



# Earthquake and Flood Disaster Management Regulations in Turkey

Esra Dobrucali<sup>1</sup>, Ismail Hakki Demir<sup>2</sup>

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**Abstract:** Natural disasters are known as natural events that usually abrupt and occurs in certain periods, cannot be stopped, causing loss of life, destruction of property and the environment and affecting negatory social life and economy. In the last quarter of the past century, “Response” and “Recovery” activities were the reactionary efforts of minimizing the losses caused by natural disasters. Since the beginning of this century, they share their place with proactive efforts as Risk Assessment, Mitigation/Prevention and Preparedness. Due to these developments, to coordinate and arrange the disaster management initiatives and activities, several laws were issued, new institutions were set and new plans and strategies have been developed. In this study, the endeavors like researches, planning and settling strategies to minimize the negative consequences of natural disasters, particularly earthquakes and flooding, are classified in the legislative context.

**Index Terms**—Disaster Management, Earthquake, Flood, Prevention Policies

## I. INTRODUCTION

Along with that enforcement of consumption with the mass production occurred during and after the industrial revolution process and development of tools and engines based of steam power led to increase of expansion of the people to the earth surface and big social changes occurred, it also led to fast increase of population of the cities that were the production centers and therefore formation of fast structuring in the central settlement regions. One of the reasons of that natural disasters occurred in the settlement areas such as earthquake and flood lead to much more losses of life and property at a higher rate today compared to the past was unhealthy structuring that is aggregated in the cities that are fast growing in an uncontrolled way. Along with that, it is known that we have no a high effect and power at the point of prevention of the disasters. But it will be possible to minimize the losses of life and property which are the results of the destructive disasters by development of the respect, communication and cooperation required by the understanding of gregariousness, formation of plan and strategies based on scientific

researches and putting the various regulation provisions into effect.

The studies that lead up being subjected to less effect than the previous one or not being affected in case of repetition of these disasters by making the analysis of natural disasters occurred in the world are called as “Disaster Management” [1]. Today, the pre-disaster (proactive) studies such as decrease of losses-damages, preparedness, early warning, estimation and understanding the disasters in the places subjected to the disaster are defined as “Risk Management” in the understanding of Disaster Management; after-disaster studies such as definition and analysis of the effect, intervention, improvement, restructuring are accepted as “Crisis Management” [2,3]. Within this context, Disaster Management studies are accepted as cycle and cover all activities including pre-disaster, during disaster and after-disaster [4].

In parallel to the developments regarding to this subject in the world, these may be defined as positive developments devoted to prevention of negative results of big scaled natural disasters that may occur in the future that the terms such as “Protection of Natural Sources”, “Sustainable Development” and “Disaster Management” are in demand, international meeting organizations, agreements concluded and precautions taken.

<sup>1</sup>Esra Dobrucali works at the Engineering Faculty, Department of Civil Engineering, Sakarya University, 54187 Sakarya, Turkey (email: eeken@sakarya.edu.tr).

<sup>2</sup>Ismail Hakki Demir works at the Engineering Faculty, Department of Civil Engineering, Sakarya University, 54187 Sakarya, Turkey (email: idemir@sakarya.edu.tr).

## II. DEVELOPMENT OF DISASTER POLICIES IN TURKEY

The death numbers and natural disaster numbers as a result of the earthquake and flood natural disasters occurred in Turkey between the years of 1900 and 2015 were taken from “The International Disasters Database”. These data are given at Table I. When death rates are reviewed according to the data given in the table, approximately 97% of the people died due to natural disasters in the last 115 years lost their life because of earthquakes. Also approximately 48% of the natural disasters occurred in our country since 1990 were formed from earthquakes, 25% were formed from floods and remaining part was formed from other natural disasters. In this paper, the disaster policies implemented in Turkey were taken under the titles of earthquake and flood based on the data in the below table.

TABLE I  
EARTHQUAKE AND FLOOD DISASTER AND DEATH  
NUMBERS IN 1900-2015 [5]

	Total Disaster Number	Total Disaster Percentage	Total Death Number
Earthquake	77	48%	89231
Flood	40	25%	1350
Other	43	27%	1533

### A. Earthquake Disaster Management Regulations in Turkey

A law no 3773 concerning to the Structures to be Constructed for the Sufferers in Erzincan and in the Regions Affected from Erzincan Earthquake was made for the first in 18 January 1940 due to that loss of life was too much in the earthquake occurred in Erzincan on 1939. But after it was understood in past five years that damage of the earthquakes may not be prevented with the precautions taken after the earthquake, the Law No 4623 Concerning to the Precautions to be Taken Before and After Earthquakes was made in 18 July 1944 devoted to decrease and prevention of disaster damages [5]. The Empowering Act No 4452 Concerning to the Regulations to be Done Regarding to the Precautions to be Taken Against the Natural Disasters and Recovering the Losses Occurred Due to the Natural Disasters was published in the official gazette in 1999. In this law, the principles of preparing a security system with the aim of recovering the damages of natural disasters and constructing earthquake resistant structures in all over Turkey were mentioned [7]. The Disaster and Emergency Case Management Presidency No 5902 was established in 2009 [8]. It was aimed to recover the financial harms occurred on the buildings due to earthquake with the Law No 6305 Concerning to Disaster Insurances in 2012 [9].

### Development Plans

The development plans in 5 years period were prepared by R.T. Ministry of Development since 1963. When these plans were reviewed, it was seen that there was no an assessment

or object regarding to the earthquake disasters in the first three published development plan. In 4th Development plan prepared for 1979-1983, it was mentioned that reinforcement of the structures available in the earthquake regions at that period are to be increased and special standards are to be applied to the buildings to be new constructed. In the 5th development plan prepared for 1985-1989, subject of earthquake disaster was mentioned. By using ‘‘earthquake resistant building term in the earthquake regions in the 6th development plan prepared for 1990-1994, the necessity of using a technology having this kind of specification was mentioned. In 7th development plan prepared for 1996-2000, it was mentioned about that studies devoted to preparation of earthquake maps, prevention of natural disasters and decrease of damages would be carried out. In 8th development plan prepared for 2001-2005, financial and material damages occurred due to earthquake and improvement studies done were mentioned by assessing the current status after 1999 Kocaeli earthquake were mentioned. It was stated that unlicensed construction stock adversely affect the precautions to be taken against earthquake and other disasters and amendment is to be done on the code concerning to the infrastructure constructions in the risky regions. By giving place to importance of location selection for dwelling and inspection and the laws concerning to this subject were not effectively implemented, it was stated that an effective building inspection system would be formed. It was mentioned about that integrated disaster maps would be prepared for the whole country. Also it was stated that zoning plans would be prepared by taking the disaster risks into consideration. In 9th development plan prepared for 2007-2013, an assessment and a target devoted to earthquake disaster was not given place. In 10th development plan prepared for 2014-2018, it was mentioned about that Disaster security law devoted to the financial harms occurred on the buildings due to earthquake was put into effect in 2012 and implementation of this insurance at other disaster types would be made widespread.

Also by stating in this plan that the studies concerning to risk decrease regarding to the disasters, preparedness and improvement at the end of the disaster had been still continued, preparation of National Earthquake Strategy and Action Plan and National Disaster and Emergency Case Intervention Plan were given place [10].

### AFAD- National Earthquake Strategy Action Plan (UDSEP)

National Earthquake Strategy Action Plan (UDSEP) was prepared by AFAD with the aim of decreasing damages and effects of the earthquake and taking necessary precautions. This action plan includes the targets between the years of 2012 and 2023 under three main titles and strategies and actions that are required to be applied for fulfilling these targets. The information at Table II, III. and IV are supplied from AFAD website.

TABLE II  
UDSEP- TARGET AND STRATEGIES DEVOTED TO LEARNING EARTHQUAKES [11]

Target	Strategy
Development of Earthquake Information Infrastructure	1 Coordination of RE&DE studies concerning to earthquake information infrastructure will be provided and prior RE&DE fields will be determined and supported.
	2 Earthquake Data Bank will be established and its function will be made sustainable.
	3 The earthquake observation networks will be developed.
	4 National earthquake pre-damage forecast and early warning system will be developed.
	5 By assessing the earthquake efficiency, the managements and public authorities will be notified from a single center.
	6 Prevention of info pollution before and after all disasters as mainly earthquakes will be achieved and public will be given right information.
	7 Tsunami early warning system will be established and adaptation to the systems in other countries will be provided.
Earthquake Hazard Analyses and Development of Hazard Maps	1 Studies concerning to a basis for regional and local earthquake hazard maps will be done and hazard maps will be prepared.
	2 The basis for earthquake risk analyses and earthquake scenarios will be determined.

TABLE III  
UDSEP- THE TARGET AND STRATEGIES DEVOTED TO SAFE EARTHQUAKE SETTLEMENT AND STRUCTURING [11]

Target	Strategy
Earthquake Safe Settlement and Structuring Resistant to Earthquake	1 Importance and priority will be given to the regulations that takes earthquake hazards and risks in the planning, environment and urbanization studies into basis.
	2 As mainly schools and hospitals, building inventory will be issued in Turkey and current structures will be grouped by taking their damage visibilities and risks into basis.
	3 The studies including design, material and standards of the buildings resistant to the earthquake will be supported.
	4 In order to that current earthquake engineering laboratory will give more efficiently and as open to everybody, a coordinated system will be established.
	5 The current earthquake code Eurocode will be followed, updated and developed.
	6 The earthquake safety that takes construction technology and practices in Turkey concerning to vital inbuilt and superficial distribution systems (pipe, natural gas, electric, communication, etc.) as well as bridge, viaduct and transportation systems into basis will be determined and methods for reinforcing the structures will be developed, standardized and applied.
	7 Interservice training of the personnel who works in the construction sector will be achieved.
Protection of Historical and Cultural Heritage from Earthquakes	1 Development and extensification of technical information devoted to determination and development of earthquake safeness of historical structures will be achieved.

TABLE IV  
UDSEP- TARGET AND STRATEGIES DEVOTED TO COPING WITH EFFECTS OF THE EARTHQUAKE [11]

Target	Strategy
Carrying Out Training Concerning to Earthquakes and Other Disasters and Activities For Raising Awareness of the Public	1 It will be allowed for that managers and decision makers who are interested in Disaster and Emergency Case management will come to a consensus.
	2 Number of expert disaster managers will be increased and development of disaster management training will be provided.
	3 In the provinces that are subjected to big earthquakes, earthquake museums will be established.
	4 The Disaster Volunteerism System will be established.
With the Aim of Making the Earthquake Strategy More Integrative and Effective, Making Regulation Arrangements	1 While preparing a new law draft concerning to disasters, effective use of current laws and regulations concerning to the earthquake will be provided.
	2 National Disaster Strategy and Action Plan will be prepared.
	3 For risky individual groups, a special arrangement will be done.
	4 Obligatory Earthquake Insurance will be expanded.
	5 Studies for forming a new financing model will be done.
Allowing for Intervening to the Earthquakes and Other Disasters on Time, Fast and Effectively	1 After disaster intervention system will be developed.
	2 Health organization in the disasters will be strengthened.
	3 Information sharing and cooperation at hazard determinations will be developed.

### *Integrated Urban Development Strategy and Action Plan (KENTGES 2010 – 2023)*

In the Integrated urban Development Strategy and Action Plan that was prepared by Ministry of Environment and Urban Planning, pre-disaster preparations were focused on for forming sustainable urban progresses after 1999 Marmara Earthquake and the necessity of its integration with the structural planning with the aim of eliminating/decreasing the disaster hazards was expressed. By mentioning about that urbanization contrary to the zoning

are seen in the natural disaster regions primarily earthquake and flood and the cities do not have sufficient preparations for the disasters mainly the earthquake, the necessity of making pre-disaster “protection” and after disaster “intervention and improvement” studies and affixing these to the regulations was mentioned. Also in this plan, a target under the title of Decrease of Disaster and Accommodation Risks against disaster risks was determined. These strategies that are put forth in order to achieve this target is as follows:

- Making regulation arrangements in order to make the disaster management as integrative,
- By determining the disaster hazards, making studies devoted to decrease the risks formed from these hazards,
- Arranging the regulation concerning to urbanization and planning by making disaster risk analysis and prevention planning,
- By supporting the emergency communication infrastructure for an effective intervention against disaster, establishing facilities such as emergency support centers [12].

#### *The Regulations Prepared Concerning to the Structures to be Constructed in Earthquake Regions*

In the Code No 4623 published in 1944 Concerning to the Precautions to be Taken Before and After Earthquakes, the necessity of determination of the regions of the country that have earthquake hazard and preparation of obligatory regulation concerning to earthquake for the structures to be constructed in these regions was stated [6]. Within this context, Map of Earthquake Regions of Turkey was prepared for the first time in 1945 with the decree no 2854 [13]. In 1945, Building Code Concerning to Earthquake Regions of Turkey and Code Concerning to the Structures to be Constructed in Disaster Regions were published [14]. By continuing development and arrangement of disaster regulations in the following periods, 1949 Building Code Concerning to Earthquake Regions of Turkey, 1953 Code Concerning to the Structures to be Constructed in Earthquake Regions, 1962 Code Concerning to Structures to be Constructed in Disaster Regions, 1968 Code Concerning to Structures to be Constructed in Disaster Regions, 1975 Code Concerning to Structures to be Constructed in Disaster Regions, 1997 (amended in 1998) Code Concerning to Structures to be Constructed in Disaster Regions were prepared [15]. The Codes Concerning to Structures to be Constructed in Disaster Regions that has been still in use was published in 2007. In 1949 Code, 1st and 2nd degree earthquake regions were determined and an equation with which calculation of earthquake forces affecting the structure would be done was mentioned. In the code that was prepared in 1953, this earthquake calculation was developed by giving earthquake coefficient and live load and coefficients of relevant structure type. Also ground safety stress values were given place. In 1962 code, a formula of which coefficient changes depending on the building height was given for calculation of the earthquake coefficient. With the code that was prepared in 1968, the calculations in the current earthquake code were come close. In this code, ground effect was calculated in detail. In 1972 code, the earthquake regions were divided into 4 degrees. The earthquake force calculation affecting the structure was arranged as it may be calculated with momentum spectrum coefficients. The explanations and rules that gave weight on the partitions and column-beam regions were brought. The irregularities were mentioned in 1997 code. This code has an important place in terms of earthquake resistant structure design [16]. It was foreseen that 2007 earthquake code will be applied to the new structures to be constructed and current structures in the earthquake regions. With this code, intended use and/or

carries system will be changed, before and/or after earthquake performance will be assessed and also provisions to be applied for current buildings to be reinforced will be given place. The changes regarding to the calculations for earthquake resistant structure designs were done [17]. After Van Earthquake in 2011, the law concerning to Transformation of the Areas under Disaster Risk was put into effect in 2012. In this law, improvement, demolition and transformation of the structures under risk were mentioned [18].

#### *B. Arrangements of Flood Disaster Management in Turkey*

The floods are the natural disaster that is most seen in Turkey and leads to most loss of life and property after the earthquakes. The flood is the natural event that the river floods from its natural bed and damages the lands, zoning regions and infrastructure facilities around it and destructs the natural life balance within its effect region and adversely affects the social and economic life. The erosion occurs as a result of destruction of forestry areas and natural vegetation cover in Turkey and instantaneous floods occur. This adverse event growing like a vicious cycle increases flow speed and severity of the instantaneous floods and leads to great amount of soil loss and landslides. Especially the instantaneous downpours that drop on the lands with high incline and without vegetation cover confirm the flood events that lead to high amount of losses of life and property [19]. Also in the regions where meteorological and hydrological conditions of the region are not taken into consideration while preparing urban settlement plans in the urban areas and construction inspection mechanisms do not give sufficient service and bad and irregular structuring are seen, it is indispensable that the flood risk will be high [20]. Production of the policies concerning to prevention of the damages that floods and overflows lead in Turkey and development of the strategies have been maintained since last century.

In 07.04.2016 Dated Village Law No 442 Articles 13/24 and 36/12, the actions that will be taken by villagers and village headmen in case floods raid the villages were mentioned [21].

With 14/01/1943 dated Law No 4373 Concerning to Protection Against Floods and Flash Floods, determination of borders of the fields that may stay under water or may be subjected to the floods with the flood of public and private and closed high level rivers and precautions to be taken were decreed [21].

In 18.06.1949 dated Law for Provincial Administration No 5442 Article No 44, Governor of Sub-district was authorized in the disasters such as floods [21].

18.12.1953 dated Code No. 6200 of General Directorate of Hydraulic Works Concerning to the Organization and Its Duties includes the provisions that regulate establishment, duty, authority and liabilities of General Directorate of Hydraulic Works that is an institution with private budget as bound to Ministry of Forest and Hydraulic Works with the aim of preventing the damages of aboveground and underground waters and/or getting benefit from these [21]. 25.05.1959 dated Code No 7269 Concerning to the Precautions to be Taken For Disasters Affecting Public Life

and Aids To be Done includes the provisions regarding to precautions to be taken in the places of which structures and public facilities are damaged or may be damaged at serious degree that may affect the general life and aids to be done in the disasters such as earthquake, fire, flood, landslide, rockfall, snowslide, subsidence and etc. [21].

11.08.1983 dated Environmental Code No 28.72 was put into effect [21].

At the paragraphs of 23.07.2004 dated Metropolitan Municipality Code No 25531 Article 7, there are provisions concerning to the precautions to be taken against the disasters [21].

In 03.07.2005 dated Municipality Code No 5393 Article 53, there are provisions concerning to that municipality will make necessary disaster and emergency case plans with the aim of being protected from fires, industrial accidents, earthquake and other natural disasters or decreasing damages of these disasters, will prepare the equipments and tools, coordination will be achieved with other emergency case plans in the province if available in the preparation of Emergency Case Plans, necessary precautions will be taken for training of the public within direction of the plans and necessary aids and supports will be given in these regions in case a fire or natural disasters occur outside borders of the municipality [21].

2010 was declared as Mobilization in Fighting Against Floods by Ministry of Environment and Forest.

### III. CONCLUSIONS

With the aim of preventing the losses led by earthquakes and floods which are two big scaled natural disasters lead to loss of life and property in Turkey, so many regulations have been put into effect within the scope of the code since last century. The disaster studies that cover after-disaster intervention and improvement actions come to forefront in the last quarter of the last century has become to be defined as disaster management in general with addition of disaster prevention studies such as risk analysis, strategic planning, etc. to the process cycle. In this paper, a general compilation for the decrees and codes taken within the context of prevention of especially earthquake and flood disasters devoted to disaster management in Turkey was done. The first target of the strategic plans of the country is that the date will be declared by the official institutions as 2023. It is required that integrated Disaster Management will be strengthened in Turkey with all institutions and codes until this stated date. Within this context; although AFAD that undertake the authority and coordination duty in Turkey in terms of Disaster Management is at establishment and development process stage, it shows optimistic developments in terms of raising the public awareness against the disasters and giving training focused on Risk Management, taking part in the national and international projects and producing solutions. As in the developed countries, especially in USA and Japan, it is expected from AFAD to develop cooperation opportunities as a coordinator institution and inclusionary activities in terms of the activities for raising awareness of the public for disasters.

Also it is recommended to start a UTAP (National Flood Search project) like 2023 targeted National Earthquake Research Project will be started for the floods that have the second biggest damage effect in Turkey after the earthquakes.

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**First Author**, Research Assistant Esra Dobrucali works at the Engineering Faculty, Department of Civil Engineering, Sakarya University, 54187 Sakarya, Turkey (email: [eeken@sakarya.edu.tr](mailto:eeken@sakarya.edu.tr)).

**Second Author**, Assist. Prof. Dr. Ismail Hakki Demir works at the Engineering Faculty, Department of Civil Engineering, Sakarya University, 54187 Sakarya, Turkey (email: [idemir@sakarya.edu.tr](mailto:idemir@sakarya.edu.tr)).