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# Development of Disaster Management in Turkey: from 1999 Kocaeli Earthquake to 2011 Van Earthquake

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**Abstract-** The natural disasters that have occurred in Turkey are categorized as % 61 earthquakes, followed by landslides, floods, rock falls, fires and storms. Between the years of 1903 and 2000, there have been nearly 150 earthquakes in Turkey which led to damage and this is a challenge for Turkey. The management and plans of these natural disasters in Turkey were first developed in 1959. In 1999, with the magnitude of 7.4, The Kocaeli and Duzce earthquakes affected a region of Turkey that constitutes % 23 of the country's population. After that, in 2000 necessary laws have been prepared and enacted. On 23 October 2011, an earthquake shook eastern Turkey (Van Province) with a magnitude of 7.2 and same results have been seen for this disaster too. After this, the existing laws regarding disaster management and hierarchy of delegation of authority were updated. This paper examines organizational coordination in the response phase of both earthquakes. A literature research on case study earthquakes were done in the meaning of disaster management perspective and after that a comparison was done to discover technological or systematic usage necessities in disaster management phases. This comparison allows providing some insight about the results of changes in the organizational structure of Turkish disaster management system for providing a new technology or system for coordination. This study also provides original research evidences for scientists to motivate them focusing on lessons learned case studies to improve the current system and to show each small effort can come through with a better disaster response ability for Turkey.

**Keywords** 1999 Kocaeli Earthquake, 2011 Van Earthquake, Disaster Management.

## 1. Introduction

"I am prepared for the worst, but hope for the best".

Benjamin Disraeli

A serious disruption, occurring over a relatively short time, of the functioning of a community or a society involving widespread human, material, economic or environmental loss and impacts, which exceeds the ability of the affected economy by having a potential to create a

crisis, effect environment in this way of polluting or loss of materials and also effect the population that are living the affected area in term of spiritual and educational way.

The early stages of disaster management in Turkey started with the responses to occurrence of past earthquakes from long time ago. It is known that the East Anatolian fault line and the Northern Anatolian fault line exists in Turkey causes over ninety percent of the country to lie in an active earthquake hazard zone. The North

Anatolian transform fault of northern Turkey as a consequence of the westward tectonic escape of the Aegean-Anatolian Plate from a collision zone between the converging African and Eurasian plates [2]. The East Anatolian Fault forms the transform type tectonic boundary between the Anatolian Plate and the northward-moving Arabian Plate.

Therefore, it can be said that Turkey is located in one of the most active earthquake and volcanic regions in the world. Thus, the challenge for Turkey is to be prepared and to minimize losses with proper engineering designs and construction measures. In this regard, proper enforcement of seismic design codes is required. More recently, scholars and authorities looked at lessons to be taken from the recent devastating earthquakes that have occurred in Turkey, which include the 1995 Dinar ( $M_s=5.9$ ), 1998 Adana-Ceyhan ( $M_s=6.1$ ) and 1999 Kocaeli ( $M_s=7.4$ ) and Duzce ( $M_s=7.2$ ) earthquakes [3].

Recent studies conducted by several scientists looked at to identify earthquakes effects on Turkey and how to manage earthquake disasters in Turkey. In short, the previous studies trying to improve the current disaster management system of Turkey. However, our study examines organizational coordination in response to the 1999 Kocaeli / Düzce earthquake and also the 2011 Van Earthquake to show the improvements and developments of disaster management system of Turkey.

The following research questions will be answered:

- What kind of challenges seen in 1999 Kocaeli / Düzce earthquake in terms of disaster management perspective.
- What kind of challenges seen in 2011 Van Earthquake in terms of disaster management perspective.
- Are there any improvements in the disaster management system of Turkey since from 1999 to 2011.
- What kind of recommendations seen as given in the literature.

This study investigates these research questions by focusing on the 2011 Van response, the research compares and contrasts it with the 1999 Kocaeli/Düzce response. Also, comparing of the 1999 Kocaeli/Düzce and 2011 Van/Erciş response operations allows providing some insight about the results of changes in the organizational structure of the Turkish disaster management system to utilize a new technology or system for coordination.

While our study does replicate some earlier research, it is unique in that the dimensions of the presented study analyze the emerged informal network and its deviation from the formal disaster response system. According to the findings from the literature review, timely and coordinated organizational response operations require the integration of organizations from different jurisdictions with different capacities as a complex adaptive system [4].

This research is relevant to practitioners and researchers because the findings may guide them to see the

development of disaster management system of Turkey from 1999 to 2011 and will motivate them to improve the system with a summary of lessons learned from the literature review done.

The literature review of 1999 Kocaeli/Düzce earthquake is given in the section 2. Section 3 describes the 2011 Van Earthquake by explaining the Van earthquake disaster management organizational specifications at that time. Section 4 presents the comparison of two earthquakes in terms of disaster management perspective. The recommendations for improving the disaster management system of Turkey are discussed in Section 5. Finally, the paper ends with the conclusion part of this study.

## 2. 1999 Kocaeli / Düzce Earthquake

The 1999 Kocaeli/Düzce earthquake (also known as the Gölçük earthquake) occurred with a moment magnitude of 7.4 that struck northwestern Turkey on 17 August at about 3:02 a.m. local time. It took 37 seconds and nearly 17,000 people died and almost half a million homeless. The nearby town of Izmit was very badly damaged. Reports from September 1999 show that the 120,000 house is severely damaged by bad engineering, 30,000 homes are heavily damaged, 2,000 have collapsed, and 4,000 buildings have been seriously damaged. In short, as an effect of this disaster, 300,000 people were left homeless after the earthquake. In the economic perspective, the estimated damage amount is equal to 23 billion dollars (US Dollars).

On the other hand, both in the environmental, social and especially economic perspective, the earthquake that happened at the industrialized and densely populated urban areas, including oil refineries, various automotive factories and Turkish naval regions, has increased severity of life and property and had a negative impact on them [5].

Beside this, the earthquake at about 70 kilometers from the main center also caused a massive damage in Istanbul, too [6]. Location of earthquake and the most effected sites can be seen from Figure 1.



**Fig. 1.** The 17 August 1999 ( $M 7.4$ ) and 12 November ( $M 7.2$ ) earthquakes struck the western industrialized corridor of Turkey, Southeast of Istanbul [7].

Many bridges and other structures on the Trans-European Motorway (European road E80), including 20

viaducts, 5 tunnels and some overpasses, have been severely damaged. In the industrial side, the earthquake caused a serious fire in the Tüpraş oil refinery. The fire was taken under control after five days when several tanks and unexplained quantities of the pipelines were damaged [8]. Moreover, the human losses of the earthquakes can be seen from Table 1 according to the effected locations/cities.

**Table 1.** The human losses of the earthquake [9]

Location	Total Population	Number of Injured	Casualties
Bolu	553022	1163	264
Bursa	1958529	348	263
Eskişehir	660843	95	86
Istanbul	8566823	3547	976
Kocaeli	1177379	4149	4083
Gölcük	132857	5064	4428
Sakarya	731800	5084	2627
Tekirdağ	567396	35	---
Yalova	163916	4472	2496
Zonguldak	612722	26	3
Total	15125287	23983	15226

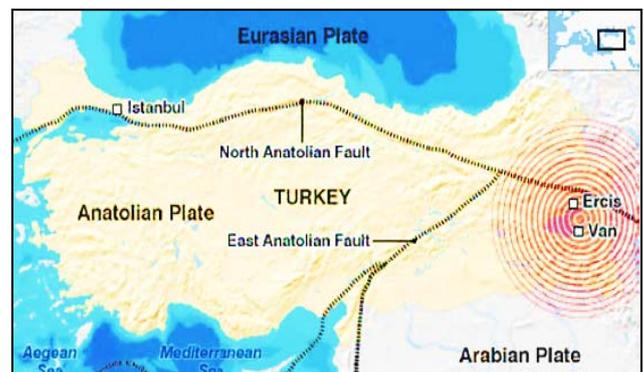
This earthquake has clearly demonstrated that Turkey is in need of a new emergency management plan that is effective from top down, and bottom up. It needs to be created from scratch and practiced frequently. The fact that disaster management in Turkey is highly centralized, hierarchical and downward encourages local initiatives and limits participation in the community and occurred with an ineffective communication and coordination. It is seen that lack of coordination in the first days of 1999 Kocaeli / Düzce earthquake caused serious problems and finally it is understood that the rigid structure of the system is not a suitable form. Communication, coordination and cooperation problems between elected administrators in certain cases and relief operations were appointed. In short, lack of a system for loss estimation at the affected zones, lack of disaster scenarios and disaster operation plans, equipment and material inadequacy and shortage of disaster response trainings before the disaster occurred, has not enable an effective search, rescue and response operations in 1999.

These lessons helped initial rectification of the emergency management system. As a matter of fact, volunteers, government and military people successfully carried out the search and rescue operations of coal miners after about three months from the 1999 earthquake [10].

### 3. 2011 Van / Ercis Earthquake

The Van earthquake (Figure 2) hit an area by Van Lake including Van and Ercis cities as well as some related towns. The earthquake has the magnitude of 7.2 on the Richter scale, epic entered between cities of Ercis and Van on October 23, 2011 at 10:41 (GMT). There were 114 aftershocks with magnitudes 4.0 - 4.9 and 7 aftershocks with magnitudes greater than 5.0 throughout week after earthquake and a daily mean of 180 aftershocks occurred as of December 9 2011. A total of 604 people died and more than 2000 people were injured in Ercis, Van and nearby towns. In the environmental perspective, 28000 properties collapsed or were heavily damaged. Beside that in the economic side, estimations show that total economic losses ranging from 555 million USD to 2.2 billion USD. Especially, natural gas system, water supply systems, power and telecommunications were affected but became functional in 24 hours [4].

It is known that, most people have died due to falling debris and building collapse. From the time of the catastrophe, there were over 4400 search and rescue personnel at the site. The Turkish Disaster and Emergency Management Presidency (AFAD) reported that 18 search dogs were served at the region. In the first three days after the earthquake, many help materials (including about 80,000 clothing items) were distributed to the public by the authorities and organizations. However, the number of shelter seekers is around 148.000, these are probably not enough for the number of people seeking support and shelter. Emergency food came in very quickly, but did not reach all regions immediately. Several mobile kitchens and bakeries were set up but it is possible to 3 meals a day to serve in shelters from third day after earthquake [11].



**Fig. 2.** Van and Ercis are located in eastern Turkey by Lake Van [12].

It is needed to be mentioned that there are important issues in Van and Ercis earthquakes at this stage. Works like preparation and developing the emergency plans, improving the information level of personnel who is given duty and responsibility in these plans by education and application, organization, development and dissemination of search and rescue works, establishing and improving of alarm and early warning systems, supplying first aid materials in regional and local scale are needed to be done

in preparedness stage before earthquakes occurred [13]. In this regards, to apply the most efficient response to earthquakes in the preparedness phase, the local authorities must organize their disaster management team organization structures. 2011 Van earthquake team organization structure is given in Figure 3.

Moreover, it should be noted that the necessary guidelines was applied both before and after the 2011 Van earthquake. But, another problem arising in the application of the guidelines is the reality of the personnel who would have part in this work has been faced with the disaster also [14].

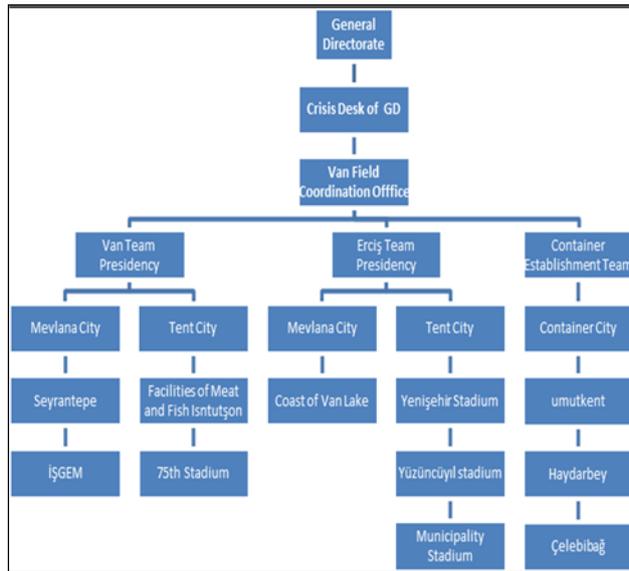


Fig. 3. The Van earthquake team organization structure [9].

During an operation, communications between affected populations and the Red Cross Red Crescent Movement, as well as with media and donors, is an essential mechanism for effective disaster response and the cornerstone to promote greater quality, accountability, and transparency [15, 16]. However, it is hard to say that this phenomenon did manage correctly.

In the affirmative side, based on the needs assessment items to be distributed were identified and included in the operational plan. The total number 986 of Turkish Red Crescent staff was involved in the operation (including volunteers, psycho-social support staff, community staff, and operation based staff) 1,183 vehicles (including rented vehicles and trucks) and 78 airplanes were engaged in the logistics aspects of the relief and rehabilitation operation [9].

In addition, as another positive fact, the Prime Ministry AFAD mentioned that their center was backed up with personnel and equipment to enable working 7/24 that provided effective and successful coordination nationally. Also, Governorship of Van established an emergency phone line and crisis desk for citizens. The governor announced that citizens who could not communicate with relatives could call 122 for to get help and information. The

Ministry of Health transferred the information on the hospitals that injured people were being treated, to the communication center Ministry of Health Communication Centre (SABİM) “Alo 184”, in coordination with Health Disaster Response Coordination Centre (SAKOM). The line 184 gave support to people whose relatives were injured (Greenpeace Report, 2014). DASK (Turkish Catastrophe Insurance Pool) declares number of buildings to be affected 64,081, the number of insurance policies to be 7,228 and ratio of insurance to be 11,28 %. Among the number with insurance policies, approximately 65% have claimed. According to AFAD, the Government of Turkey has allocated approximately \$22,138,586 in Emergency Aid Allowance to the Governorship of Van, to Ministries, to the University of Van and to other institutions to respond to urgent needs [17].

#### 4. Comparison of 1999 and 2011 Earthquakes

After the 1999 Kocaeli and Düzce earthquakes, planning, training and exercises were needed as a mitigation tool for future natural disasters. In this regard, Istanbul Technical University (ITU) and the United States Federal Emergency Management Agency (FEMA) signed an agreement to train future trainers for Turkey. The purpose of the project which is called “ACHIEVE” (A Cooperative Hazard Impact reduction Effort via Education) is to educate a selected group and to train local and central government officials in charge of disaster relations at that time [3].

After these efforts in Turkey, the disaster management system has been highly centralized and is mainly the responsibility of the central government, not the responsibility of the local administration. Furthermore, Turkish Red Crescent Society, General Directorate of Civil Defense, and armed forces also play a major role in rescue and relief operations [18].

On the other hand, after the October 23, 2011 earthquake in Van, it can be seen to have some comparisons with other previous recent Turkish Earthquakes. Some good additional work has been produced by AFAD, Middle East Technical University (METU) and Kandilli Observatory and Earthquake Research Institute (KOERI) [14]. The following observations can be made about Van / Erçiş earthquakes. Firstly, construction plans that are sensitive to disaster planning were not occurred by approving illegal and unlicensed constructions at Van. Also, precautions like designing wider roads and having alternative transport routes and floor heights and towing distance in the construction plans were not considered before the earthquake hit. For this reason, the closure of the roads has limited the opportunities for intervention, first aid and rescue efforts. Compared with 1999 earthquake, it is only seen at Van Earthquake that, a rapid migration started after the earthquake with the interruption of education services, occurrence of unemployment and poverty. This is the other

important issue that needs to be focused on when preparing for disasters. When compared, temporary accommodations for the affected cities, AFAD and Housing Development Administration of Turkey (TOKI) coordinate and organized this time in a more quick and efficient way to solve the housing problems by providing containers at Van earthquake. Huge cities with over 15 thousand houses built for the earthquake victims in Erçis and Van were established. However, in some point it was a little late to be delivered to the victims when compared with 1999 earthquake [14].

When the 1999 and 2011 earthquakes are compared in the meaning of disaster management principles, these positive factors have seen in 2011 Van earthquake response. These are the coordination, the correct authorization between responsible, and the good communication qualities during the earthquake response phase.

Also, the control of the responsibilities is on the correct authorized persons at the local levels. The social media like twitter were used effectively by the university student and the visual media was used correctly for the aid campaigns.

Moreover, it is seen that the correct response was done to the survivors in the meaning of psychological assistance given by the health authorities at the tent cities. The only negative response on 2011 was seen in the caught unprepared of lack of materials, lack of maintenance of the material in the Red Crescent. In addition to this, an unprepared situation is seen in the shortage of foreign assistance and coordination in search and rescues during the Van earthquake. To understand the affects and the responses taken just after the both earthquakes, a general summarized comparison is given in Table 2.

**Table 2.** Comparison of 1999 Kocaeli and 2011 Van Earthquakes in the Meaning of Disaster Management Principles

	<b>1999 Kocaeli Earthquake</b>	<b>2011 Van Earthquake</b>
<b>Intensity of Eq.</b>	7.4 Magnitude	7.2 Magnitude
<b>Affected Human Number</b>	Approximately 300.000	Approximately 3.000
<b>Affected Facilities</b>	Approximately 120.000	Approximately 15.000
<b>Economical loss</b>	23 billion dollars	2.2 billion USD
<b>Affected Regions</b>	High	Local
<b>Factors that cause destruction</b>	Local soil conditions	Building stock status
<b>Earthquake insurances</b>		
<b>Earthquake regulations</b>	Not enough	Building Regulations To Be Done Seismic Areas (DBYBHY 2000)
<b>Transportation</b>	Not enough	Normal
<b>Health</b>	Hospitals are affected by the earthquake too.	Normal
<b>Search and rescue</b>	Untrained staff	Professional Staff
<b>Shelters</b>	Old style shelters	Container cities
<b>Distribution of stores (TR)</b>	Random/ uncontrolled distribution	Regular distribution
<b>Distribution of stores (foreign)</b>	Poor distribution in the storage and same locations	Coordinated distribution, accurate store requests
<b>Technology</b>	Not enough	Good
<b>Rehabilitation</b>	Not enough	Good
<b>Disaster Management Legislation</b>	1. disaster affairs directorate 2. disaster emergency presidency	Gathered under one roof, AFAD 2009

<b>Communication</b>	There was no communication for 3 days There was partial in 3-5 Days	Good
<b>Social media</b>	Not enough	Used effectively, especially Twitter for requests for help

## 5. Recommendations

It must be known that after each disaster some actions have been taken to address challenges and to improve the disaster management systems but they have to be found insufficient in each time and these efforts must continue every day. The issues of control, distribution, and tracking are still the areas to be improved. The renewal of the building stock must continue steadfastly. Using the technology; the control, distribution of stores and helps, monitoring the data, record keeping of in an efficient way should be developed immediately for the response phase. As GIS technology has the ability to upgraded, the desired information can be reached in a short time, and it can be integrated into other systems, it can provide information on the static locations of critical infrastructure and evacuation routes [19], is must be integrated to the disaster management system of Turkey.

In short, today's disaster management systems need real-time information to local governments and communities and enhance decision-making capabilities, during chaotic disaster response operations to be more succeeded at the operations [19]. By using these recent technologies, with help of device people who do the distributions will conduct in more efficient and effective by flow of information and coordination. Finally, deficiencies in realistic exercises must be done periodically by local and governmental authorities.

## 6. Conclusion

Turkey has been exposed to seismic risk for thousands of years and is trying to find a better way to respond to communities that have died since the 1940s. The disaster management system of Turkey has significantly developed from the recovery perspective to effective mitigation, preparedness and response stages. The Kocaeli earthquakes of 1999 represented a mile stone in developing the organizational and technical capacities of the disaster system. However, the critical problem within the system is having a bureaucratic model approach. Despite improvements, central actors seem more effective and local capacity is inadequate. Moreover, the emerging conditions of disasters create a dynamic organizational structure that involves many public, private, and nonprofit organizations from different jurisdictions while the linearly designed formal structure cannot function effectively. Despite changes in the central and local organizational structures of the system since 2009, similar problems still arise in Van/Ercis same with the Kocaeli/Duzce response operations.

In conclusion, it must be said that after 1999 earthquake the efforts to creating safer and improved living environment for people affected by disaster and to take precautions to minimize the effects of disasters by updating the disaster management plan and system of Turkey were seen their benefits at the 2011 Earthquake response.

## References

- [1] IFRC (2017). "What is a disaster?", International Federation of Red Cross and Red Crescent Societies, Retrieved: 21 June 2017. www.ifrc.org.
- [2] Aksu A. E., Calon T. J., Hiscott R. N., Yaşar D., (2000). "Anatomy of the North Anatolian Fault Zone in the Marmara Sea, Western Turkey: Extensional Basins Above a Continental Transform", The Journal of Geological Society of London.
- [3] Ural, D. N., (2001). "The 1999 Kocaeli And Duzce Earthquakes: Lessons Learned and Possible Remedies to Minimize Future Losses", Proceedings of Workshop on Seismic Fault-induced Failures, pp.27–32.
- [4] Celik, S., (2011). "Inter-Organizational Coordination: Analysis of 2011 Van Earthquake", Disaster Resiliency: Interdisciplinary Perspectives, pp.1–30.
- [5] Marza, V. I., (2004). "On the death toll of 1999 Izmit (Turkey) major earthquake", ESC General Assembly Papers, pp.6–9.
- [6] Barka, A., (1999). "The 17 August 1999 Izmit Earthquake", Journal of Science, 285, 1858–1859.
- [7] Reconnaissance Team Event Reports, (2000). "Kocaeli, Turkey Earthquake", Risk Management Solutions,
- [8] Scawthorn, C., Eidinger, J. M. and Schiff, A. J. Edited by Scawthorn, C., Eidinger, J. M. and Schiff, A. J. (2005). "Fire Following Earthquake", ASCE publications, USA.
- [9] Report, F. (2013). "Revised Emergency Appeal Report Turkey : Van Earthquake Final", (October 2011).
- [10] Erdik, M., (2000), "Turkish Earthquakes: Response, Lessons Learned, New Procedures and Mechanisms", pp. 111–124.
- [11] CEDIM, (2011). "Comparing current impact of the Van Earthquake to past earthquakes in Eastern Turkey", CEDIM Forensic Earthquake Analysis Group Report.

- [12] Güney, D., (2012). “Van earthquakes (23 October 2011 and 9 November 2011) and performance of masonry and adobe structures”, *Natural Hazards and Earth System Science*, 12(11), 3337–3342. doi:10.5194/nhess-12-3337-2012.
- [13] Ergünay, O., (2008). “Afet Yönetiminde Kurumsal Yapılanma ve Mevzuat Nedir? Nasıl Olmalıdır?”, *İstanbul Depremini Beklerken Sorunlar ve Çözümler Bildiriler Kitabı*, pp. 97-108, İstanbul.
- [14] Turan, M., (2012). “Lessons Learnt From Van and Erciş Earthquakes 2011, Turkey: An Evaluation of Disaster Management”, 3(22), pp.42–52.
- [15] IFRC, (2011). “Emergency appeal operation update Turkey: Van Earthquake”, *International Federation of Red Cross and Red Crescent Societies (IFRC) Report 2011a*, pp.1–8.
- [16] IFRC, (2011). “The October 23, 2011 Van, Turkey Earthquake (Mw=7.2) and The November 09, 2011 Edremit-Van, Turkey Earthquake (ML=5.6)”, *The International Federation of Red Cross and Red Crescent Societies (IFRC) Report, 2011b*, pp.1–8.
- [17] Greenpeace n.d., (2014). “Situation Report No. 18. Turkey Van Earthquake on 2011”, viewed 28 January 2014, from <http://reliefweb.int/report/turkey/van-earthquake-situation-report-no-18>.
- [18] Peynircioglu, N., (2003). “Disaster Management Policies in Turkey”, *The Disaster Management Model in Turkey, In The Role of Local Governments in Reducing the Risk of Disasters*. İstanbul.
- [19] Chatfield, A, Wamba, SF and Hirokazu, T, (2010). “E-Government challenge in disaster evacuation response : the role of RFID technology in building safe and secure local communities”, 43 *Hawaii International Conferences on System Sciences (HICSS),Electronic Government, Emerging Topics, Koloa, Kauai, Hawaii*