzincan: TUJJB Project. An EMP for Gaziantep has not been prepared, yet. Current studies should be examined to present a feasible earthquake master plan. Preparing a specific plan for Gaziantep will be ensured by the active role of stakeholders in working.

3.1 Izmir Earthquake Scenario and Earthquake Master Plan, 1999

Detailed studies on earthquake within the scope of Izmir Metropolitan Municipality started with the application of the United Nations RADIUS Project (Risk Assesment Tools for Diagnosis of Urban Areas against Seismic Disasters) and the designation of Izmir as one of the 9 cities in the world to be implemented by the United Nations IDNDR (Decade of International Natural Disaster Reduction) Secretariat (IESEMP, 1999).

As a result of the cooperation between İzmir Metropolitan Municipality and Boğaziçi University, İzmir Earthquake Scenario and Earthquake Master Plan was prepared (July, 1999). The main purpose of the plan was to generate scientific data for the Radius project. The report, which is the result of this cooperation, contains researches, compilations and evaluations related to the preparation of an Earthquake Scenario and

Master Plan which includes determination of the damages of earthquakes that may occur in İzmir and determination of precautions to reduce these damages. The plan consist of 8 main sections;

1. Geology and Tectonics
2. Earthquake Occurences
3. Earthquake Hazard
4. Geotechnical Evaluation
5. Infrastructure
6. Buildings
7. Socio-Economical Losses
8. Risk Reduction and Recommendations

Geology and Tectonics: In this section, detailed information about the geological features, tectonic status and faults that may affect the region are given for the Western Anatolia and İzmir environment. Seismic zonation has been made and geological map is provided. The generated maps are very complex. The geological map is arranged in 2 ways; regional and topical. The regional map includes Foça-Menemen in the north of İzmir and Seferihisar in the south. The topical map included the Izmir metropolitan area. At the end of this section, in order to put forward the earthquake risk in İzmir in a more detailed manner, the next step is to propose what to do about faults and geographic information system.

Eartquake Occurences: In this section, necessary information for earthquake occurrences is given. The main factors in determining earthquake hazard are date-time of origin, center position, source parameters and their effects. National and international literature review for historical and instrumental earthquakes has been made and the damages caused by them have been explained in detail. Utility programs were used to introduce the geographical information of seismicity studies to GIS and to use these data systematically. Earthquakes inner and surrounding of İzmir, which have caused damage in the historical period and in the 20^{th} century, have been investigated and reported in this section.

Earthquake Hazard: Deterministic and probabilistic methods are used to determine earthquake hazard. In this study, it is aimed to prepare earthquake hazard maps for

İzmir and its surrounding. Main research steps; collecting and compiling all historical data as geological and seismological, determination of seismicity parameters and statistical properties of earthquake occurrences, compilation of reduction relationships that may be appropriate for earthquake sources together with uncertainty coefficients, obtaining maximum horizontal ground acceleration probability distributions and maximum intensity distributions, preparing equal acceleration and equal intensity maps corresponding to the determined turn periods.

In this section, deterministic earthquake hazard, probabilistic earthquake hazard, probabilistic earthquake hazard for İzmir and earthquake occurence models are examined in detail.

Geotechnical Evaluation: The studies carried out in this section are divided into 4 stages. In the first stage, all the obtained and compiled drilling data were transferred to computer. These points were determined on the map and soil classification was made on the basis of the regulations regarding the structures to be built in 1997 disaster zones. In the second stage, the shear wave velocities in the ground section were calculated using the standard penetration-static (SPT) and dynamic penetration results of the existing drillings (for the upper 30 meters of the ground layer). In the third stage, the shear wave velocities and ground magnifications were calculated and as a result of this calculation, a map was created to show the distribution on the map in İzmir borders. In the fourth stage, SPT-N impact numbers (for the upper 15 meters of drillimgs) obtained from standard penetration tests and tip strength obtained from static cone penetration (CPT) test and friction ratios were mapped by calculating the safety coefficient according to liquefaction.

Infrastructure: In this section, the general earthquake performance of infrastructures, bridges and viaducts, inner city and intercity highways, railway rail routes, airlines, tunnels, harbors, power lines, power generation plants, distribution lines, communication systems, gas stations and drinking water lines are examined and all of them also were examined in İzmir. Damages that may occur for infrastructures in earthquakes are given in this section.

Buildings: In this section, building inventory study for İzmir city, explanation of building damage methodology, building damage levels and probability curves and

analysis of damage estimation are given. The building inventory of all buildings within the boundaries of Izmir Metropolitan Municipality was conducted and the buildings were classified according to construction date, usage characteristics, project and construction quality and structural characteristics. The damage estimation methodology is used to estimate the building damage that may occur in a possible earthquake. Structural earthquake damages are classified for each building class and building fragility curves are plotted. The displacement capacity of the building under the effect of earthquake is expressed. Structural damage of all buildings in Izmir has been estimated over the last 50 years. Damage levels were expressed as undamaged - slightly damaged, moderately damaged, heavily damaged - ruined.

Socio-Economical Losses: It has been examined under 3 titles. *Physical losses* emphasize losses caused by buildings and infrastructure. *Social vulnerability: injuries and casualities* are explained that the rate of loss of life per building destroyed for a certain type of building is related to population in the building during the earthquake-building damage type and rescue-first aid services calculated using various combinations and and the results of the calculations. Building damage-injury ratios were calculated using methodologies that defend a direct relationship between building damage and death and injuries. *Primary physical and secondary economical losses:* In addition to the financial losses of the structures that are expected to be damaged, secondary disasters that may occur in earthquakes are examined in this section. The most important secondary disasters are fire and hazardous material leaks. In this section, the economic losses that will arise due to the inability of the damaged facilities and the firms which are unable to do business are mentioned.

Risk Reduction and Recommendations: This section includes the plans and activities to be done before, during and after the earthquake. The earthquake disaster damage reduction programs in Turkey have been described. Recommendations for reducing earthquake risk in İzmir are included in this step in order of priority.

3.2 Istanbul Disaster Prevention/Mitigation Basic Plan Including Seismic Micro-Zonation Study: JICA Report, 2002

Unfortunately, the 17 August 1999 Kocaeli earthquake was effective in deciding on the preparation of the JICA report. The earthquake with magnitude of 7.4 affected seven provinces, causing more than 15,000 deaths. About 80,000 buildings occurred severe damage. There are important lessons to be learned from the Kocaeli earthquake, which has severe consequences. Public institutions and organizations to fulfill their duties, ensuring the availability of communication tools, the attitude of the public after the earthquake, unconsciousness of emergency aid create the technical cooperation between Istanbul Metropolitan Municipality and JICA in 2000 (JICA, 2002). The scenarios put forward after the Kocaeli earthquake which occurred nearby Turkey's most important metropolis, suggest that a major earthquake awaits Istanbul in the future. The Kobe earthquake (Japan), which occurred in 1995, has more than 6000 life loss and more than 230,000 homeless people, in addition to the severe damage that metropolitan areas will suffer from the earthquake. The distorted urbanization in Istanbul, the rapidly increasing population, the narrow roads, and the applications other than the planning revealed the importance of Istanbul once again. The study area includes Büyükçekmece-Silivri and Çatalca district centers in addition to the 27 districts of Istanbul Metropolitan Municipality. The JICA report shed light on the Istanbul Earthquake Master Plan, consists of 7 stages.

These stages are;

Stage 1: Collecting, analyzing and evaluating the available information for the identification of study subjects

Stage 2: Investigation of the land, population, building conditions and other issues in the field

Stage 3: Establishment of Geographical Information System database and analyzing the data

Stage 4: Analysis of earthquake motion

Stage 5: Calculation of seismic hazard and damage

Stage 6: Evaluation of hazard maps and seismic microzonation maps

Stage 7: Detailed investigation of urban disaster prevention and damage mitigation

These 7 stages have been examined and reported in detail under 9 section.

1. Earthquake Disaster Management Administrative Conditions: The boundaries of the applicable disaster management are determined within the current legal regulations for Istanbul by examining in detail the existing disaster management system in Turkey.

2. Non-Governmental Organizations for Disaster Management: The main purpose of this section, which includes the definition of non-governmental organizations, is to reveal the responsibilities of non-governmental organizations in disaster management and their important roles with the facilities and equipment they will have. Continuous cooperation with non-governmental organizations (NGOs) should be ensured for community-based disaster management. Non-governmental organizations have different legal framework. For a properly functioning disaster management, sometimes the competencies of NGOs should be flexible. It is necessary to have an understanding of management which is in constant communication with local governments and clearly shares all steps of disaster management.

3. Disaster Preparedness Training for Public Awareness And Disaster Damage Mitigation: It has an important role in the studies to protect from earthquake, to act more consciously during earthquake or to stand up fast after earthquake. Some of the public duties in the community-based disaster management strategy are; to raise public awareness about risk and danger and to spread information about seismicity at neighborhood level. In particular, doing these works through the media most commonly used by the public will reach more people. It will be the most effective method to separate the activities of the public sector into normal and urgent stages and to take steps in this direction.

4. Urban Situation for Earthquake Disaster Management: In this section, first of all, the natural due diligence is determined. Natural due diligence was done by compiling and evaluating earthquake damage data for topography-geological data, geotechnical data, earthquake data-tectonic structure-seismic status and risk assessment. For example, in this section, the damages caused by 17.08.1999 Izmit-Kocaeli earthquake, includes the use of scenario earthquakes for damage estimation. The fact that Izmit earthquake damage data is in the hands of the working team ensures that the report

gives realistic results. Building inventory information, population distributions on the basis of neighborhoods and buildings were used as data obtained from the State Institute of Statistics and used as a source for damage detection distributions. It is a fact that the earthquake will adversely affect roads, transport and infrastructure. Due to the importance of post-earthquake relief efforts, infrastructure and transport networks were included in the reports in the most accurate manner. The data of some facilities located in the city are given in detail in the JICA report. Because the impact of damage to buildings such as school, safety facilities, flammable material facilities, hospitals, which contain a large number of people during the earthquake or which will be dangerous after the earthquake will have more impact.

5. Earthquake Analysis: Under this title, first of all damage estimations were made in North Anatolian Fault Line and scenario earthquakes were created in order to prevent disaster. Four scenario earthquake models with different magnitudes and fault parameters were determined (Model A, Model B, Model C, Model D) Model A was the basis of the Istanbul Earthquake Master Plan.

6. Damage and Loss of Life Calculations: In parallel with the earthquake models, the damages were calculated by comparing the reaction displacement of the building and the displacement that caused the damage in the building. The buildings were calculated as heavy, moderate and slightly damaged. The most important data in the damage calculations is the building inventory. The combination of the number of floors and the year of construction is included in the combination of building types. Damages were calculated for each neighborhood and building class. The relationship between building damage and loss of life has been examined for the loss of life calculations. Because the weakness of the buildings can not be ignored in an earthquake in Istanbul.

7. Urban Vulnerability Analysis: In this step, which is one of the longest parts of the report, starting from the quality control of construction works, the points to be considered during the license stages, important public facilities, damage calculations and results related to important buildings, possible fires after the earthquake and the probability of spread are included. Infrastructure bridge power lines and pier harbors vulnerability calculations were made in detail. And the precautions to be taken as a result of these calculations shall be included in the report.

8. Precautions to be taken to Strengthen of Vulnerable Urban Buildings and Constructions: Secondary disasters are important hazardous situations for the post-earthquake. The fact that the structures that can be damaged and in need of reinforcement will be dangerous in this sense and the things to be done for these structures have been put forward in this step.

9. Recommended Precautions to Reduce Earthquake Disaster: These precautions are grouped as long, medium and short term precautions. Because the precautions to mitigate the negative effects of the earthquake are usually on project basis. Short-term measures mean that important facilities and infrastructures are secured to reduce earthquake damage. Long-term and medium-term measures are project-based and implementation-based measures without structural content. Arrangement of an institutional structure for disaster management is the most important measure to be taken to reduce earthquake disaster.

3.3 Istanbul Earthquake Master Plan, 2003

Istanbul Metropolitan Municipality has requested the Earthquake Master Plan including possible problems to be encountered after an earthquake in Istanbul and precautions to be taken against it from Istanbul Technical University (ITU), Boğaziçi University (BU), Yıldız Technical University (YTU) and Middle East Technical University (METU). Istanbul Earthquake Master Plan (IEMP, 2003) has been prepared by these universities. Geological phenomenon which is described as Scenario – A in Istanbul Disaster Prevention/Mitigation Basic Plan Including Seismic Micro-Zonation Study: JICA Report has been based for preparing IEMP. The necessity to prepare comprehensive earthquake interference plans based on detailed earthquake analyzes in Istanbul following the losses of the ‘1999 Kocaeli Earthquake’ emerged as a realityaccepted by local government, governmental institutions, non-governmental organizations and academic surroundings. Uncontrolled and rapid urbanization, failure city and regional planning, failure construction techniques and applications, inadequate infrastructure and services have led to high levels of earthquake risk.

The study identifies all kinds of ‘Risk’ in Istanbul due to earthquake hazard and sets out how to conduct 'Risk Management' in Istanbul. The requirements to be fulfilled in each risk sector are defined as independent 'Project Packages'. The “Avoidance Plan” is a document of work packages. These work packages should clearly include the

stakeholders, responsibilities of stakeholders and the sanctions (contracts) for the fulfillment of their responsibilities. In addition to the avoidance plan, “Action Plans” in high-risk urban areas is prepared and urgent interventions is programmed. These areas, where both natural hazards and the human and economic resources are high danger, are at the same time 'priority transformation areas'.

The main steps of Istanbul Earthquake Master Plan as follows;

1. Current situation of Istanbul
2. Analyzing and strengthening of earthquake resistance of constructions
3. Settlement, law, administrative structure and resource management
4. Composing of earthquake information infrastructure
5. Education and social works to reduce earthquake damages
6. Risk and disaster management

In assessing the ***current situation***, probabilistic and deterministic earthquake hazard and possible soil problems were examined. For this purpose, the existing information about buildings, urban infrastructure (transportation network, natural gas, water, electricity and telecommunication networks) and industrial plants were evaluated for earthquake performance. The social losses and expected performances of buildings, infrastructure and industrial plants were evaluated.

One of the main issues in the application of the master plan is the ***analyzing of the earthquake resistance of the stock of buildings*** exposed to earthquake hazard, and consequently the identification of high-risk structures and buildings that require reinforcement. The main objective is to estimate the probability of damage to buildings in a major earthquake, and to identify areas with high-risk buildings that may cause loss of life. Earthquake resistance of the buildings were examined in three stages. The first stage is inventory and preliminary evaluation works. The aim is to rationally evaluate the limited number of data that can be collected in a short time by looking from the outside of the building and pre-ranking the buildings in terms of earthquake performance. In the second stage, more detailed studies have been carried out, starting with the buildings in the first place according to first stage. In the third stage, high rise buildings, office buildings and important public buildings were examined in detail.

A ***settlement*** plan was developed to improve the quality of the natural and urban environment. On the other hand, the ***legislation*** concerning the earthquake risk within the legal system was reviewed and the mistakes, deficiencies and gaps in the legal level were examined to reveal the problems in the system. The aim of the ***administrative structure*** step is to propose an administrative structure that includes all parties expected to be responsible for the activities that take place before and after the disaster. Therefore, the existing regulations and practices in Turkey were evaluated, distribution of powers between the central and the local government units, responsibility and coordination systems were determined. ***Resource management*** is essential for the determination of national and international resources for all the works to be carried out before and after the earthquake and ensuring their proper use. Due to the limited current resources, the total resource requirement needs to be determined.

A geographic information system (GIS) model should be developed in order to reduce the effects of the earthquake and provide effective disaster management. This spatial ***information system*** for IEMP was named as Istanbul Earthquake Information System (ISDEBIS).

Education and social activities related to the earthquake are not sufficient. Therefore, Municipalities, Professional Chambers and Non-governmental Organizations should open training courses for adults and these activities should be enriched. It has been suggested that the following projects would be appropriate for public education in Istanbul; "Istanbul Earthquake Master Plan Promotion Campaign"; "Public Education: Social Awareness Campaigns"; "Public Education: Awareness Raising"; "Practicing Skill Training for Volunteers"; and "Organizing and Participating Local People in Disaster Management".

According to the ***Disaster Management*** model developed within the framework of Istanbul Earthquake Master Plan, it is stated that the countries that are successful in disaster management in the world are not only limited to intervention and improvement stages but also preparedness and damage reduction activities are developed. Considering this situation, disaster management consists of 4 phases; preparedness, damage reduction, intervention, and improvement.

3.4 Determination of Potential Earthquake Damages in Erzincan: TUJJB (Turkey National Geodesy and Geophysics Association) Project, 2015

Erzincan is located on North Anatolian Fault which is the most complex region of Turkey in terms of geological and seismotectonics. Therefore, urban region has surrounded by North Anatolian Fault, Northeast Anatolian Fault, Ovacik Fault and secondary faults which are still active faults. Erzincan Earthquake (1939) is known as the largest earthquake in its history (Magnitude=7.9, Loss=116.720 lives) (Özşahin and Eroğlu, 2019). In addition, another earthquake of 6.8 magnitude in 1992 caused to loss of lives around 8000. This situation which clearly indicates the seriousness of earthquake necessitates to take precautions against earthquakes in Erzincan. For this reason, TUJJB (2015) (Turkey National Geodesy and Geophysics Association) had prepared a project in the name of Determination of Potential Earthquake Damages in Erzincan. The main steps of this project as follows;

1. Determination of active faults near Erzincan
2. Setting ground models in Erzincan city center
3. Probabilistic seismic hazard analysis (PSHA)
4. Establishment of ground movements to be used in damage estimation
5. Determination of structure vulnerability
6. Estimation of earthquake damage

This report has similarities with Istanbul EMP, technically. ***In the first stage***, active faults and all earthquakes that caused damage near Erzincan were determined. Reports and catalogues belonging to historical and instrumental period were examined one by one. ***In second stage***, 1-dimensional velocity models have been extracted in 9 fields in Erzincan city center, North-South and East-West directions. Erzincan city center, which is an alluvial basin and located in Erzincan basin. These models provide a basis for future full wave propagation studies using advanced numerical modeling methods in this heterogeneous basin. ***In third stage***, probabilistic seismic hazard analysis were done. It was done several analysis at 123 vital points by using works on regional resources, catalogue information, decrement states and local ground characteristics. It was obtained probabilistic and spatial distributions for different ground motion parameters and different repetition time. The PSHA results can be used directly to determine seismic hazard of any point in the future. ***In forth stage***, ground motion simulations were made. It includes numerical modeling of ground motions that may

show up in possible earthquakes. Simulation parameters were verified by ground motion of the earthquake in 1992. ***In fifth stage***, structural properties were determined and numerical models were made according to the physical properties of these types of structures. ***In final stage***, the damage distribution of a possible earthquake in Erzincan is modelled.

With this project, a damage detection algorithm starting from earthquake source is presented for the first time on a city basis. This interdisciplinary algorithm, which extends to structural damage, is presented based on the fundamental principles of earthquake engineering and considering ground and wave propagation characteristics. In order to keep the results of these kinds of projects not only at academic level, but also administrative level i.e. administration should cooperate with academy and work on pre-earthquake damage reduction and emergency plans.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 General

In this section, it is mentioned about two important most update works on earthquake awareness of Gaziantep City:

i) Gaziantep Earthquake Master Plan: Roadmap Workshop, January 2018 organized by Gaziantep Chamber of Civil Engineering and prepared by Hacer Çiftçi, Dr. Cahit Ali Bayraktar and Dr. Murat Durucu (IMO, 2018).

ii) Disaster Awareness and Sensitivity Symposium in Gaziantep: Final Report, May 2018 organized by Hasan Kalyoncu University and prepared by Prof.Dr. Yusuf Arayıcı and Hacer Çiftçi (Arayıcı and Çiftçi, 2018)

The results of the above works are given in systematic and those results are discussed in detail in further sections of this chapter.

4.2 Gaziantep Earthquake Master Plan: Roadmap Workshop, (IMO, 2018)

The aim of this workshop is to raise awareness of the roadmap of the Gaziantep Earthquake Master Plan and to provide that the obtained result is a guide for Gaziantep EMP. 59 participants (architects, engineers, members of non-governmental organization, academicians, local administrators, employees of public institutions and organizations) attended in the workshop. Also, it was organized and managed by professional project managers. The interior design of this workshop was based on a mixed use of workshops, guided workshops and focus group models. Accordingly, there were five main sessions, one of which was for information purposes(IMO, 2018);

- Information on seismicity of Gaziantep.
- ***Workshop I*** – What should be the content of Gaziantep EMP? /What should the plan include? Its purpose is to create recommendations for the complete description of the content of the Gaziantep EMP roadmap. These suggestions will be guiding for further studies.

- ***Workshop II*** – What should be done by stakeholders to prepare the content where identified in the Workshop I? (Roadmap proposal).With this question,it is aimed to formulate proposals for planning which tasks to what institutions and organizations.
- ***Workshop III*** – What should be done to actualize Gaziantep EMP after prepared? These recommendations will provide guidance on what institutions and organizations should do when Gaziantep EMP is prepared.
- Presenting the preliminary results of the workshop by the groups.

When the outputs of the five groups were evaluated collectively, it was decided that the Gaziantep EMP should include three main parts;

a) Planning what to be done before the earthquake
b) Planning what to be done during the earthquake
c) Planning what to be done after the earthquake

After evaluating the suggestions of the five groups, the results obtained are as following tables.

Table 4.1: Activities to be carried out prior to the earthquake (recommended) and the stakeholders recommended to contribute to these activities (IMO, 2018)

Proposed Studies	**Stakeholders Proposed to Contribute**
1) Seismicity and seismic hazard analysis of Gaziantep a. Tectonic maps b. Seismological maps c. History of seismic activity d. Micro zoning e. Geological, geotechnical and soil survey (soil structure and cave mapping, determination of hazards and risks and faults) f. Soil survey and evaluation	Universities Kandilli Observatory National Earthquake Monitoring Center Gaziantep Metropolitan Municipality Provincial Directorate of Environment and Urban Planning Ministry of Environment and Urban Planning Private Sector Relevant Trade Associations Earthquake Research Institute Mineral Research and Exploration
2) Taking building stock inventory and determination of their resistances to earthquake a. Taking building stock inventory before and after earthquake regulation (taking inventories of housing and workplaces, critical structure such as public enterprises, hospitals, airports, schools, sport halls, industrial structures, also taking inventories of historical structures) b. Infrastructure inventory (electrical, water, sewage, natural gas, roads, bridges, barrages, communication networks) c. Taking inventories of current gathering grounds	Gaziantep Metropolitan Municipality Gaziantep Governorship Municipalities Universities Provincial Directorate of Environment and Urban Planning Ministry of Environment and Urban Planning Ministry of Culture and Tourism Ministry of Transportation, Maritime Affairs and Communications Investment Monitoring Coordination Department Trade Associations Infrastructure Coordination Center ENERJISA TURKTELEKOM

Table 4.1: (continued)

Proposed Studies	Stakeholders Proposed to Contribute
3) Population density study a. Determination of Gaziantep day and night population distribution b. Keeping an account of population, age etc. of people lives in buildings	Turkish Statistical Institute Directorate of Population Municipalities Mukhtars Immigration Authority
4) Determination of risky structures, development of inspection and strengthening systems a. Developing methods for the assessment of existing buildings b. Developing methods for the improvement and strengthening of hospitals and public institutions c. Development methods for the improvement and strengthening of industrial structures d. Development methods for the improvement and strengthening of infrastructure and superstructure e. Development methods for the improvement and strengthening of historical structures f. Development methods for the improvement and strengthening of critical structures	Ministry of Environment and Urbanization District Governorships Ministry of Culture and Tourism Ministry of Defense General Directorate of Foundations Union of Chambers of Turkish Engineers and Architects Universities Local Governments Ministry of Forestry Ministry of Energy Ministry of Communication Technologies Ministry of Health GASKI (Gaziantep Water & Sewerage Administration) GAZDAS (Gaziantep Natural Gas Distrubuting I.C.) Highway Commission DSI (State Hydraulic Works) Directorate of Youth and Sports
5) Risk Analysis a. Constituting of earthquake scenario b. Taking a map of risk c. Forecasting of losses (loss of lives, economic structure and other losses)	General Staff Relevant Research Institutes Universities AFAD (Disaster and Emergency Management Administration) General Directorate of Security Affairs KIZILAY

Table 4.1: (continued)

Proposed Studies	Stakeholders Proposed to Contribute
6) Necessary precautions to make the structures earthquake resistance a. Precautions to make the structures earthquake resistance (precautions to make the structures earthquake resistance, precautions on city planning, urban transformation, strengthening of structures and enable building audit) b. Legal works (preparation of relevant planning and regulations, examination of the legal situation of the beneficiaries) c. Planning of fiscal resources (composing local sources and liability, determination of individual contributions)	Housing Development Administration of Turkey (TOKI) Ministry of Environment and Urbanization Bar Associations Gaziantep metropolitan Municipality Trade Associations Building Audit Institutions Private Sector Ministry of Labor and Social Security DSI DASK (Natural Disasters Insurances Authority) Insurance Firms European Settlement Fund
7) Disaster management training and information (public and contractors) a. Training and information of experts and responsible personnel b. Training and information of public c. Identifying and providing training in schools d. Doing exercises and applications e. Informing the public about the gathering areas and housing areas f. Using of media and communication tools g. Taking advantages of developing technology (Industry 4.0 – Society 5.0)	AFAD AKUT (Search and Rescue Assoc.) Universities Ministry of Interior Trade Associations Ministry of Education NGO Directorate of Religious Affairs Private Sector Sanitation Department International Scientific Committee on Risk Preparedness (ICORP)

Table 4.2: Activities to be carried out during the earthquake (recommended) and the stakeholders recommended to contribute to these activities (IMO, 2018)

Proposed Studies	Stakeholders Proposed to Contribute
1) Planning of emergency activity and rescue teams a. Planning of information flow b. Composing of emergency action plan (planning of intervention activities, determination of institutions and organizations to take part in search and rescue, planning the guidance of emergency activity teams, planning, the field organization of rescue teams, evaluation and planning of additional team needs, planning how to perform search and rescue activities in priority areas)	AFAD Disaster Coordination System (AKOM) Disaster and Emergency Management Centers (AADYM) Governorship Gaziantep Metropolitan Municipality Chamber of Civil Engineers STK KIZILAY Chamber of Medical Doctors Ministry of Health District Governorship Ministry of Environment and Urbanization Provincial Gendarmerie Command Provincial Dictorate of Security Provincial Dictorare of Health National Medical Rescue Teams Universities Provincial Diretorate of Family and Social Policies TEDAS GASKI GAZDAS
2) Planning how to do damage and loss assessment a. Planning how to identify secondary impacts (fire, flood, landslide) b. Planning how to determine damage assessment and priorities c. Rapid detection of heavily damaged buildings and planning how to evacuate	
3) Planning the sustainability of health and vital activities a. Determination of how health services will be provided in the gathering places b. Planning how to organize social networking and communication paths c. Planning how to satisfy food, clothing, heating and shelter needs d. Ensuring the safety of earthquake victims (dying and living) during disasters e. Planning how to perform burial services f. Planning the organization of relief works	AFAD AKUT Disaster and Emergency Management Centers (AADYM) Ministry of Health TURKTELEKOM GSM Companies KIZILAY Gaziantep Metropolitan Municipality Municipalities SAHKUT UMKE Fire Department Directorate of Security General Directorate of Highways Ministry Of Maritime And Transportation

Table 4.3: Activities to be carried out after the earthquake (recommended) and the stakeholders recommended to contribute to these activities (IMO, 2018)

Proposed Studies	**Stakeholders Proposed to Contribute**
1) Planning the sustainability of health and vital activities a. Planning how to satisfy the sheltering needs (planning the places where temporary accommodation facilities, determination of place for permanent housing, construction of permanent residences) b. Planning of food needs c. Planning of debris removal works d. Execution of burial according to sanitary e. Planning of security measures f. Safety of life and property g. Providing psychological support to citizens after earthquake (determination of psychological, sociological and economical effects of earthquake)	Disaster and Emergency Management Centers (AADYM) Ministry of Health TURKTELEKOM GSM Companies KIZILAY Gaziantep Metropolitan Municipality Municipalities Fire Department Directorate of Security General Directorate of Highways Ministry Of Maritime And Transportation Natural Disasters Insurances Authority (DASK) Ministry of Environment and Urbanization TOKI International Scientific Committee on Risk Preparedness (ICORP) Provincial Diretorate of Family and Social Policies
2) Planning of damage assessment works and recovering of damages a. Determination of socioeconomic and environmental damage b. Demolition of pose risk structure c. Activation of public utility, transportation and communication needs d. Strengthening buildings appears to strengthen	Governorship Ministry of Environment and Urbanization Chamber of Civil Engineers Gaziantep Metropolitan Municipality Municipalities Fire Department TEDAS GASKI GAZDAS AYKOME
3) Assessment and reporting of disaster management after earthquake	Governorship AFAD AKOM Universities

As a result, this workshop proposed that;

1. Earthquake Master Plan Preparation And Implementation Committee should be established
2. Gaziantep Earthquake Master Plan should be introduce
3. Gaziantep Earthquake Master Plan should be taken into consideration in new zoning applications
4. Implementation plan should be prepared to apply the Gaziantep Earthquake Master Plan
5. Gaziantep Earthquake Master Plan should be kept up to date
6. Legal arrangements should be made for the implementation of Earthquake Master Plans
7. Continuity of training, information and exercises should be increased.

4.3 Disaster Awareness and Sensitivity Symposium in Gaziantep: Final Report, May 2018 (Arayıcı and Çiftçi, 2018)

Within the scope of this symposium, it was aimed to increase the disaster awareness and sensitivity level of the stakeholders and a program was organized in this direction.

Topics discussed in the symposium as follows;

- Earthquake Risk Analysis in Gaziantep and Turkey Disaster Response Plan
- Gaziantep Earthquake Master Plan Roadmap
- Disaster Management
- What is AFAD (Disaster and Emergency Situation)?
- Basic Disaster Awareness
- Health Developments in Disasters from Past to Present
- Media and Communication

Before the symposium, street interviews were conducted in order to draw the attention of the citizens about the disaster and to form an opinion about the level of awareness (Arayıcı and Çiftçi, 2018).

“Disaster Awareness and Sensitivity” survey is as follows;

1. What is your occupation?
   • Engineer
   • Architect
   • Administrator
   • Academician
   • Contractor
   • Other
2. Educational Attainment
   • BSc.
   • MSc.
   • PhD.
   • Other
3. How many years of experience do you have?
   • 1 – 5
   • 5 – 10
   • 10 – 15
   • +15
4. Do you think Gaziantep EMP should be prepared?
   • Yes
   • No
   • Time-sink
5. What institutions or organizations would prepare the EMP in the most accurate way?
   • Metropolitan Municipality
   • Governorship
   • Non-governmental Organizations
   • Universities
   • All of them
   • None of them (different institution)

6. Would EMP be applied if it was prepared for today?
   - Yes
   - No
   - Impossible
7. What are the 3 precautions to be taken before the earthquake?
   - __
   - __
   - __
   - I have no idea.
8. What are the most basic 3 requirement for earthquake moment?
   - __
   - __
   - __
   - I have no idea.
9. What should be done return to normal life quickly after earthquake?
   - __
   - __
   - __
   - I have no idea.
10. Do you think that disaster education in Gaziantep is adequate?
    - Yes
    - No
    - Not received any announcement

11. Do you think there is an earthquake resistant structure?

    • Yes

    • No

    • I don’t know

12. What is the ratio of risky structures in Gaziantep?

    • 20 – 30 %

    • 30 – 40 %

    • 50 – 60 %

    • 70 – 80 %

    • Other

13. Is Gaziantep located in a risky region?

    • Too risky

    • Less risky

    • Risky

    • I don’t know

14. Do you think local authorities do adequate work on disaster?

    • Yes

    • No

    • Inadequate

15. Please tick 3 reliable news sources on disaster.

    • Radio

- Television
- Newspapers
- Social Media (Facebook, Twitter etc.)
- Internet
- AFAD
- STK (TMMOB, AKUT, MAD-DER etc.)
- Bosporus Kandilli Observatory
- Family, friends
- Other

16. Where did you learn about EMP in Gaziantep?
    - I don’t know EMP
    - Local media (newspaper, radio and TV)
    - Internet
    - Immediate vicinity
    - Other
17. What kind of news do you want to watch/read in the media about disasters?
    - News about possible disaster hazards and risks
    - Informative news on disaster prevention
    - News about the applications of institutions on disasters
    - Disaster early warning signal and things to do
    - Educational series and documentaries on disasters
    - Other

The final report of the “Disaster Awareness and Sensitivity” survey, which conducted with a total of 87 participants, is shown in Table 4.4, Table 4.5 and Figure 4.1.

Table 4.4: Education level, profession, work experience of the participants(Arayıcı and Çiftçi, 2018)

	Administrator	**Engineer**	**Academician**	**Others**
Number of Person	8	17	5	57
Educational Level*	(2) Secondary and High school Graduate	(17) Bachelor and Postgraduate	(5) Bachelor and Postgraduate	(23) Secondary and High school Graduate
	(6) Bachelor and Postgraduate			(34) Bachelor and Postgraduate
Professional Experience*	(1) <10 years	(8) <10 years	(2) <10 years	(41) <10 years
	(7) ≥10 years	(9) ≥10 years	(3) ≥10 years	(16) ≥10 years

**The number of person is indicated in parenthesis.*

Table 4.5: Answers to Questions Related with Gaziantep EMP and Disaster (Arayıcı and Çiftçi, 2018)

	Yes (%)	**No (%)**	**Other* (%)**
Do you think GDMP should be prepared?	88.5	9.2	2.3
Do you think GDMP is feasible?	36.8	47.1	16.1
Do you think that disaster education in Gaziantep is adequate?	20.7	56.3	23
Do you think there is an earthquake resistant structure?	56.3	19.5	24.2
Do you think local authorities do adequate work on disaster?	13.8	51.7	34.5

**According to the question order "waste of order", "impossible", "never had", "I do not know" and "inadequate" are the percentages corresponding to their answers.*

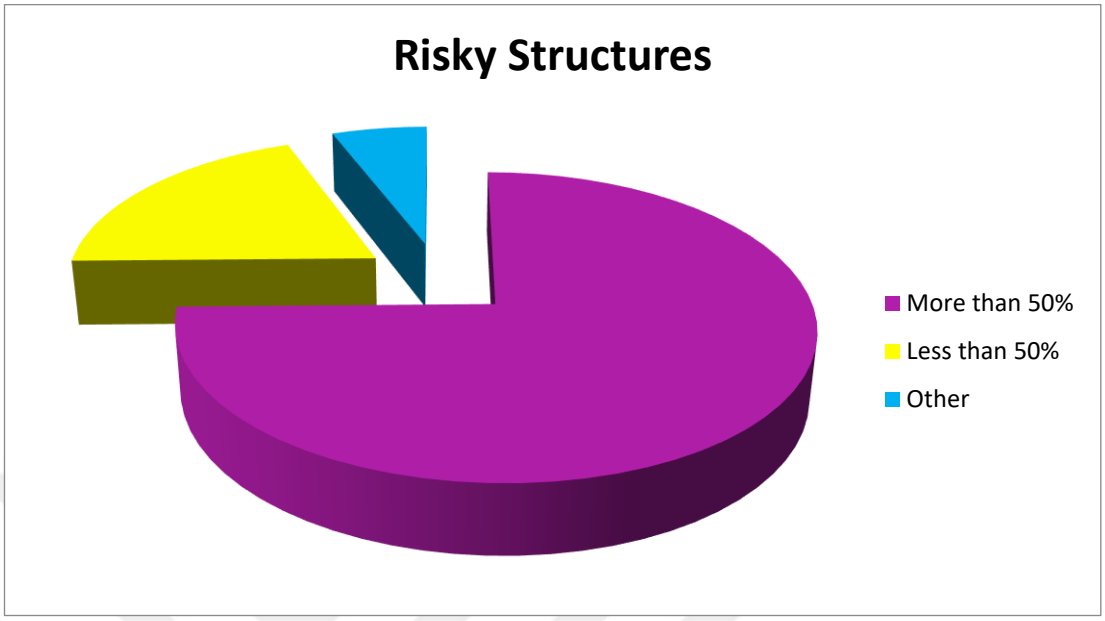

Figure 4.1: Ratio of risky structures in Gaziantep (Arayıcı and Çiftçi, 2018)

The final report of the "Disaster Awareness and Sensitivity" survey conducted for a total of 87 people is as follows (Arayıcı and Çiftçi, 2018);

- According to 75% of the people, the ratio of risky structures in Gaziantep is 50% and above, and the rate of those who think that it is below 50% is 19.5%.
- While 32% of the people think that Gaziantep is located in a risky region, 13% think that it is quite much risky and 49.5% think that it is located in a less risky region.
- 57% of the people answered 'all of them' to the question of "What institutions or organizations would prepare the EMP in the most accurate way?" The options are Metropolitan Municipality, Governorship, Non-governmental Organizations and Universities. While 14% of the participants thought that the Metropolitan Municipality would prepare the most accurately, 12% preferred the universities. The remaining 17% of the participants chose one of the responses from the Governorship, NGOs, 'all of them' and 'totally different'.
- When people are asked the three securest news sources; 24.4% Television, 22.3% AFAD and 19.3% Internet and Social Networks responses were

obtained. The answers following these results were Radio and Kandilli Observatory at a rate of 11.3%.

- 55 out of 87 people knew about the Earthquake Master Plan from the local media, internet and immediate surroundings, while 32 people chose the option that they didn't know about the Earthquake Master Plan.
- When people are asked what kind of news about disasters they wanted to receive from the media, 34% of the results stated that they wanted to receive informative news about the precautions against disasters, while 19% stated that they wanted to receive information about early warning and actions to be taken. 20% of people think that there should be educational series and documentaries about disasters.

The answers to the questions asked to the people about the precautions to be taken before the earthquake are mostly as follows;

- Construction of durable structures
- Raising public awareness and providing training on the subject
- Completion of urban transformation
- Regular building inspections
- Increasing the gathering areas
- Fixing of objects in living spaces

The answers to the question “What are the most basic needs required in the event of an earthquake?” were mostly answered as ‘earthquake bag’, ‘water and food’, ‘communication tool’ and ‘flashlight’.

The answers to “What needs to be done to turn back to normal life quickly after the earthquake;

- Carrying out improvement works by acting in a coordinated manner.
- To supply the housing and health requirements of the public as soon as possible
- Getting psychological support

When the results of survey were examined;

Reducing the important proportion of participants who think that disaster education in Gaziantep is inadequate will provide active participation of citizens to the trainings.

The percentage of participants who think that local administrators do not do enough work on disasters reveals that the studies or announcements made on this issue are inadequate. Most of the participants have the idea that the Gaziantep Earthquake Master Plan should be prepared. As a result of the responses, it was revealed that Gaziantep did not have enough information about the seismicity. More than half of the buildings in Gaziantep are considered to be risky. Accurate definition of risky structure to citizens will increase awareness. The fact that television was chosen as the most trusted means of communication comes in sight that it is the right choice to make announcements through television with correct and effective expressions. The results of this survey have the characteristics of guide for future works.

The summary of the symposium topics is as follows:

When the damage and loss of life caused by disasters are examined in our country, the earthquake takes the first place with a rate of 61%. Between 1900 and 2017, there were 212 earthquakes greater than 6 in Turkey. 87,093 people lost their lives, 527,812 houses were heavily damaged or destroyed. There is no active fault in Gaziantep city center. 145 km long Türkoğlu-Antakya section of the Eastern Anatolian Fault Line passes through Nurdağı and İslahiye districts. There are two faults that can affect Gaziantep city center and the provincial. Turkey Earthquake Monitoring Network has a total of 950 earthquake observation stations and 11 of them located in Gaziantep. The data obtained here are used in earthquake maps, earthquake regulations, damage estimation system. Turkey Earthquake Map has been renovated. The latest version of the map, which will be used in 2019, has been created especially due to updates in Europe and new faults detected. According to this map, Gaziantep city center has decreased in terms of earthquake hazard value. Considering the new map, part of about 27% of Turkey's population lives in the 1st degree earthquake zone. Making an Earthquake Master Plan for each city will be an important step in struggle against earthquakes. Disaster sensitivity and steps to be taken are important for the predetermination of hazards that create disaster risk and risk management. Disaster and risk management activities are always a whole. Disaster management means bringing risk to a manageable level. Unfortunately, nowadays it is focused on crisis management, however steps should be taken to switch from crisis management to risk management.

Disaster management is a development problem, indeed and if societies can implement it, they will move towards faster development.

Disaster management principles include;

- Damage/Risk Reduction
- Preparation
- Intervention
- Recovery

AFAD is one of the leading organizations working for disaster management. Its aim is to minimize the problems confronted with disasters. This institution, which is affiliated to the Prime Ministry, is responsible and authorized to implement disaster and emergency issues in our country. The definition of the task distribution clearly stated in public institutions and organizations within the scope of Turkey Disaster Response Plan. In this direction, the disaster recovery will be ensured in cooperation.

The importance of first aid will be seen if the disasters are considered in terms of health. One of the most important subjects is to understand the importance of first aid training and to implement the solutions in Gaziantep by reaching the answer to the question of "What can be done to increase the awareness of receiving education?"

The importance of the role of media in disasters should not be underestimated. The role of the media should be to raise awareness in disaster preparedness and response. Inclusion of media in disaster management will ensure that the management plan is feasible. Disaster news should have the characteristics of taking lesson. The cooperation of Gaziantep media representatives with the institutions that will enable them to play an active role in awareness studies will ensure that the activities are announced to the citizens more accurately.

A disaster-resistant society is capable of adapting, resisting and moving easily in possible crisis (natural or man-made), and disaster-resistant societies are always less affected by crises. This resilience comes from a gathering of local government, which takes the necessary responsibilities for sustainable urban planning and collective efforts of society, as well as proper city planning and infrastructure. Sustainability is the ability to be permanent. However, while providing this capability, productivity and

continuity of diversity should be ensured, as well. Sustainability for Gaziantep is the ability of the city to forward its rich cultural heritage to future generations.

4.4 Steps of Feasible Earthquake Master Plan for Gaziantep

It consists of 3 main parts;

- What to do before earthquake
- What to do during earthquake
- What to do after earthquake

Before starting to studies on Gaziantep Earthquake Master Plan, deriving lessons from earthquakes heavily damaged occurred in Turkey and seting out positive and negative ways will help in determining the needs to be done.

The following steps are outlined and the stakeholders of each step must be identified (Stakeholders in Istanbul Earthquake Master Plan and Earthquake Master Plan Roadmap Workshop).

What to do before earthquake;

1. Determination of seismicity of Gaziantep and seismic hazard analysis: It involves tectonic, geological, geophysical, geotechnical and microzoning studies. Compiling all kinds of geological, geophysical, geotechnical, seismological and tectonical data made in city.
2. Building inventory for whole city in detail and determining earthquake resistance. Building inventory must be carried out on a building basis in site. It should include information about construction year, type of construction and number of floor. With the determination of the construction year, it will be possible to classify the buildings before and after the last earthquake regulation. The building inventory will include historical buildings, bridges, roads, infrastructure inventory and information on buildings such as public institutions, hospitals, schools and airports.
3. Risk analysis: It includes the calculation of economic losses and loss of lives after composing earthquake scenario and plotting risk maps. This includes scientific studies including the determination of faults that may occur

earthquakes and the creation of scenario earthquakes by calculating earthquake magnitudes.

4. Determining of risky structures, improvement and strengthening of these structures by developing suitable methods and implementing them quickly or demolition of these structures. Urban transformation projects are carried out in this step. In addition to the technical point of view, the social dimension must also be taken into consideration and projects that will easily adapt to the new life of the people should be created. In this step, legal studies and financial resource studies are also important.
5. Determination of population density: The number of people living in buildings will be recorded as a result of determining day and night population density.
6. Providing disaster management trainings, organizing public events to expand disaster awareness. In this step, studies should be planned with the aim of reaching every person in the society. Schools should be included in the trainings. The importance and repetition of the exercises should be ensured. Public announcements of the meeting areas are also included in the disaster management step.

What to do during earthquake;

1. Planning of emergency response and rescue teams, making an emergency action plan:
    - ❖ Determining priority fields
    - ❖ Planning of intervention for rescue teams
    - ❖ Determining additional team needs in nearby cities.
2. Organization of damaged structure record
    - ❖ Sequencing of damage assessment, setting priorities
    - ❖ Leaving of heavily damaged buildings and planning demolition works
    - ❖ Determining the secondary effects after earthquake such as fire, landslideand cave collapses and taking precautions.
3. Provision of living services
    - ❖ Providing health services
    - ❖ Planning to support food, clothing, warming and shelter needs
    - ❖ Making communication networks serviceable quickly

- ❖ Providing security services for earthquake survivors and victims
- ❖ Burial and registration of people who passed away.

What to do after earthquake;

1. Providing temporary accommodation
2. Activation of electricity, water and transportation needs
3. Planning and construction of permanent houses
4. Debris removal works
5. Starting works to eliminate the psychological effects of earthquake
6. Demolition of damaged structures
7. Ensuring the use of structures that are reported to be reinforced after strengthening
8. Assessment of disaster management and taking precautions to take lessons from disaster.

All the things to be done before the earthquake are the steps to minimize earthquake damage. And each of these steps outlined above includes scientific data and the current situation of the city. The mapping of the existing caves in Gaziantep must be done and should be included in the plan as a special section.

A special study should be prepared for Organized Industrial Zone considering the differences in structures and problems such as fire, chemical explosion that may arise due to earthquake. The applicability of the actions to be taken before will ensure that the actions to be taken during and after the earthquake are not very damaged and compelling. The applicability of the actions to be taken during the earthquake will be ensured by aligning it with the existing Provincial Disaster Response Plan.

CHAPTER 5

CONCLUSION & RECOMMENDATION

5.1 Conclusion

In this thesis, earthquake master plans in Turkey and works to guide for preparation of the earthquake master plan were examined and the steps that must be included in the content of a feasible earthquake master plan specific to the city of Gaziantep have been put forward. The similar and different points of current studies (IMO, 2018; Arayıcı and Çiftçi, 2018), work packages, durations, details in the contents, and the complexity of the study fields were taken into the consideration. When the studies are examined, it is one of the most important details to determine the users of the master plan for Gaziantep and to include this clearly in the results. While forming the steps of Gaziantep Earthquake Master Plan, the contents of the existing plans and applicable and non-appicable parts of these plans were shown regard. It is essential that the plan be applicable, while the principles of preparing Gaziantep Earthquake Master Plan are put into practice. The biggest factor in the fact that existing master plans cannot be fully implemented is that they require the implementation of very large scale urban transformation projects. Financial resources are also very important for this issue which may be a social problem. In addition, it is also important to ensure their currentness by taking into account the changing earthquake regulations. The plan should be practical, easy to understand, applicable and intrinsic to city. The resulting master plan will be a clear plan that can be used by public institutions and organizations, non-governmental organizations, local governments, engineers and architects. The first step to be taken with this awareness is the establishment of the Earthquake Master Plan Preparation Commission. The urgent establishment of a committee of experts, which conduct the project management, by public institution or non-governmental organization undertaking the preparation of the plan will ensure a controlled beginning. The fact that the project management team is at the top of the organization chart and is coordinated with each group until the plan is concluded

proves that preparing a master plan is not only a technical work but also a project management work. It is the most important factor that the persons in the management scheme to be formed approach the plan from the point of view of applicability. The studies conducted in the recent years show that the purpose of creating society with higher level of awareness is attached importance by managers. The existence of a comprehensive geological study in Gaziantep and the preparation of a preliminary report to be the basis of the earthquake master plan indicate that the preparation of the Gaziantep Earthquake Master Plan is one step closer to the result. In the research conducted within the scope of this thesis, examining all the reports of the city and choosing the ones that can be used in the principles of the Earthquake Master Plan means that the evaluation of the data at the beginning of the plan. When the budgets of the existing plans are examined, it is very important to search for financial support when determining the steps for the master plan. The most realistic budget will be set by the new studies to be done by eliminating the current data. Particularly for building inventory, critical studies will be required on site and building basis. The fact that there is no realistic information about the structures other than TURKSTAT data shows the importance of adding the information of the structures made to date to the archives.

When the congresses, conferences, symposiums, panels and workshops organized in Gaziantep are taken into consideration, a perspective has been formed in order to spread the importance of being a heightened awareness society and to create conscious mass. This perspective is of course formed by authorities in the city administration and non-governmental organizations and occasionally by university collaborations. In fact, the end point of all studies is being a sustainable society. Sustainable societies are the societies with high sensitivity, resistant to disasters and negativeness, and getting up quickly after any usual or unusual events.

5.2 Recommendation for Future Work

Keeping up-to-date of Gaziantep EMP is provided by processing the new zoning plans and any new data in the preconditioned electronic system. An active organizational team should be established to follow this process and communicate with all stakeholders. An applicable earthquake master plan can only be provided by this way. Subsequent to the objective of this thesis has been achieved, a path towards the preparation of the “Disaster Master Plan” should be followed. The absence of a disaster

master plan in Turkey will prolong the process. However, the disaster master plan to be present will be taken as an example by other cities. It is the organization team that will put forward the facing problems in Gaziantep in order of priority. If this team, which will also work for the solution of the problems, ensures that collaborative works are carried out with local government, universities and non-governmental organizations, each work will be the step for next. Consequently, this will make a city which makes more effective plans through collaborations.

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