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Usability and Accessibility of Transportation Systems for Disabled People During Emergencies

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The overall aim is to contribute visions for better emergency management plans including the critical infrastructure system for people with disability in terms of usability, accessibility and design standards. The study has been conducting in Kadikoy which is the district that is characterized by being both residential and working zone and on the other hand being present at the historical and the touristic zones of Istanbul.

In the first part, the literature review and methodology are presented. The main research question involves three objectives under itself and the first objective which is indicating the being affected of disabled people from natural disasters have found the answer from literature. Then, the standards which are Turkish, European and international standards which have included people with disabilities have taken part with the explanations and comparisons in literature chapter. The second research question which is highlighting the regulations on transportation infrastructure systems according to needs and requirements of disabled people in case an emergency. To answer this objective, design standards and designed systems have been examined. Finally, the thesis argues that the transportation infrastructure systems from the disability point of view in case study area. The emergency evacuations and disaster preparedness of the district have been highlighted and the participation of disabled people in emergency management plans have been searched to improve the third aim.

L'obiettivo generale è di fornire un contributo per una migliore pianificazione dell'emergenza, che comprende il sistema di infrastrutture critiche, per le persone affette da disabilità in termini di usabilità, accessibilità e standard di progettazione. Lo studio è stato svolto a Kadikoy, distretto caratterizzato dall'essere da un lato, zona residenziale e lavorativa, dall'altro, data la sua collocazione nella zona storica della città di Istanbul, zona turistica. Nella prima parte, la rassegna bibliografica e la metodologia sono presentati. La domanda principale della ricerca svolta è suddivisibile in tre sotto quesiti. Il primo, la cui risposta è stata trovata tramite lo studio della rassegna bibliografica, riguarda la determinazione delle persone affette da disabilità durante un disastro naturale; successivamente, gli standard turchi, europei e internazionali, che considerano le persone con disabilità, sono stati considerati e spiegati nel capitolo riguardante la letteratura usata. Il secondo, riguarda il mettere in evidenza le norme sul sistema di infrastruttura dei trasporti in caso di emergenza, secondo le necessità di persone soggette da disabilità; per rispondere a questo quesito gli standard di progettazione e sistemi già esistenti sono stati analizzati. Per ultimo, la tesi tratta del sistema di infrastruttura dei trasporti, dal punto di vista di una persona soggetta a disabilità, nella zona oggetto di studio. L'evacuazione in caso di emergenza e la preparazione verso i disastri del distretto sono stati sottolineati, ed è stata analizzata l'inclusione delle persone soggette a disabilità nei piani d'emergenza in modo da migliorare il terzo quesito.

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*To my parents,
Anne ve babama,*

1.1 Background Info

The inadequacy of preparedness for almost one billion people in the world who experience different disabilities has been taken place in UNISDR Annual Report 2013 which has been published on the International Day for disaster reduction, 13th of October 2013. According to the reports and researches of World Bank both in the last decades, in 2016 the number of disabled people which are living with different kind of disabilities reaches to one billion that means 15% of the world population. Inside this number, an important proportion of these people, between 110 and 190 million, are face to face with serious disabilities.

In Sendai framework for Disaster Risk Reduction (SFDRR) 2015-2030 has been subjected people with disabilities for disaster risk reduction in terms of accessibility, inclusion and universal design throughout. It makes mention of casualties of disabled people in different disaster from all over the world, development of the framework and how the disabilities were started mentioning in meetings, 'How SFDRR Includes the Needs of Persons with Disabilities'. Working on disaster risk reduction ways, researches and studies should be people oriented and this should be taken into account that the respond to disaster is varied for each person, especially for a person with disabilities. In literature, there are many different explanations for disability and disabled people are entitled in different ways such as affected populations, vulnerable groups, social vulnerable groups, people with impairments, marginalized people and special needs populations.

In the world, people with disabilities mostly have issues with transportation infrastructure systems. Despite the rapidly developing world, the crucial problems have been observed by people with disabilities while getting transportation service [Mashiri et al, 2005]. Because the transportation infrastructure systems have been designed for the abled population and generally they do not concern the people with disabilities [Zhou et.al, 2012]. When being vulnerable to disability and age is considered as a common concept between all individuals, everyone should be taken into account in the design of transportation systems [Naniopoulos, 2001].

Urban public transportation is the essential tool for people with disabilities in order to integrate to the daily life, continue to education, work and live on by themselves and proceed to social life. In this light, design and application of Intelligent Transportation Systems (ITS) have been initiated in the world. ITS consider the challenges and barriers that are experienced people with disabilities and aim to identify the solutions. Being the first place in Canada in 1997 [Mitchell, 1997], other several countries have been started to renovate and upgrade their transportation systems. One of them is Mobi+ which is practiced in France which improves the accessibility of disabled people to the public transportation with Mobi+ card and GPS system used between the bus and the bus stops [Zhou et al., 2012].

Moreover, World Bank introduced ITS and began to give funding for the expansion of this transportation systems in the world. The aim of these projects is to provide improved information to customers, decrease the taxes and costs, improve the communication with passengers, improve the environment, bring into safety, rise the efficiency, usability and accessibility. Although they are more low cost progresses, they regard the people with disabilities and their needs. One of the project has been done by founding of World Bank in Izmir, Turkey which is mainly focused on operational control, real time passenger information on board, developed security, fare collection system and advanced electronic ticket system.

In Turkey, according to Turkish Statistical Institution (2015) the 5 million people have experienced the various disabilities. Although, still in local or in national level the disaster preparedness plans for people with disabilities are not well developed. However, the number of people exposed directly to a disaster in Turkey is 23% of the population [AFAD, 2014]. In many studies and practices which are prepared by universities, organizations or agencies the disabled people are overlooked. In this research Kadikoy, a pilot district in the researches of the Istanbul Metropolitan Municipality, is selected to perform a case study. The importance of Istanbul is located on one of the North Anatolian Fault and in 1999 two catastrophic earthquakes were experienced consecutively which resulted in the loss of the lives of 15 million people and Kadikoy was the one of the most affected districts due to being located near to Marmara Sea. After the enormous losses, the government and the agencies started several researches to understand the consequences and in order to develop the disaster management plans as an outcome of the studies.

The overall purpose of this research is to provide insights for better emergency management plans that are considering the needs of people with disabilities in transportation infrastructures. There are three objectives to be followed in this research as 1) to determine the consequences of the disasters on disabled people in order to minimize the risk occurring due to their handicaps, 2) to analyze transportation infrastructure systems for usage of people with disability in case of a disaster by examining the usability and accessibility of transportation infrastructures with the different design standards and 3) to examine the disaster preparedness plans and emergency management plans, which are prepared after the significant losses in 1999 Kocaeli-Duzce earthquakes in order to decrease the losses for the expecting Istanbul earthquake in the following decades. Although there are many different vulnerability classes in the literature such as mentally, physically and sensory disabled people, elderly people, immigrants, children and socially vulnerable citizens, this research will mainly focus on people with physical, mental and sensory disabilities to prove the reader that having any kind of disability is being at-risk groups in emergency case.

1.2 Research question

The proposed research will contribute to understand the place of people with disabilities in society, to assess their use of transportation infrastructures and to examine their responses to an emergency which can be affected in the case study area. Specifically, the main question is;

How can the transportation infrastructures be organized inside emergency management plans according to the needs and current situations of people with disabilities?

The main question contains three objectives which will be studied in this research and will be answered in view of people with disabilities in the following;

Q1: How are the disabled people affected by the disasters?

Q2: How can the transportation infrastructures can be predisposed for disabled people in any emergency?

Q3: How can the people with disabilities get involved in the disaster risk management plans?

1.3 Scope of the research

The case study has been taken place in Kadikoy, Istanbul in Turkey. As a metropolitan city, Istanbul is subjected in this research as the densest city in Turkey with 2.849 people in each km² while in all the country this number is 104 people/km². On the other hand, Istanbul is located as an international junction of land and it generates the 30,5 percent of all the country while the having GDP 622,762 billion TRY [Turkish Statistical Institute, 2014]. From another point of view, being under the effect of North Anatolian Fault Zone, Istanbul is prone to have catastrophic damages and it can be seen in the history of the city that the several crucial earthquakes had been experienced. There are 39 districts in Istanbul which have their own municipalities and the several mahalles are directed by their own mayors. Kadikoy is one of these districts located in the Asian side of the city. Being near to Marmara Sea makes Kadikoy more prone to the catastrophic effects of an earthquake which has been expecting in North Anatolian Zone. Due to all these reason Kadikoy is selected as the case study area. Moreover, Kadikoy district is preferred due to not only being residential and working zone but also being a port of historical and touristic area of the city. Kadikoy is a dense district in Istanbul with almost 453 thousands of habitants [TUIK, 2016] and 1686 of them have different disabilities (ISEM, 2016). According to ISEM 2016 data, physically, mentally and sensory disabled people who have more than 50% disability rate are taken into consideration for the research. Regarding to the large number of people with disabilities in Kadikoy, in this research the accessibility, usability and insufficiencies of the transportation infrastructures are considered in aspect of the those people. Some interviews were done with disabled people who are taking help from the Municipality of Kadikoy, with associations in this area and with the people who are making researches about different disability groups.

The application of this research targets to advice for organization of the disaster preparedness plans and design of transportation infrastructure systems according to needs of people with disabilities. It is believed that this research will be beneficial for the following works of Istanbul Metropolitan Municipality and Municipality of Kadikoy and the organizations and agencies which are interested in disasters and people with disabilities. The study which has been held by Earthquake Planning and Protection Organization in Greece asserts that not only Turkey but also the other European countries who have the same concerns related with disability are trying to advance the disaster awareness by people who experience the disabilities. In conclusion, the application section will be advantageous for each organization and person who encloses the same concerns.

1.4 Structure of the research

The first chapter, introduction chapter, is an entire empirical argument. It explains the background of the problem, the propose of the research, the research questions, the methodology of the entire study, the assumptions and the scope.

In the next chapter, in order to give to the reader a better understanding about the gap in the knowledge, various definitions which forms the structure of the research, plans prepared by different governments and organizations in worldwide and standards which are used in structural designs will be mentioned. Especially, the vulnerability of the disabled people, accessibility and usability of transportation infrastructure systems, disaster preparedness and management plans, last but not least the standards prepared in Turkey, Europe and by other countries will be pointed out with examples and explanations.

The way of studying and analysis of the research question will be pondered in methodology chapter which demonstrates the collected qualitative and quantitative data about people with disabilities living in Kadikoy district, interviews with them, preparedness plans of the city and Kadikoy which are prepared by municipality and organizations and reports for expected natural disaster. Furthermore, the international interviews and seminars which are ensured gain as well as new aspects have been highlighted in this chapter.

To held the case study, Kadikoy district has been selected in Istanbul. Chapter 4 includes two sections which are current situation, hazard exposure risk of the area and the application that will be performed respectively. The current situation reveals the current situation in Kadikoy by examining the position of people with disabilities in designed reports after 1999 Kocaeli and Duzce earthquakes, transportation infrastructure systems present in the area and the disaster preparedness plans produced by the municipality for an expected earthquake which can affect the whole district. What's more, the second section is the application of the optimization of transportation infrastructure system for people with disabilities in emergency situations and ensuring the participation of disabled people in disaster risk management plans.

In the discussion, chapter 5, the answers of the main research question and three objectives will be discussed and the collected data will be summarized. The work will be explained by starting from the current situation in research area, then the progress and studies from different countries will be inspected and lastly all the developments in transportation infrastructures and in disaster mitigation plans will be integrated into this research.

The research will be finalized in the conclusion chapter with the explanation of the progress the summary of the research.

Accessibility and usability in emergencies are two important norms that affect the life of people with disabilities differently compare to people without disabilities. The literature study has been held under three main principles. First of all, some notions are chosen in order to explain the topic better to readers about people who have experienced the disasters with high losses due to their vulnerabilities, the occurred and expected disasters, the preparation for the disasters and usability and accessibility of transportation systems by use of people with disabilities in daily life and in an emergency. Then, some selected disasters from the worldwide will be under debate to see the effects of the disasters on people without disabilities and people with disabilities. Additionally, standards and emergency management plans, which are prepared as thesis master plan, annual reports and preparedness plans, are analyzed in transportation, disability and emergency point of views.

Secondly, the reason of clarification about people with disabilities does not include only the mentally, physically or sensory disabled people also it counts immigrants, elderly people and children in. These links are planned to explain in a detailed way under vulnerability scale.

Thirdly, people with disabilities will not be taken into consideration only due to their behaviors during a disaster but also they will be figured out in the way of attainability to them, usability of transportation systems during an evacuation and in recovery phases, and also the methods which can be advanced the transportation infrastructures for people with disabilities.

In this topic, these terms will be taken part:

- Vulnerable groups;
- People with disabilities;
- People with disabilities in disaster preparedness plans;
- Accessibility and usability of transportation infrastructure systems by people with disabilities;
- Use of transportation system in emergency;
- Design standards of transportation infrastructures.

2.1 Vulnerable groups

In the last decade, due to the continuous disasters in the worldwide more than 700,000 people died and at least 1.2 billion people injured. The disasters affected people in local and national levels and women, children and other vulnerable people wounded unequally [UNISDR 2015]. This inequality is encountered during the disaster risks for some groups which are more inclined to injuries, death and misery as the result of various hazards [Wisner et al., 2004]. Elsewhere it is mentioned ununiformed effects of the environmental threats on communities, even if being small or large, their accessibility to resources differ in terms of age, gender and ethnicity. From point of vulnerability and adaptive capacity, the diversities are very important for special individuals [Yamin et al., 2005]. While mentioning about nonhomogeneous contact with the vulnerability for some people, who are exposed to higher risk, it can be named as vulnerable population due to having the unfortunate end [Wisner et. Al., 2004].

The people with special needs are forgotten in natural disasters and emergencies. It was noticed lately that women, children, elderly people and disabled people are vulnerable populations to inequity, gender assault and they are neglected to assist support and services that they need [Battle 2014]. In the literature, vulnerable groups are characterized by the social characteristics such as gender, age, disability, health status, ethnicity or race and socio economic conditions [Wisner et. al, 2004] which are named as affected populations, social vulnerable groups, marginalized groups, socially unequal groups, people with immobility and people with special needs.

Diversity between the people due to ethnicity, age, gender, disability and race leads to different exposure levels in same disaster or suffering from the same event. The distinctive exposure levels lead to different responses and sometimes it results in migration of people [Oliver-Smith, 2006]. In the literature, migration has been taken place as immigration and forced migration, which is actualized by authorities as evacuation after a disaster. Guadagno (2016) entitles the migration and displacement as 'human mobility' and adds that vulnerability of immigrants when they experience the disaster is related with language and cultural barriers. Indeed, Gaillard (2012) declared that language is the fundamental barrier for the immigrants. On the other hand, temporary or permanent displacements, migrations, are seen as the result of natural disasters. In the last decade 27 million people in the world lost their houses or were displaced because of hurricanes, floods, earthquakes and other hazards and this number is much more than the number of relocated people in 2013 due to the war. [Goldenberg, 2014]. In contrast, Buckle (2012) points out that evacuation is not a migration although it is a relocation from hazardous areas to the safe places till the emergency finishes.

The first time the disaster had been analyzed for the gender issue in literature by Fothergill (1996). She declares that researchers have been classified women according to their social class, maintaining households' duty and the low statues. In the later studies, it is seen that women have been categorized such as disabled women, immigrant women, older women and women who is maintaining households [Enarson, 2000]. In some developing countries they have been seen as invisible in disaster preparedness and Fordham (2012) explains that in a disaster the inequity will be much more perceived for those women.

Older people are mentioned in the vulnerable group and they are correlated with disability because of loss of their physical, social and mental functions [Prakash, 2003]. Despite the fact that Fernandez and co-workers (2002) analyzed the vulnerability does not depend on the age, it is a correlation between age likelihood having special needs. Because being elderly is considered lack of mobility, dependency

on other people and supplies such as medicines or equipment to preserve the life of people. Due to this fact that the elderly people are more vulnerable in a disaster than younger people. Besides this, elderly people have been widely pointed out in transportation systems with disabled people in order to have same concerns for the use of transportation systems. The obstacles experienced by elderly people are in use of transportation infrastructures such as walking to the station, waiting the transportation vehicle, taking the vehicle, finding a seat, using stop signals and moving off the vehicle. Besides elderly people have difficulties in use of their own cars such as night vision difficulty, not perceiving the signals, not noticing the obstacles and getting tired in long journeys. For these reasons, elderly people are taken place in development of ITS [Naniopoulos, 2001; Mitchell and Suen, 2010]. In the last decade, after many deaths due to being vulnerable the children took place in the DRR plans for occurred and expected disasters. It is seen in these researches that taking voice of children who are affected disasters in DRR plans will give them an access to risk mitigation and emergency management activities, personnel support and it will improve the mitigation progress for others [Mudavanhu et al., 2015].

2.2 Disability

Disability is a component of human status. During a part of the life, permanently or temporarily almost everyone will be faced with it [WHO&World Bank, 2011]. Disabilities can be divided as visible or invisible, gained at birth or during childhood, or in old ages [Rohwerder,2015]. UN Equality Act defines disabled people who have a mental or physical impairment that can affect to perform their daily activities negatively [Legislation.gov.uk, 2010]. The daily activities can be considered as lifting, moving, and carrying the objects, concentration, mobility, physical coordination, eyesight, hearing, learning and protecting themselves from physical danger. U.S. Census Bureau determines the disabled people as people with sensory, physical mental, self-care, mobility and employment related disabilities [Peek and Stough, 2010].

In WHO and World Bank Report (2011) evaluates the number of people who are faced with the disabilities as more than one billion which is equal to 15% of the world population. All people with disabilities cannot be thought as equally disadvantaged. The disadvantageous may differ according to disability type such as people with mental disabilities are seemed to be more vulnerable than physically or sensory disabled people. Besides, people with same disabilities can be affected differently from the same barriers [WHO&World Bank, 2011].

The exposure rate to natural and man-made disasters may be similar for different people but exact vulnerability is conditional to their social, civil and socio economic conditions and access to resources. Because of the inaccessible evacuation, response and recovery phases, people with disabilities are influenced unequally in conflict, emergency and disasters [United Nations, nd].

2.3 Disability and disasters

It is acknowledged that during evacuation in disasters people with disabilities are left behind due to the absence of planning and preparedness, inaccessible transportation and services. The needs of

disabled people are still being overlooked in terms of long term recovery and reconstruction attempts which make the cities and people less resilient to a future event. [United Nations, nd].

People with disabilities were mentioned first time after the fails in 9/11 attacks in New York due to insufficient warnings and blocked evacuation ways [Byzek and Gilmer, 2001] then Hurricane Katrina and Hurricane Rita in 2005 because thousands of people with disabilities were experienced various difficulties during evacuation, transportation, in shelters and accessibility difficulties [LaCheen 2010]. Not only in low income but also in high income countries disabled people are seen as poorest of the poor [Priestley and Hemingway, 2007]. During Hurricane Katrina, the failures of authorities are both not acting appropriately and not giving the priority for vulnerable groups to evacuate firstly [Litman 2006]. In the following, in 2011 Japan Earthquake and Tsunami, The General Secretary of the Japanese Federation of the Deaf Mitsuji Hisamatsu declared that the rate of death of people with disabilities is more than half of the rate of death of whole population [2013]. When the Hurricane Irene happened almost 900,000 people with disabilities were needed assistance and 26% of the shelters were accessible for disabled people [Battle 2014].

Both children and the individuals with disabilities have the same risk of experiencing with disasters' negative aspects. According to WHO&World Bank report (2011) approximately 10% of the children are experienced with disabilities. Children with disabilities have a big percentage of the population in developed and also developing countries. Likewise, they are exposed to disasters more apt and more vulnerably. Also, the response of disabled children to warnings are taking more time [Peek and Stough, 2010]. However, not all the children are equally vulnerable to the effects of the disasters. The effects on children varies according to their age, geographic location, social and personal characteristics [Peek and Stough, 2010]. For example, children with mental disabilities are affected negatively by the warnings while a kid with special needs is having a problem due to not put his/her body under the table [Ronoh, Gaillard and Marlowe, 2015].

2.4 Disaster preparedness and disability in emergency management plans

Preparedness refers to the degree of alertness and readiness of an individual, a household, or a community against an impending disaster. Among many activities, preparedness includes such activities as formulating, testing and exercising disaster plans, providing hazard warnings, communicating with the public and others regarding disaster vulnerability and what to do to reduce it, evacuating people from harm way, conducting emergency response drills, and providing disaster training for emergency responders and the public (Perry *et al.*, 2001).

The main part to be prepared for the emergencies is planning. Plans are made both in national and in local levels to insure the resources, manpower and institutions. In planning and response phases in order to maintain applicable programs for disabled people social services, volunteer organizations and health services should cooperate in civil protection and disability fields [Mechthilde, 2014]. If it is expected that a disaster preparedness plan to address the inequalities for people with immobility in the communities which are vulnerable to disasters, it should outstrip being practical guidance [Priestley and Hemingway, 2007].

Disaster preparedness for people with disabilities came into stage with disaster risk reduction researches after The UN Convention on Rights of Persons with Disabilities in 2006. Mechthilde (2014) expresses the key documents about this topic as;

- The Council of Europe Disability Action Plan 2006-2015,
- Hyogo Framework of Action in 2005-2015

- UNISDR 2013 – International Day for Disaster Reduction

The third Sendai Framework for Disaster Risk Reduction 2015-2030 follows the progress of disaster preparedness researches for people with disabilities. The Sendai Framework for Disaster Risk Reduction (SFDRR) was a human related document and after the second World Conference on Disaster Risk Reduction (WCDRR) it became a disability related document by collaboration with Disability Caucus^[1] [Stough and Kang, 2015]. The SFDRR 2015-2030 declares that in order to implement the vulnerable people in disaster preparedness plans the duty is given to stakeholders in Paragraph 36:

- ✓ Gender sensitive disaster management policies includes preparedness of women in Paragraph 36a-i with managing the disaster and design phases
- ✓ Paragraph 36a-ii is devoted to youth and children in education, curricula and practice phases
- ✓ In the assessment of disaster preparedness plans people with disabilities and their organizations have a big role in design phase (Paragraph 36a-iii)
- ✓ In Paragraph 36a-iv it is mentioned that elderly people must be included to disaster preparedness plans in early warning and design phases
- ✓ Migrants are taken place in design and implementations phases due to their skills and knowledge

Moreover, in Paragraph 19g,

“Disaster risk reduction requires a multi-hazard approach and inclusive risk-informed decision-making based on the open exchange and dissemination of disaggregated data, including by sex, age and disability, as well as on easily accessible, up-to-date, comprehensible, science-based, non-sensitive risk information, complemented by traditional knowledge” [UNISDR 2015].

The important attribute in order to assess and minimize the effect of the disaster from the stand point of vulnerable populations is to advance the preparedness for these people [Bethel, Foreman and Burke 2011]. Smith and Notaro (2015) suggests a method in order to simplify the emergency preparedness substantially for disabled people which is contributing crucial information on preparedness. To protect people with disabilities in disasters, to ensure that the problems are solved in national levels, to deploy the emergency warnings to people who have cognitive problems or who do not understand the local warnings like tourists and visitors some specific organizations, running practical programs are advised [Mechthilde, 2014].

In some countries, which are located in active seismic zones, some approaches are present to be used for people with disabilities in the emergency preparedness. One of them is to do nothing. This is cruel but in the studies done in various countries, disabled people are overlooked. The second approach is providing special services and opportunities to disabled people [Wisner, 2002]. Handicap International (2009) states the second approach of Wisner with a mainstreaming model which highlights the increasing awareness of population about disability; adapting the infrastructure systems, policies, society law and information to environment of people with disabilities; developing tools in order to support the disability issues in DRR, technical support for DRR plans and training of the professionals and actors, measuring the progress on inclusion in DRR and lastly learning and sharing the data, tools, experiences.

In US after various fails in natural disasters, disaster preparedness plans include and focus on people with disabilities such as Individuals with Disabilities in Emergency Preparedness (2005) by Homeland Security, Saving the Lives: Including People with Disabilities in Emergency Planning (2005) and Effective Emergency Management: Making Improvements for Communities and People with Disabilities (2009) by National Council on Disability. In Ireland, for the evacuation of people with immobility the guideline

of Promoting Safe Egress and Evacuation for People with Disabilities was prepared by National Disability Authority (2008).

Since 2007, Earthquake Planning and Protection Organization (EPPO) is conducting a research in Greece in order to include the people with disabilities in earthquake preparedness plans. The project has been started with analyzing the needs of disabled people and nowadays it is conducted with the dissemination activities and earthquake drills for both disabled adults and children with disabilities. Inside this research, a language program named as "*Makaton*" has been developed which is focused on communication disabilities. It involves not only children with communication disabilities due to their diagnosis but also it collaborates with parents, careers, friends and professionals. In addition that, Easy-to-Read guidelines have been prepared as the safety instruction for migrants, people with intellectual disabilities, social difficulties and limited education. The guidelines have been prepared with simple, short, visual and motivating texts by supporting symbols. Easy-to-Read and Makaton projects have been performed in schools for small ages and multi-disability cases [Gountromichou, 2017].

In contrast, various disaster preparedness plans do not contain vulnerable groups even many disasters have been occurred which came to a bad end. When the 'Template of emergency planning for a standard' [Alexander, 2005] is investigated, there are the sections for emergency, emergency management, preparedness, recovery, response and scenario which overlook the people with disabilities. However, it is known that people with disabilities need more time to be prepared for an emergency and the reaction of some vulnerable people like older, blind or visually impaired and deaf people is slower during an emergency situation [Wisner, 2002]. Due to multiple reasons, people with disabilities are less prepared for a disaster with respect to people without disabilities [Smith and Notaro, 2015].

While until 1999 the activities were focused on ad hoc solutions and managements after disasters by the state, the first attempt for disaster risk management in Turkey has been started in 1999, after the significant losses in Kocaeli-Duzce earthquakes and still the covering studies have been conducting by the government. From these studies, the most known is the law which was enacted immediately after Kocaeli-Duzce earthquake (1999) comprises the 'Obligatory Insurance' and 'Building Control' [Balamir, 2002]. Istanbul was the one of the most effected city in Marmara region after the epicenter of the earthquakes. Since Earthquake Master Plan of Istanbul [Ansal, 2003] was developed by the four biggest universities of Turkey which contains the current situation of Istanbul, seismic assessment of existing buildings, urban planning, legal considerations, structural design in pre-and post levels of an earthquake, the plan of the city and the disaster management. In this plan, it is seen that the people with disabilities are mentioned in the process of mitigation and preparedness phases. Indeed, in State of Art in Natech Risk Management (Cruz et al., 2004), Turkey is involved with highlighting the vulnerable areas and infrastructures while the vulnerable groups are not mentioned while the legal researches has started considering the vulnerable population. In 2005, Disaster Risk Management Profile of Istanbul, which is prepared after the effects of 1999 Kocaeli and Duzce earthquakes, includes vulnerable buildings and infrastructures but not vulnerable people. It is seen that the vulnerability concept has been started to be investigated in time. Because, in 2011 the report of Republic of Turkey Prime Ministry Disaster and Emergency Management Presidency (AFAD) for the first 72 hours in earthquake articulates the people of disabilities at before, during and after the earthquake. Moreover, Turkey's National Disaster Response Plan (TAMP) has been prepared in 2015 by AFAD which is in use nowadays. This plan embodies the disaster preparedness for all kind of disasters and objectives of the plan are to define the roles and responsibilities of service groups and coordination units to be involved

in disaster and emergency response interventions and to define the basic principles of intervention planning before, during and after a disaster. The plan sees able-bodied people and people with disabilities equal and there is no specification in the disaster phases.

Since 2015, Turkish Research and Rescue Association (AKUT) has been participating the European Disaster in Urban Centers (EDUCEN) project which has been held in 7 case study cities in Europe with 11 partners and the main idea of the project is based on city, cultures, disaster affected communities and disaster managers. Each case studies focus on an aspect of “city, culture and catastrophe” which is demonstrating that the disaster aspects and disaster-affected people from point of different cultures. Inside this project AKUT performs in Istanbul, the case study of Istanbul, and focuses on the obstacles that can be experienced by people with disabilities in an emergency, accessibility of disaster preparedness plans and their participation in these plans. The case study addresses to bring a new approach which is giving disabled people a hearing; in preparation of disaster mitigation plans in order to display their own vulnerabilities, participating in disaster practices and as the result of this being able to lead a team in the emergency events.

AFAD and Eskişehir^[2] Metropolitan Municipality, started an Erasmus+ Project in 2014 and it is planned to finish in 2020. The Erasmus+ Project on loss reduction is aimed at minimizing the possible risk of people with disabilities in natural disasters. The public advertisements and training programs have been organized by project partners in order to increase the public awareness.

2.5 Considering disabled people in transportation infrastructure systems

In growing and developing world, the main attention is taken by economic growth and employment while the cities are broadening with lack of interest in transportation [Cohen, 2006]. However, during urbanization the main differences between rural and urban areas are telecommunication and transportation. Inadequate access to transportation systems precipitate of incompleteness approach in training, education, health and social services [Rickert, 2001].

Usable, accessible and designed travel information maintain an adequate knowledge to travelers while relocating. Inclusion of people with disabilities in designing of transportation is essential in terms of accessibility of visual information, tactile information, audible information, non-textual visual information and staff training who can assist to disabled people when it is necessary [Mashiri et al., 2005]. Unfortunately, in developing countries the design, planning and construction of the transportation infrastructures do not have the first concern [Roberts and Babinard, 2004]. Bombom and Abdullahi (2016) explains that the great proportion of the challenges of inclusive transportation are appeared when being faced by people with disabilities.

Needs of different disability groups for supplying transportation information and the challenges that are faced by people with disabilities are placed in the following Table 1;

Disability type	Challenges	Needs of transportation information
Physically disabled	Objects on the roads, road surface, road rages, parked vehicles on the roadways,	Accessible information, accessible position of the sign boards

	open holes, drivers without empathy	
Sensory disabled (visually and hearing)	Being overrun by moving vehicles, lack of signs on pedestrian ways, road rages, insufficient or unmended tactile surface, parked vehicles on the roadways, open holes, crossing a busy street, drivers without empathy	Color-contrast information, visual signs with clear and large fonts, short, repeated and simple messages, tactile surface, tactile maps in the stations, audible signs with sufficient volume and understandable language, and maintenance
Cognitive disabilities		Signs with non-text forms and different visual representations
People with multiple disabilities (age)	Lack of signs on pedestrian ways, drivers without empathy	Multiple minor impairments

Table 1. Needs of transportation information and challenges for different disability groups (non-drivers) [Sources: Bombom and Abdullahi, 2016, Mashiri et al., 2005; Table: Author]

The objects, barriers, parked vehicles on the pathways are the common problems which people with disabilities experience. Especially, for visually disabled people because if there is tactile road they follow it and when it finishes in the middle of the way due to poor construction and low maintenance or when there is an obstacle it becomes a great challenge for them. Moreover, the behavior of car drivers with lack of empathy or impatient drivers create a huge chaos for every disability groups. Venter et al. (2002), Maunder et al. (2004) and Bombom and Abdullahi (2016) commented the poor behaviors of drivers which are experienced by people with disabilities. For sensory disability types, the alerting systems, announcements and visual signs are stated as another great challenge. In the past decades, it is easy to find fails due to these problems.

In the last years, much more practices and developments have started on *traffic-based* which considers vehicle movement and on *mobility-based* which includes people and benefits [Litman, 2008]. World Bank is the one organization started a new focus on transportation systems that includes road safety, intelligent transportation systems, accessibility and affordability. Their aim is to build a transportation system in the world which is safer, cleaner, affordable and accessible. Several projects have been dominating by World Bank in several developing countries in Africa, East Asia and Pacific, Europe and Central Asia, Latin America and Caribbean and South Asia in order to generate new systematic, selective, focusing on ending the poverty and take account of the needs of people with disabilities. Intelligent Transport Systems (ITS) are the utilization of advanced technologies such as sensors, communications, computing and controls also ITS maintains the safety and efficiency both for drivers and for travelers. In the world, elderly population, which is 60 years or over, is estimated to be 56% of the world population between 2015 and 2030 (UN, 2015) while 15% of people have severe disabilities in the world. Design of ITS has been produced to fill the lack of efficiency and safety of transportation infrastructures for use of these people.

Several countries are using guidelines and standards for different parts of the transportation systems like building environment, service and different public transport services. These guidelines contain

information about non-slippery firm surfaces, maximum gradients on ramps, space for wheelchair users, design of handrails and markings for people with visual and hearing impairments [Babinard et al., 2012] however they are only low cost treatments and not incomparable with the advancement in transportation systems of developed countries. For this reason, World Bank supports developing countries with the projects and founding in order to implement Intelligent Transport Systems to existent transportation systems.

2.5.1 Accessibility of transportation infrastructures for people with disabilities

The expression of accessibility can be done as person accessibility or place accessibility [Chang, 2002]. Accessibility is defined with synonymous by Iwarson and Stahl (2002) as 'approachable, at hand, available, attainable'. The term should combine the access to the physical, social and economic environments as well the mobility requirements in community [Bombom and Abdullahi, 2016]. Stough and Kang (2015) express mobility involving both physical access of transportation infrastructures during evacuation and communication access during emergency. All these definitions show us the accessibility can be thought as a generic approachability term which is specifically used in disaster topics as accessibility of people, places, infrastructures and resources both by authorities and by other people.

In developing countries accessibility of transportation has not been developed for a part of the community yet. This part of people is categorized as 'transportation disadvantaged' by Bombom and Abdullahi (2016) and they define these people with being dependent to others in order to achieve their needs. Moreover, they add that older people enter to 'transportation disadvantaged' group due to not being able to drive anymore, children are considered as being younger than legal driving age, poor people cannot support the fees of transportation systems and people with disabilities are involved to this group due to their inadequate capacity of using a vehicle.

Having accessible transportation systems in daily life provides finding job, education, access to health services and social activities for people with disabilities. Thus, accessibility in transportation is crucial in urban and suburban areas. Removing the barriers in transportation infrastructures provide benefit both to people with disabilities and also to other travelers such as pregnant women, elderly people and pushcart carriers [Venter et al., 2004]. For instance, the ramps on the sidewalks can be useful also for parents with baby strollers [Babinard et al., 2012].

Recent findings of Venter and co-workers (2004) regarding in barriers of favorable access originate as social barriers which includes high costs, absence of disability consciousness and trouble in communication, psychological barriers which can be thought as a fear of own safety and lastly structural barriers which contain the infrastructure and information obstacles. They exhibit that the social and psychological barriers can be overcome by training of the personal of transportation infrastructures.

In the world, barrier free transportation designs have already started to be conducted, as well the World Bank promotes the progress in developing countries with founding projects which aim the accessible transportation systems and disability-related issues [Roberts and Babinard, 2004]. As the low-cost practices, the curb insets, ramps and tactile ground surfaces have been done in the first place in developing countries [Venter et al., 2004]. In these countries, as the low-cost developments, the transportation systems, the design of bus stops and stations, street crossing and pathways are still being improved. Venter and colleagues (2002, cited by Stanbury and Hugo 2000) trace the solutions

for transportation infrastructure systems and specify that the principal improvement of the accessibility especially for physical disabled people, wheelchair users.

The accessibility of urban public transportation systems should be advanced in order to make better the life condition of people with disabilities since in developing countries the needs of disabled people are not fulfilled in public transportation [Zhou et al., 2012]. For this reason, Intelligent Transport Systems are designed to meet the accessibility requirements of transportation infrastructure systems for disabled people. In France Mobi+ project has been initiated to make accessibility better in transportation systems to satisfy the demands of people with disabilities by using green technologies as well information and connection technologies. This project involves the transportation infrastructures such as busses, trams, subways and trains and also information [Zhou et al., 2012].

Transportation Development Center of Canada has developed ITS since 1995 with the projects which contain communication systems, smart payment cards, wheelchair security, transit buses, audio announcements, emergency alert systems, location of vehicle and involves especially ITS. These services help to disabled people in order to develop the transportation accessibility on board. Moreover ITS has been implemented for pedestrians with visual disabilities by use of audio announcements, guidance systems and visual displays [Mitchell, 1997].

2.5.2 Accessibility in emergencies

Stough and Kang (2015) states that the accessibility in disaster contains both physical approachability of emergency evacuations and access of emergency resources and communication ways. They add that emergency communication during a disaster had the pivotal place in order to supply the necessary and understandable information via media to the populations. Information can create a great difference in emergencies in the light of early warning and evacuations [International Federation of Red Cross and Red Crescent Societies, 2015].

In U.S. media involves people with sensory impairments to access of services. To make the emergency communications accessible closed captioning, different alert systems and sign languages are developed. The design of accessible technology provides accessibility to disaster risk reduction plans for people with disability.

With society support, communication and support networks provide service to vulnerable populations. In each community or neighborhood, there should be the list of people who need support, ways to communicate with them, information of their families and friends who can provide emergency support and information of evacuation route [Litman, 2006]. People with disabilities should have a quick access and use of warning, evacuation, shelters and housing [Mechthilde, 2014]. Because shelters and specific evacuation ways are required by disabled people [Wisner, 2002].

The reason of failing in emergencies which is frequently seen in catastrophic disasters is ignoring the evacuation orders and they finalized with suffering and deaths. It is important to understand the reason of rejecting the evacuation orders. Smith and Notaro (2015) proves the results of their survey which give the reasons for not evacuating such as lack of transportation, lack of trust to public officials, concern about safety of personal, family and property. Some people are ignoring the orders due to the logistical and financial barriers or lack of opportunity of safe place to move, the bad conditions in shelters, and to protect their property and houses [Litman, 2006].

2.5.2.1 Evacuation:

Oliver-Smith (2006) states that evacuation is a response of a physical danger. Evacuation starts with the first alarm of the event and it finishes when the people turn to their homes safely [Buckle, 2012]. In previous researches emergency evacuations have been studied under four forms as protective, preventive, rescue and reconstructive. Protective evacuation is a regional relocation for an undetermined event or an individual preparedness for an undefined event such as hurricane while preventive evacuation is a short-term removal for localized events such as bomb threat, rescue evacuation begins immediately after a short-term emergency and finally reconstructive evacuation takes place after a long-term emergency and pursues the health and safety threats [Christensen et al., 2007 cited by Perry et al., 1981].

Many factors are effective in evacuation design such as type and scale of the emergency [Litman, 2006; Skinner and Robert, 2009], environment, human behavior, procedures [Fong and Ma, 2004], and lastly the time of the incident [Skinner and Robert, 2009]. Larger and catastrophic disasters necessitate to transportation systems for the evacuation to shelters and hospitals while the smaller events require mass evacuation [Litman, 2006; Skinner and Robert, 2009]. For instance, Hurricane Katrina started with a hurricane then it was followed with damage in infrastructure and it finalized with the fail in evacuation and transportation. People who used public transportation systems suffered. While Hurricane Rita transport dependent people had better service but this time they experienced the traffic blockage and problems of fuel supplies. [Litman 2006]. Personal and vehicle capacity is great during the peak hours however during the off-peak hours the equipment and personal adequacy is low and calling back to people is time loss [Skinner and Robert, 2009].

Human is another preeminent factor for emergency evacuations. In societies, people with disabilities are under double threat due to inaccessibility of private transportations [Steinfeld, 2008]. Transit dependent people involves special needs populations and they need assistance in the evacuations [Skinner and Robert, 2009]. The first time in the history, people with disabilities came to stage in 1993 bombing of the World Trade Center by failing in evacuation. Until September 11, 2001 disaster disabled people were not taken into consideration. The National Institute of Science and Technology (NIST) operated a research on 9-11 attacks and presented a report. In the report, after 1993 however some residents of the building provided the evacuation chairs they were less prepared for a real evacuation, people with disabilities were dependent on others for evacuation, 50% of disabled people were delayed to evacuate due to lack of evacuation information in the building and WTC did not have an evacuation plan for people with disabilities [Steinfeld, 2008].

People with disabilities are more vulnerable to harmful effects of disasters and they are overlooked in emergency preparedness and evacuations [Steinfeld, 2008]. Instead of using evacuation systems, people with motor and sensory impairments should be evacuated by the warning of humanitarian workers and first responders. Because people with hearing impairments are not able to receive the evacuation warnings and messages from television or over loud speakers. On the other hand, people with motor disabilities are not able to climb, jump or access to rescue boats in any emergency case [Battle, 2014]. People with learning problems may be late to understand the evacuation order or react in a wrong way due to the confusion [Wisner, 2002]. For the mentally disabled individuals the concept of accessibility contains the assistance for evacuation and the evacuation orders [Stough and Kang, 2015].

In an emergency, people with limited mobility prefer to use escalators instead of using stairs in order to evacuate a multi-story building. In fact, this is the only way for people with disabilities to wait

passively for someone to assist them in order to evacuate the building [Steinfeld, 2008]. If the evacuation has been taking place in a transportation infrastructure, escalators which are operating on the way along the exit direction can be used while the others which are working on the opposite direction can be stopped to use as stairs [Fong and Ma, 2004]. On the other hand, evacuation strategies for people with disabilities will be useful also for people who cannot walk long distances [Stough and Kang, 2015].

2.5.2.2 Accessibility of shelters:

Shelters are designed in order to accommodate people whose daily lives are suspended after a disaster or an emergency. There are four different shelter groups in literature and there are emergency shelters which is public shelter like school or shelter under plastic sheet, temporary shelter which is to be used for few weeks, temporary housing which is nearer to return to normal life and permanent housing which is reconstruction of a new house. [Gupta, 2012].

Shelters and health care facilities should be accessible and barrier free for people with disabilities before, during and long after an emergency in order to provide secured, safe and healthful environment [WHO, 2013]. It can be succeeded with the presence of handrails and ramps, and enough openings that a wheelchair can pass. [International Federation of Red Cross and Red Crescent Societies, 2015]. Americans with Disabilities Act (2007) states that shelters should supply basic needs like food, water and blanket but also they must be accessible for disabled people. The food provided by shelters should be selected according to dietary of people with special needs [Stough and Kang, 2015].

For example, in 2005 after Hurricanes Katrina and Rita, many people with disabilities stayed behind in shelters, made fit into the places and given inadequate materials such as inaccessible bathrooms, trailers without ramps and other equipment with lack of accessibility [LaCheen, 2010]. International Federation of Red Cross and Red Crescent Societies' report '*All Under One Roof*' provides the design standards for accessible shelters. These design rules are;

- Entrance of the shelter should not have any slope;
- The ramp for the entrance should be with maximum 1:10 or 1:12 slope, minimum 90 cm width, non-slip surface and with 5-10 cm curb, if it is necessary;
- Handrails of the ramps should be provided for people with physical or visual disabilities;
- Shaded porch should be minimum 150 cm in order to give ease of turn to a wheelchair user;
- In the entrance, there should not be any barrier and openings must be minimum 90 cm;
- In the entrance, instead of using reflective materials contrasting color should be preferred;
- Inside the shelter enough space should be provided for the turn of wheelchair;
- The thermal comfort should be provided to people with disabilities inside the shelter.

2.5.3 Usability of transportation infrastructures for people with disabilities

In the literature usability is used in different ways and meanings even as a parallel meaning with accessibility. Although the definition of usability is given in International standards, ISO 9241-11.2 :

“the extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.”

Besides when concept of accessibility is considered statements should be formed with personal and environmental components while the concept of usability involves personal, environmental and occupational components [Carlsson, 2004; Iwarson and Stahl, 2002].

Usability is the essential requirement for travelling. Carlsson (2004) delineates the usability as a term which requirements can be achieved by the human performance. Disabled people experience several challenges in terms of usability in daily life and they are performing as safely as possible. The common barriers for people with disabilities in accessibility and usability of transportation systems are described by Mampearachchi and Suman (2014). These are in the buses; narrow entrances, less audible announcements, lack of auditory signals, less openings between the seats, driver attitudes with less empathy, not proper bus stops with not readable or lack of timetable, unattainable handrails, height of bell pushes, unreadable sign boards and lack of stopping place for wheelchair users [Mampearachchi and Suman, 2014, Carlsson, 2004].

Children with disabilities have similar needs when they are using the transportation infrastructure systems. Wheeler and co-workers (2009) shows these difficulties in three groups and they are transportation related, disability related and other. Firstly, transportation related difficulties involve not having a car, lack or absence of transportation, buses which do not serve in time and bus stops located far. Secondly, disability related the transportation vehicle with lack of special mobility equipment and thirdly, other difficulties such as high costs, unwillingness to ask for help, do not want to be dependent on someone else.

While the capacity of the transportation vehicles are not necessary and usable for people with disabilities in current situation, during an emergency it will become more difficult. While a bus carries 50 people in usual time, in emergency due to the luggage of evacuees and wheelchairs or other of disabled people 30-40 people can use the bus [Litman, 2006].

2.5.4 Standards

2.5.4.1 Turkish standards:

These can be used in the design of accessible and usable transportation infrastructure systems: TS 9111, TS 7635, TS 7937, TS 12127, TS 12186, TS 12460, TS 12574, TS 12694. In this research TS 9111:2011 is considered to compare with others due to being the latest published standard containing the needs of disabled people.

- TS 9111:2011

It contains orthopedic disabled people with wheelchairs, people with visual impairments, people with hearing disability and inarticulate, mentally disabled people.

Accessibility is defined as all places and services can be accessed by everyone.

In the buildings (ICS 11.180.01; 91.040.30), the design for emergency plans, evacuation routes and equal exits are in with lifts which are secured for the fire and unobstructed, signings, lights, fire safety and accessible evacuation routes.

In the transportation infrastructures, ramps, lifts and other movement areas should be located to minimize the distances for people with disabilities. In each station and in each route of the station should be designed due to the accessibility rules.

On the sidewalks, the present obstacles should be removed and the sidewalks should be redesigned. The unwelcome vehicle traffic should be discarded and to prevent the car parking on sidewalks barriers should be placed without creating any handicap for visually impaired people.

In the public transportations, for the people with physical disabilities firstly three types of ramps are taken place in the standards. Due to the costs, they can be orders as;

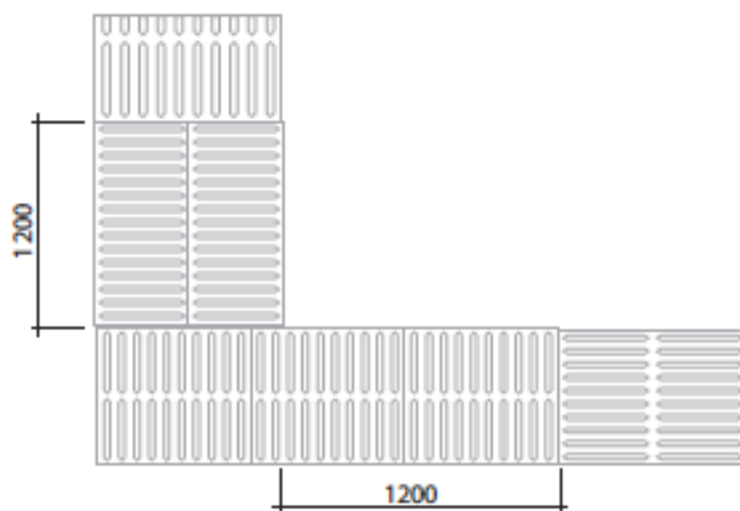
- 1- Portable ramp with hand control: It is kept inside the bus and when needed it can be placed to an appropriate position.
- 2- Foldable ramp with hand control: It can be folded and opened when it is needed.
- 3- Electric ramp: It works with electric, the height and slope can be arranged according to the position.

Secondly, the stop buttons should be placed between 90 cm and 1.2 m above the insole of the bus.

For the visually disabled people, contrary colors should be used for handrails and buttons, voice announcements should be performed for the stations, route and the bus numbers. For the people with hearing impairments, the warnings of 'stop' and station names should be written.

For the people with wheelchair, the doorway wideness should be minimum 75 cm, preferentially 80 cm or more. The floor should be without any obstacle and the wheelchair area should be minimum 1.3 m x 75 cm.

In the subways, to use the vehicles without any handicap the door of the wagon should be on the same level with the platform or there should be an electric ramp. For the people with disabilities, tactile ground surface must be designed.



Picture 1. Turn of the tactile ground surface (Thomas Telford Publishing, 2007)

For the tactile ground surface width is specified as 50 cm in TS 12576.

2.5.4.2 European Standards:

In this research EN 81-70:2003 and EN 115-1:2011 are used.

- EN 81-70:2003:

The standard describes the safety of lifts and mentions about the disabilities with the table in the following;



Category	Sub-category	Characteristics
Physical disability	Impaired Mobility	Need of use -Wheelchair -Walking stick -Crutches -Walking frame -Rollator
	Impaired endurance, equilibrium	Slow mover, poor balance
	Impaired dexterity	Reduced function on upper limbs (arms, hands, fingers)
Sensory disabled	Impaired vision	Blind(stick, guide dog), partially sighted, color blindness
	Impaired hearing	Deaf, hard of hearing
	Impaired speech	Reduced ability and inability to communicate by voice
Intellectual disability	Learning difficulty	Reduced understanding of controls

Table 2. Disabilities included in the scope of the standard [EN 81-70:2003]

The standard gives the door opening of lift as 800 mm and it mentions about 3 types of lifts and their properties on the Table 3.

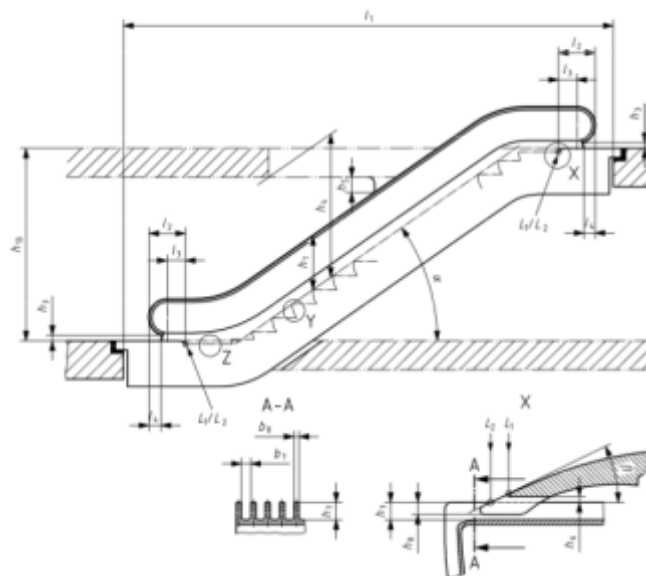
Type of lifts	Minimum car dimensions	Accessibility level	Remarks
1	450kg Car width: 1000 mm Car depth: 1250 mm	This car accommodates one wheelchair user.	Type 1 ensures accessibility to persons using a manual wheelchair described in EN 12183 or electrically powered wheelchair class A described in EN 12184
2	630 kg Car width: 1100 mm Car depth: 1400 mm	This car accommodates one wheelchair user and an accompanying person.	Type 2 ensures accessibility to persons using a manual wheelchair described in EN 12183 or electrically powered wheelchair of class A and B described in EN 12184. Class B wheelchairs are interested for some indoor environments and capable of navigating some outdoor obstacles.
3	1275 kg Car width: 2000 mm	This car accommodates one	Type 3 ensures accessibility to persons using a manual

	Car depth: 1400 mm	wheelchair user and several other users. It also allows a wheelchair to be rotated in the car.	wheelchair described in EN 12183 or electrically powered wheelchair of class A, B or C described in EN 12184. Class C wheelchairs are not necessarily intended for indoor use but are capable of travelling over longer distances and navigating outdoor obstacles. Type 3 provides sufficient turning space for persons using wheelchairs of class A and B.
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Table 3. Minimum car dimensions for wheelchair cars with a single or 2 opposite entrances [EN 81-70:2003]

The standards give place to explanation of ‘accessibility’ which involves people, including people with disabilities, in order to engage in the social and economic life and this approach is based on the universal design principles which can be applied for buildings, installation and facilities, infrastructures and products. The main aim of the standards is building an independent and equal environment for use of everyone.

- EN 115-1:2011: Safety of escalators and moving walks - Part 1: Construction and installation
The standard contains the safety of escalators and moving walks for people with physical and sensory disabilities, particularly wheelchair users and persons with guide dogs.
For the escalators’ step height x_1 should not exceed 24cm while the step depth y_1 is 38 cm and the main design drawings are in the following picture;



Picture 2. Escalator design from the standard [Source: EN 115-1:2008]

Symbol	Designation	Unit
b_1	Distance between the handrail centre lines	m
b_2	Width of the handrail	mm
b_3	Horizontal distance between skirting and interior panel	mm
b_4	Width of the horizontal part of the lower inner decking that directly joins the interior panel	mm
b_5	Horizontal distance between the inner edge of the handrail and the top edge of the interior panel	mm
b_6, b_6''	Horizontal distance between the handrail profile and guide or cover profiles	mm
b_7	Width of the grooves	mm
b_8	Web width	mm
b_9	Horizontal distance between the outer edge of the handrail and a non-continuous obstruction, e.g. roof intersection, column	mm
b_{10}	Horizontal distance between the outer edge of the handrail and a continuous obstruction, e.g. wall	mm
b_{11}	Horizontal distance between the handrails of adjacent escalators/moving walks	mm
b_{12}	Vertical distance between the lower edge of the handrail and the balustrade decking	mm
b_{13}	Width of the lower outer decking	mm
b_{14}	Horizontal distance between the outer edges of interior panels on adjacent escalators or moving walks	mm
b_{15}	Horizontal distance between the building structure (wall) and the centreline of the handrail	mm
b_{16}	Horizontal distance between the centrelines of the handrails of adjacent escalators/moving walks	mm
b_{17}	Horizontal distance of the anti-slide device to the outer edge of the handrail	mm
h_1	Vertical distance between the top of the handrail and step nose or pallet surface or belt surface	m
h_2	Vertical distance between top edge of skirting or bottom edge of cover joints and the line of the step nose or the tread surface of the pallets or belt	mm
h_3	Distance between the entry of handrail into the newel and the floor	m
h_4	Free height above any point of step surfaces, pallets or belt over the area between both outer edges of the handrails	m
h_5	Height of the deflector	m

Table 4. The symbols related with the Picture 2 [Source: EN 115-1:2008]

The width of the grooves, b_7 , shall be at least 4.5 mm and not exceed 7mm.

The depth of the grooves h_7 , shall not be less than 5mm.

The web width, b_8 , shall not be less than 4,5m and not exceed 8mm.

The structural load is calculated from static load 5000 N/m^2 by multiplying with impact factor 1,2 and obtained 6000 N/m^2 .

According to European Standards the height between pavement and bus floor must be less than 5 cm to provide the bus access of people with disabilities. When these conditions are obtained people with disabilities can get in and out the buses without any problems. If there is a high difference between pavement and bus floor three keys can be applied which are rebuilding the pavement, deploying pallets and adapting the bus floors to the height of pavement [Zhou et al., 2012].

	Key words	Turkish Standard	European Standards	
		TS 9111	EN 81-70	EN 115-1
	Accessibility	Defined	Defined	Not defined
	Usability	Not defined	Not defined	Not defined
	Evacuation	Evacuation routes are mentioned.	Not defined	Not defined
	Buildings	ICS 11.180.01 : 91.040.030 is given as reference	Not defined	Not defined
	Sidewalks	Tactile ground surfaces with design standards	Not defined	Not defined
Transportation infrastructure systems	Vehicles	3 types of ramps; portable, foldable and electrical. Stop buttons should be placed between 90 cm and 1.2 m above the insole of the bus. Warnings should be both voiced and visual. Doorway wideness should be min 75 cm.	Not defined	Not defined
	Lift	Not defined	Mainly, 3 types of lifts and their properties	Not defined
	Escalator	Not defined	Not defined	Defined with design standards

Table 5. The comparison of the Turkish and European standards which are studied [Author]

2.5.4.3 International Standards:

ISO 14798:2009 and ISO/TR 19083-1:2006 are shown under international standards in order to support the risk assessment and emergency management aspects with design standards.

- ISO 14798:2009:

This standard includes lifts, escalators and moving walks in risk assessment and reduction methodology. The standard starts with the definitions of risk assessment and safety and it goes on with risk analysis, risk evaluation, mitigation process, reduction of risk and protective measures. In the risk assessment part for the relation of disabled people and lifts in the section 4.c.4 is took place to determine the risk assessment and related factors. Moreover, in the following section the standard contains the estimation of possible danger for people with disabilities and people from different ages.

The main aim of this standard is analyzing the possible risks for users in different hazard scenarios and provides mitigation and protection measures.

- ISO/TR 19083 – 1 :2016

Intelligent Transportation systems are held in this standard in terms of emergency evacuation and disaster response and recovery. Evacuation, response and recovery phases are examined in local, regional and national levels with roles and responsibilities of the related agencies. The overall aim of the standard is saving lives and aid recovery by using Intelligent Transportation Systems. It recommends the decision support system based on emergency management system to assist and coordinate the public transport, services in emergencies and traffic management which contain both the population, first responders and personnel. The standard takes into consideration the all phases of disasters which are before, during and after.

In the standard, the use of public transportation in evacuation and response is explained with planning of evacuation, identification of the need for residents and tourists, transportation dependent people, special facility residents who are in hospitals, nursing homes and prisons, and people in schools, and response. The transport dependent people are classified as people without private vehicles, children, people with driving limitations, people with special needs, people in stations and ports, and population in schools, hotels, restaurants etc. People with special needs are considered in two different aspects; children and adults. In this concept, the standard explains the actions and responsibilities of organizations and agencies in preparedness, response and recovery phases.

3 Methodology of the research

This research, includes both primary and secondary data collection. Primary sources contain the interviews, meeting and seminar information, photographs and questionnaires that have been prepared for associations working on different disability types. On the other hand, the secondary sources involve the articles, selected transportation projects from other countries, selected emergency management and disaster preparedness plans, and standards produced for transportation design for people with disabilities.

- Primary resources:

They are on one hand, qualitative data that is collected as primary source are, interviews with both disabled people and administer in Municipality of Kadikoy Disability Center, reports of attended seminars related with disability and disaster and questionnaires that have been held in different disability associations in Turkey and Earthquake Planning and Protection Organization (EPPO) in Greece. The qualitative data are collected from the interviews in Disability Center such as insufficiencies in transportation systems, medicine use and obstacles can be experienced in case of an evacuation are placed in Table 6. The attended seminars that are asserted in two different boxes gave useful information and opinion about current situations of people with disabilities. The questionnaires done in different disability associations are shown in the following pages.

On the other hand, quantitative data are accumulated from Disability Directorates of Istanbul Metropolitan Municipality (ISEM) in May 2016. In these inputs, some classifications are taken part as stated in gender, home address, disability type, education status, working status and disability rate. These data are represented in Chapter 4 with graphs. The other quantitative data which contain the number of members, types of facilities and usage of the facilities have been provided by Disability Center of Kadikoy Municipality and listed on Table 7.

Disability type	Gender	Working status	Difficulties	Can he/she evacuate a structure alone?	Is he/she using devices or medicines?
Blind	Male	Working in the library of disability center	Using many vehicles between home and work but there is no difficulty because	Yes	No

			his disability rate is less than 50%.		
Dwarfism	Female	Working in the disability center	Avoiding to use old buses because of her shortness. She cannot reach the 'stop' buttons in the vehicles.	Partially. No: if there is door to open or high structure.	No
Mentally disabled and epilepsy disease	Male	Not working	He cannot use the long stairs to pass above the road.	Yes	Yes (epilepsy medicines)
Partially sighted	Male	Not working	No	Yes	No
Parent of 2 mentally disabled children	Male	Not working	Dependency on parents.	No (for children)	Yes (depression medicines)

Table 6. Interviews made in Kadikoy Municipality's Disability Center [Author, April 2016]

- Questionnaire:

The questions asked to people with physical and sensory disabilities are:

- 1- What are the difficulties that you experience when you are using the transportation systems in daily life? Can you categorize according to different vehicles? (e.g. ferry, subway, bus, metrobus and tram lines)
- 2- What kind of attitude and behaviour should be displayed to you in these transportation infrastructure systems in an emergency?
- 3- If you need to make evacuation in an emergency case, under which conditions can you evacuate on your own?
- 4- What do you need mostly during disasters and how should people approach to you? (For example, a person who is with a very heavy wheelchair can specify the chair should not be lifted because it may lead to a physical damage on the person who is trying to help him. What should be the first approach for you?).
- 5- How should be the behaviour of the field personnel in the transportation systems and how can this be improved?
- 6- How should be a 'disaster preparedness process' in which you will be actively involved?
- 7- What are the necessary equipment that you must find in the shelters when you are evacuated due to a disaster? (Drugs and devices can be specified.)
- 8- Is there something you want to add?

The questions asked to authorities in mentally disabled association are:

- 1- What are the difficulties that can be faced by people with mental disabilities in disasters? How should they be approached?

- 2- What are the problems that they face in daily life when they are using the transportation infrastructures?
- 3- What should be the behaviour and attitude towards people with mental disabilities in the transportation infrastructures during an emergency?
- 4- What is the proportion of people who can evacuate on their own if an evacuation is necessary? What should be the behaviour of people who are helping to people with mental disabilities for the evacuation?
- 5- Does the emergency education vary according to the disability rate? How can individuals with high disability rate be reached?
- 6- How can the people with mental disabilities be included actively in disaster preparedness process?
- 7- Which tools and equipment must be found for the mentally disabled individuals in the shelters when they have to be evacuated in a disaster? (Drugs and devices may also be specified.)
- 8- Is there something you want to add?



Box 1. Seminar Report

Educen Webinar (17.11.2016)

It is learned that not all people with disabilities need assistance during and after the disaster and to understand their needs it should be asked to them. Also, it is mentioned that 100% accessibility to people with impairments is not possible and in a big city to reach the evacuation warning is very hard.

Accessibility of disaster preparedness materials by people with disabilities can be hard due to having different impairments and preparing all materials according to disability types may be costly, difficult and boring. But all the information should be available for people with all kind of disabilities.

Lastly, the study which was held by Harvard University students can be useful due to containing both disaster and disability.

<http://www.educenproject.eu>

Box 2. Case Study Istanbul – AKUT (17.03.2017)

The main purpose of the first part of the seminar was to involve the people with disabilities in disaster preparedness plans. The participants from different countries took this topic into consideration with different aspects such as, culture, capacity and obstacles for disabled people. In the second part of the seminar the floor was given to people with disabilities and the disability associations' directors. They mentioned 'How can the people with disabilities be involved to disaster management plans; What is the approach to reach them; How can they have an active role in preparation of disaster management plans?' from disability point of view. They reported especially that people who are helping or working together with people with disabilities should act equally and same how they act to an abled person.

From this seminar, it is learnt that disability is a capacity issue: We are abled up to our capacities. Besides, Sendai Framework, Hyogo Framework, World Disability Report and Handicap International Reports have been mentioned and highlighted to be followed by associations in order to pursue the progress of reports that should be prepared by Turkish Government and associated organizations. In this seminar, author found the chance to follow the progress of disaster mitigation researches in Greece by Earthquake Planning and Protection Organization (EPPO) and to ask some questions about their ongoing projects. These answers will be represented inside the chapter.

<http://www.educenproject.eu>

FACILITIES	ESTIMATED NUMBER OF USE
Disability Center	Number of registered people: 261 (in 2015)
Library	28 people (in 2015)
Door to door taxi	Approximately 5500 times from 350 people (in 2015)
Educational programs	Number of active students : 130 (in 2016)
Getting service (total number)	1032 people (in 2015)

Table 7. Facilities of Disability Center of Kadikoy Municipality [Source: Kadikoy Municipality, March 2016; Table: Author]

- Secondary resources:

These are articles, reports, books, plans, standards and quantitative data from previous researches. Quantitative data collection from the secondary sources have been completed with the documentary analysis which contains both qualitative and quantitative. Qualitative data are collected from previous researches which are completed for various reasons about people with disabilities, infrastructures, usability and accessibility of infrastructures and disaster preparedness. These existing documents are giving a chance to researcher to appreciate the useful aspects of researches and on the other hand, they provide an opportunity to criticize and advance these researches according to attitudes, needs and difficulties experienced or can be came up in an emergency situation. All advanced and developing researches are planned to be considered in this study and they are represented in Table 8. The qualitative documents are collected from the previous studies, international and national articles, plans, online resources, that involve evaluations and strategies about this topic, and hand books which are done by researchers, municipality and organizations in Turkey and in all over the world.

In order to analyze the qualitative data, in literature chapter the key words have been assigned and have been made a table placed in the Appendix. This table has been prepared to classify the articles, chapters of books, design standards, reports by governments and agencies. Disabled people, disabled children, vulnerable groups, transportation, evacuation, resilience, Turkey, examples, emergency planning, fails, ignorance, usability, accessibility, disaster preparedness, literature, infrastructures and shelter are selected as the key words for the categorization of the secondary sources. The main reason of selecting these key words is to organize these sources in order to prepare a structure for the research by staying inside the topic of each chapter. Till now more than 120 articles and 8 books with several standards and reports of organizations are read and studied. On the left side of the table the articles take place and in the following each key word is placed. While reading the articles, all key words are searched and the present key words are specified with 'X' if they are mentioning as the concepts or they are noted with short explanations if they are giving an example or explaining from another point of view. In each chapter, they have been mentioned with different aspects.

In Istanbul Metropolitan Municipality (IMM) and Japan International Cooperation Agency (JICA) report (2002), Municipality of Kadikoy is taken place with being the only municipality in Istanbul where the disaster prevention and preparedness have been developed more. Municipality of Kadikoy is an important example because of performing disaster management with the cooperation of civil organizations and achieving the activities free of charge. In the way of coordination arrangements and practical operations, this municipality is shown in the report who

is managing the best practice in the city. Quantitative data of IMM&JICA (2002) report have been used in this research as the background information about both Istanbul and Kadikoy. The data that have been selected is;

- Scenario Models for Istanbul,
- Number of collapsed and damaged buildings in Kadikoy after 1999 Kocaeli and Duzce earthquakes,
- Vulnerable buildings in Kadikoy which have been built before last 2 building codes,
- Data of streets in Kadikoy,
- Number of critical infrastructures in the area such as schools, medical facilities, fire brigades, police stations and possible hazardous facilities like LPG storages, paint factories, chemical warehouses,
- Infrastructure pipeline data of Kadikoy and Istanbul.

RESOURCES	FORMAT	WHERE WERE THEY TAKEN?	DO THEY CONTAIN PEOPLE WITH DISABILITIES?	SCALE
Disaster Settlement Plan (MAP)	CD -.jpeg and A3 map	Municipality of Kadikoy- Environmental Protection and Control Directorate	No	Areas which will be used in an emergency case
Photos in Subway Stations (Ayrilikcesmesi and Sogutluceme)	.jpeg	Taken by Author with the permission of Ulasim AS	Yes	Developments for people with disabilities
Book (Çaresi Var)	Book	Municipality of Kadikoy- Disaster Coordination Department	No	Preparation of municipality in case of any emergency
Disabled People Information	CD - excel	Istanbul Metropolitan Municipality - Directorate of People with Disabilities	Yes	Types of disabilities, name, status, gender, address, disability rate
Map of Istanbul Subways	.jpeg	Ulasim AS	No	Stations

TAMP (Turkey National Disaster Response Plan)	.pdf (in Turkish)	Website of AFAD	No	Response organizations –roles, duties and responsibilities of every service group and coordination unit taking part in every type of disaster such as earthquake, floods, landslide, avalanches, fires, industrial accidents, mass influx
National Earthquake Strategy and Action Plan 2012-2023	.pdf	Website of AFAD	Partially	National level
Istanbul Infrastructure Analysis Report	.pdf	Web	No	Infrastructure systems of Istanbul
Earthquake Master Plan of Istanbul	.pdf	Web	Partially	Master plan
First 72 Hours in Earthquake for Disabled People	.pdf	Web	Yes	Earthquake Management Plan for Disabled People
The study on A Disaster Prevention / Mitigation Basic Plan in Istanbul (IMM&JICA Report, 2002)	.pdf	Web	No	Local and National level. It contains various data about Kadikoy Municipality.
Kadikoy Earthquake Emergency Preparedness Project	.pdf	Politecnico di Milano	Partially	Only to transport disabled people, one task has been designated.
Usage of facilities	Number	Disabled People Center of Municipality of Kadikoy	Yes	In 2015, new enrollments to center and library. Number of people who got service from center.

Table 8. The collected reports and plans related with the disaster preparedness of Istanbul and Turkey [Author]

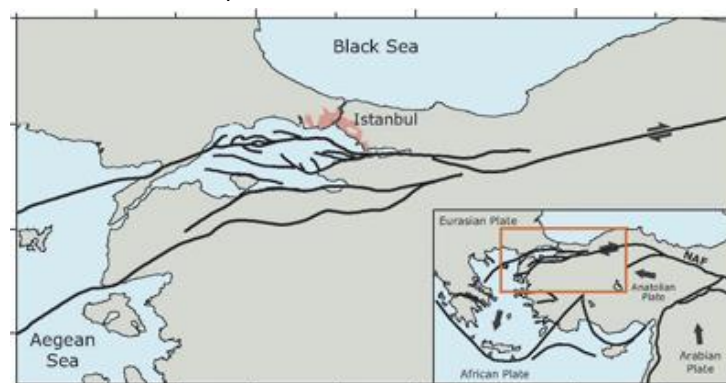
4.1 Background information of Istanbul

Istanbul is the most populous city in Turkey, with estimated population 15 million in 2015 and approximately 400,000 immigrants [TUIK, 2016] for each year who are migrating to find new job opportunities in this megacity. Industry and tourism have still been growing both in European and Asian sides in Istanbul and this is why, it lets in immigrants more than other metropolitan cities. Since migrated people are not aware or informed about the natural hazards in the territory, this makes these people more vulnerable to natural hazards.

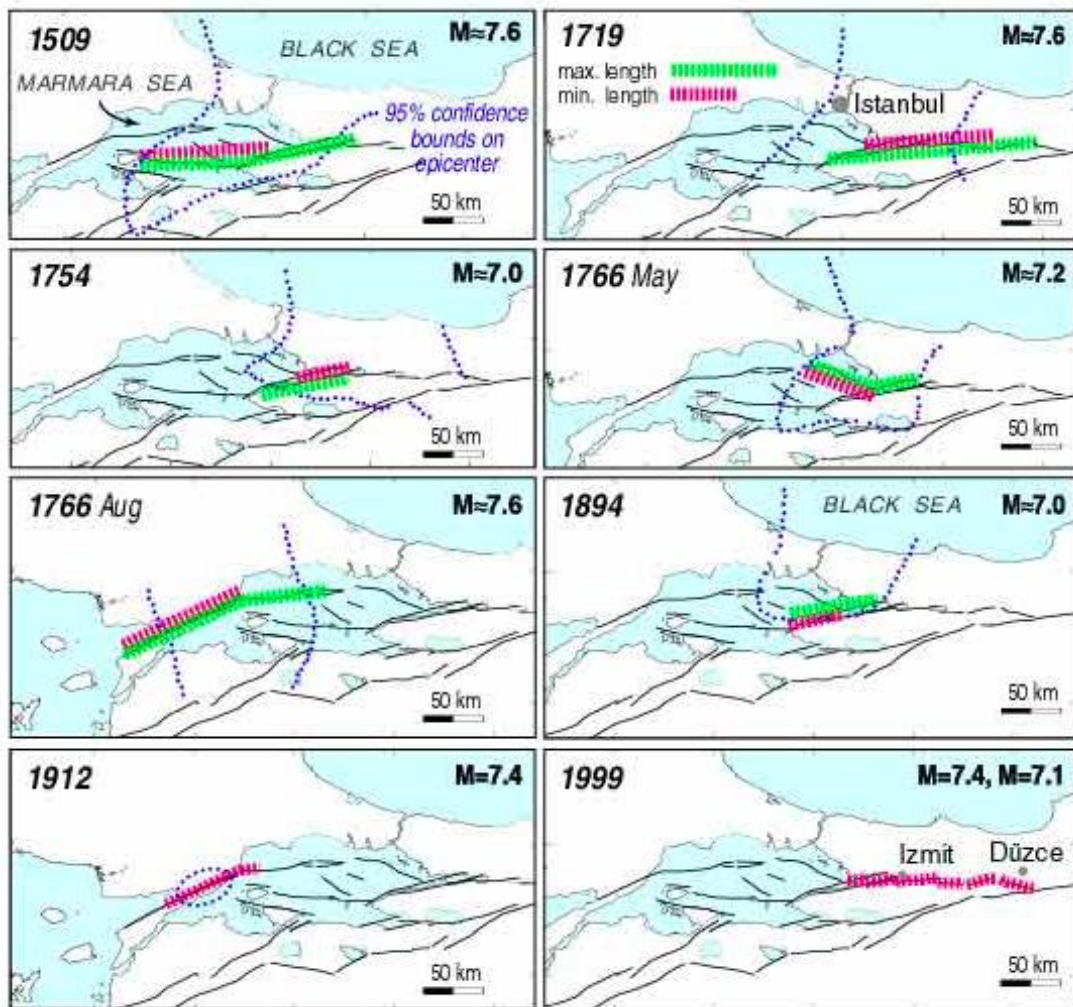
In the history of Turkey, great earthquakes appear in because of the Himalayan Alpine belt [Taymaz, 1999; Kundak, 2010]. Due to the records in the last 70 years, 130 natural disasters were occurred in the country and they resulted in above 80,000 death, more than 440,000 heavily damaged houses [IMM&JICA, 2002]. Two big faults are located in Turkey, Anatolian Fault which has approximately 700 km length and Northern Anatolian Fault (NAF) with 1300 km length, which caused the occurrence of strong earthquakes in the several parts in the country [Ural, 2001; Kundak, 2010]. Kundak states that the characteristics of NAF should be taken into account which are;

- 1) The vital earthquakes with high frequencies can occur due the presence of this fault;
- 2) It pursues a particular sequence which takes place from east through west.

Istanbul is located near to Marmara Sea where the North Anatolian Fault (NAF) is passing through. During the past 15 centuries, twelve earthquakes which were resulted with the high damages demonstrate a significant hazard with 15-25% probability. A major earthquake risk, that will affect the considerable part of Istanbul which can occur in the 30 years following the 1999 earthquake, is appraised in the vicinity of $65 \pm 15\%$ while over the 22 years $50 \pm 13\%$ and in the next 10 years this value is expected $32 \pm 12\%$ (Parsons et al. 2000).



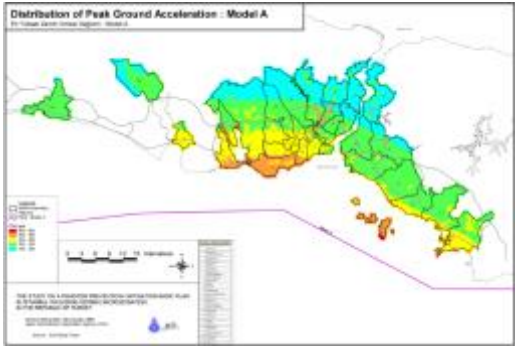
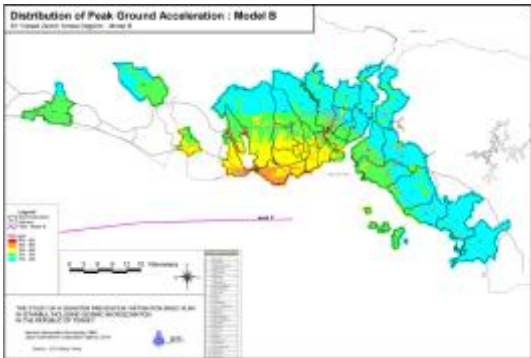
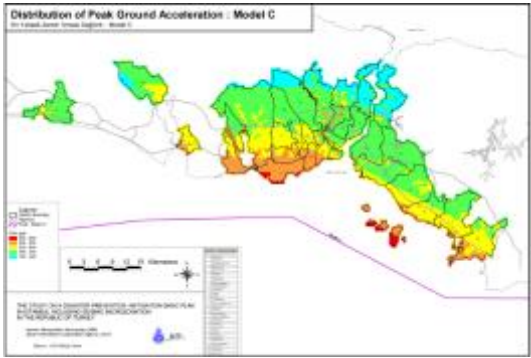
Picture 3. North Anatolian Fault [Hergert, 2010]



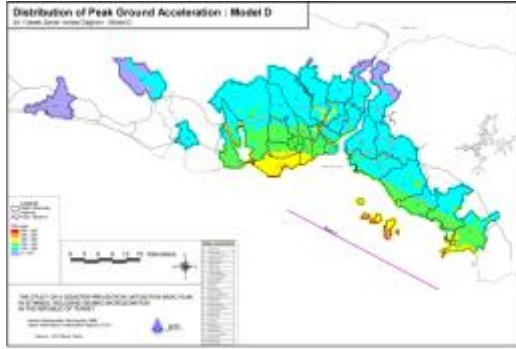
Picture 4. The locations of the significant earthquakes in Istanbul [Taymaz, 1999 cited by Parsons et al., 2000]

In 1999 Kocaeli (Izmit) earthquake was one of the significant earthquake in the world with 7.4 (USGS 1999) magnitude and between 1910 and 2010 then three months later Duzce earthquake followed it with 7.1 Mw (USGS 1999). Istanbul was one of the most affected cities during the 1999 Kocaeli and Duzce earthquakes [Wisner, 2012] due to the location of the city and the fault. According to Japan International Cooperation Agency and Istanbul Metropolitan Municipality report (2002) Kocaeli earthquake was the second worst human casualty in the 20th century. As the consequence of these earthquakes 6% of the population experienced with human and economic losses [Ural, 2001]. While more than 15 million people lost their lives [IMM&JICA, 2002], \$14 billion economic lost reported [Ural, 2001]. In the disaster zone 43 schools collapsed and 377 schools were damaged, due to the dislocation of fault main fiber optical cables were damaged and the communication lifelines were not used for 48 hours [IMM&JICA, 2002]. Confort and Sungu (2001) express that at the first day communication and electricity was not operating in the entire area then at the second and the third days it was very limited. After 1999 Kocaeli and Duzce earthquakes, government published reports and plans in order to take precaution for a possible earthquake. In Istanbul Metropolitan Municipality (IMM) and Japan International Cooperation Agency (JICA) report (2002), 4 different models of scenario are represented. Model A is the most probable one with progression of the seismic activity in the west. The magnitude

is supposed 7.5 (Mw) while the magnitude assumption of Model B is 7.4 (Mw). The worst case is stated in Model C with 7.7 moment magnitude because it is the highest magnitude which has never been reached in historical earthquakes. Last but not least, Model D represents a normal fault model in Marmara Sea with the assumed moment magnitude 6.9 (Mw). Due to the presence of NFA, the highest risk zone arrives in the east-west side of Turkey and includes southeastern part of the Istanbul on Asian side.

SCENARIO EARTHQUAKE MODELS	PROPERTIES OF THE MODEL
Model A 	-Strike-slip fault -120 km long from west of 1999 Izmit earthquake fault to Silivri. -The most probable model. -The moment magnitude: 7.5 Mw
Model B 	-Strike-slip fault -110 km long from the eastern end of 1912 Murefte-Sarkoy - The moment magnitude: 7.4 Mw
Model C 	-Strike-slip fault -Simultaneous break of the entire 170 km section of NAF, in Marmara Sea. - The moment magnitude: 7.7 Mw (the largest amount) - The worst case

Model D



- Normal fault model which follows the northern slope of the Cinarcik basin.
- The moment magnitude: 6.9 Mw

Table 9. Scenario Earthquake models [Data: IMM&JICA, 2002; Table: Author]

Supposing the occurrence of Scenario C which is considered as a planning tool, Earthquake Master Plan of Istanbul has been prepared by four universities collaboration and studies. Earthquake Master Plan which has been developed considering the high seismicity of the city and the studies of Istanbul Metropolitan Municipality (IMM) under Japanese International Cooperation Agency contains infrastructures, building stocks, urban and public facilities, strategies for earthquake preparedness, counting implementation plans at the pilot districts which were demanded by metropolitan municipality [Ansal, 2003].

The first building code had been published in 1940, after Erzincan Earthquake occurred in 1939 with 7.9 Mw magnitude. After each catastrophic earthquake in Turkey, the seismic design codes for buildings had been revised. When 17th August, 1999 Kocaeli and then 12th November, 1999 Duzce earthquakes occurred with great magnitudes, respectively 7.4 and 7.1 (USGS 1999) the valid building code was 1997 code. Soyluk and Harmankaya (2012) highlights that the effect of these two earthquakes had been seen in the whole country. The restoration should be done for the existing building because many buildings had been damaged and a crucial part of the buildings could not resist to another earthquake. Therefore, a chapter titled “Seismic Assessment and Rehabilitation of Existing Buildings” has been added to the code and in March 6th, 2007 the new code has been published. Today the last building code which has been publicized in 2007 is “Specifications for building to be Built in Earthquake Areas”. Two procedures that are based on linear and nonlinear assessments are proposed in the last code in order to assess the seismic performance in reinforced concrete buildings.

4.2 Background info of Kadikoy

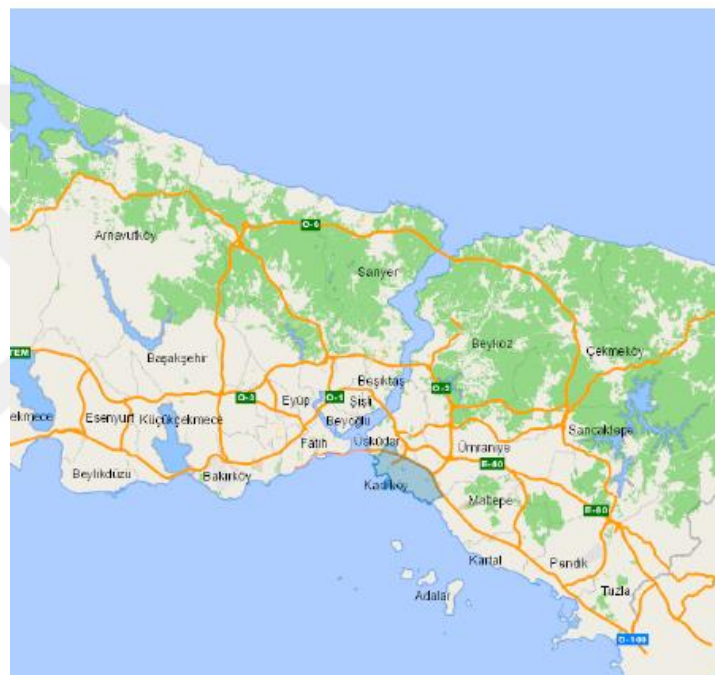
The population of Kadikoy is 452,302 (TUIK, 2016) and 1686 people have disabilities in this district (ISEM, 2016). In IMM&JICA report (2002), Kadikoy has been stated as the most dense district with 660,000 population however this number has decreased in 15 years because of the division of the district into two separated districts.

Kadikoy is a cosmopolitan district of Istanbul, Turkey on the northern shore of the Sea of Marmara, facing the historic city center on the Asian side of the Bosphorus. Kadikoy is also the name of the most

prominent neighborhood of the district, a residential and commercial area that, with its numerous bars, cinemas and bookshops, is the cultural center of the Anatolian side of Istanbul. The district is stated inside the trade centers of Istanbul in Earthquake Master Plan of Istanbul [Ansal, 2003].

	POPULATION (persons)	AREA (km ²)	DENSITY (persons/km ²)
ISTANBUL	14804116	5313	2786
KADIKOY	452302	41	11031

Table 10. Population [Data: TUIK, 2016; Table: author]



Picture 5. The location of Kadikoy [Source: Istanbul City Maps]

The area of the district is 40.21 km² and it is divided to 21 mahalles. There are 3 public hospitals with 1033 beds and 9 private hospitals with 858 bed capacity in Kadikoy. In addition, there are 9 nursery homes, 37 family health center, 13 medical center and 1 disabled center belonged to municipality and there are 137 schools (primary and high school) with 6 schools for children with disabilities.

Kundak states that the growth of Istanbul started in the southern of the city and it developed parallel to the NAF. The main factor of earthquake risk is rapid development in southern Istanbul in terms of building constructions and population (2010). In addition that the destruction and loss of lives have been seen mostly in collapse of masonry buildings and the fires on wooden structures. Kadikoy is known as 'Kalkedon' which the first district where the urbanization was started [Ersoy and Kocak, 2015] and it keeps all the characteristic of the pre-developed area which is located parallel to NAF in the south.

Box 3. IMM&JICA (2002) Report Data for Kadikoy

In 1999 Kocaeli-Duzce earthquakes, the collapsed building number are mentioned as 77 and heavily damaged buildings are 305 in Istanbul.

In Kadikoy there are 38165 buildings and according to Model A of the report, 1994 buildings with heavy damages; 4755 buildings with heavy and moderate damages and 12206 buildings with heavy, moderate and partial damages are analyzed. In Model C these numbers are seen 2312, 5554 and 13569 for heavy, heavy- moderate, heavy-moderate-partial damages respectively.

The research area is one of the high-density population city due to having high story buildings (13.4% of the buildings have more than 8 floors).

The narrow streets are between 2 and 6 m, the roads around the residential areas are between 7 and 15 meters while the highways and principal roads have more than 16 m wideness. In Kadikoy the percentage according to the width respectively, 53.8%, 40.7% and 4.2%.

In Istanbul, there are 1933 schools while 137 of them are located in Kadikoy district (94 primary and 43 high school). On the other hand, 62 medical facility with 1127 beds take place in the report.

The fire fighter departments in Istanbul are 40 while police departments are 166. In Kadikoy these numbers are respectively 2 and 1. Total governmental buildings (province, municipality and ministry) are 491 and Kadikoy has the second in point of number of building view, 38 buildings.

Hazardous facilities are described as, large LPG storage, paint/polish product factory, chemical warehouse, fuel/LPG filling station, fuel filling station. In research area, these numbers are respectively 6, 0, 35, 5 and 0. The total hazardous facility number is 45 in the district.

The damage estimation has 3 categories which are; catastrophically, heavily and moderately damaged buildings. These categorizations have been made according to mahalle building damages. In Kadikoy the catastrophic damage is not seen however heavily damaged is seen on 4% and moderately damaged mahalles are 89%. The number of vulnerable mahalle is 26 (93%).

AREA	CONSTRUCTION YEAR (NUMBER OF BUILDINGS)					
	1949 and before	1950- 1959	1960- 1969	1970- 1979	1980- 1989	1990 and after
ISTANBUL	37444	26976	63335	141788	213330	232699
KADIKOY	1140	1459	4250	11735	11885	7657

Table 11. Comparison of number of buildings according to construction years [Data: IMM, 2002; Table: Author]

	Istanbul			Kadikoy			
		Damage scores				Damage scores	
	Total	Model A	Model C	Total	Percentage in Istanbul	Model A	Model C
Natural gas pipelines (length)	4670 km	14%	16%	462 km	9,89%	9%	10%
Sanitary Water pipelines (length)	7568 km	1395	1577	527 km	6,96%	71	85
Waste Water pipelines (length)	6174 km	1152	1299	613 km	9,93%	87	103

Table 12. The infrastructures' total length data from IMM&JICA report (2002) and their damage scores according to the earthquake scenario models of Master Plan

For the comparison of transmission infrastructure lines Model A, the most probable model, and Model C, the worst case, has been selected. Due to the earthquake scenario models, the damage of 800 km of transmission infrastructure lines are observed in Model A while the damage of 1100 km of transmission infrastructure lines are predicted in Model C. Infrastructure and transportation damage caused to serious business disruption in 1999 Marmara earthquakes (Kundak, 2010).

The greatest part of the deaths are due to building damage or collapse in earthquakes [The World Bank, 2016]. Buildings have been classified in IMM&JICA report (2002) as heavily, moderately or partly damaged. Heavily damaged buildings are the buildings that are severely damaged or collapsed, moderately damaged buildings can be facilitated for evacuation immediately after the event and partly damaged buildings can be lived in but they should be repaired. According to Model A there are 38,615 buildings in Kadikoy and 5% of these buildings will be heavily, 12% moderately and 32 percent will be partly damaged. Model C gives 6, 14 and 35% damage ratio for the buildings which will be damaged heavily, moderately and partly, respectively. According to given data about damaged buildings the number of evacuee in Kadikoy, which is calculated for both models, is presented in the following table:

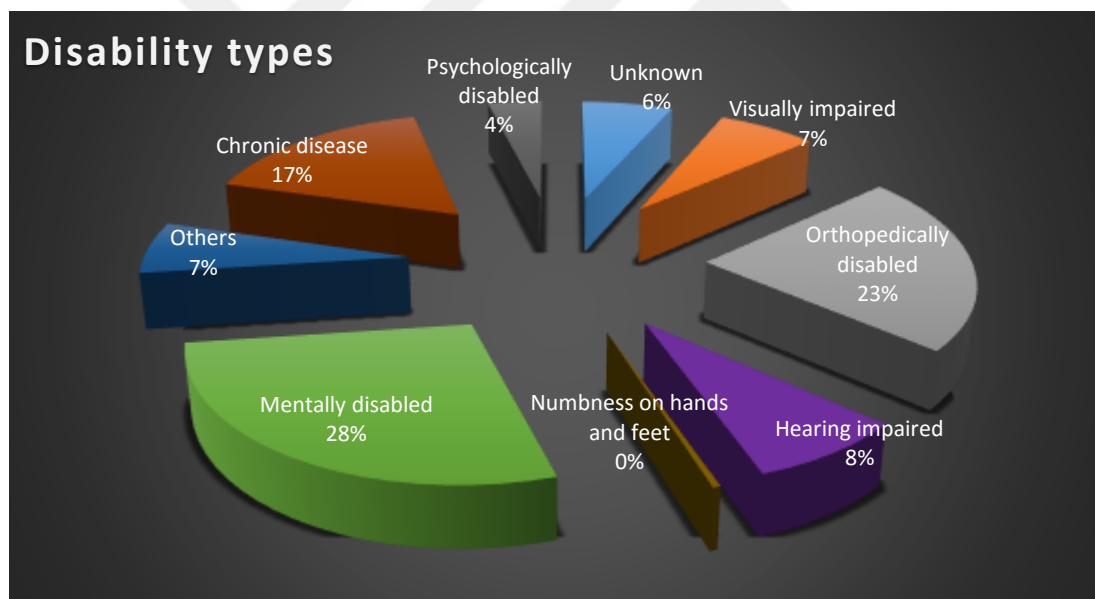
IMM&JICA (2002) scenario models	Number of evacuees		
	Heavily damaged	Moderately damaged	Partly damaged
Model A	1935	4640	12360
Model C	2320	5410	13516

Table 13. Number of evacuees in Kadikoy [Source: IMM&JICA report (2002), Table: Author]

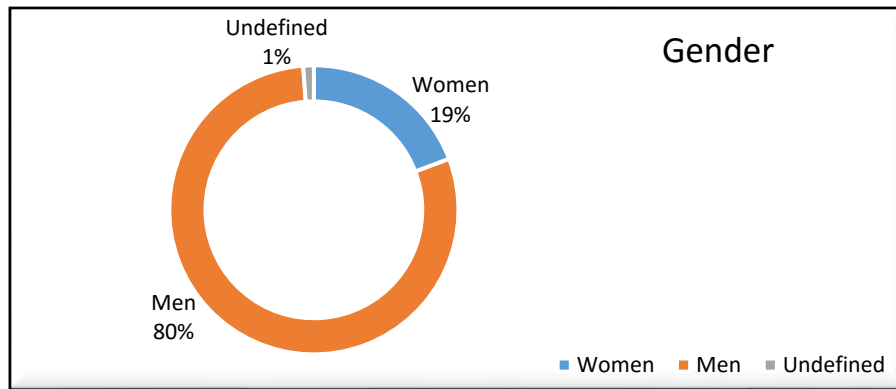
- People with disabilities in Kadikoy:

In 1997 Prime Ministry Department for Affairs of Disabled People was authorized and it was indicated with Act 571 as the system between national and international organizations for collaboration and constructing. The Act 571 involves the equal cooperation of people with disabilities, providing accessible environment, information and services, preparation of environment and systems for needs of disabled people, taking equal education, having social security and protection, last but not least assurance the full-participation of disabled people in decision making progresses which is made for their needs. In 2002, Act 3194 which mainly contains new construction rules but also aims to develop the accessibility of public environment for vulnerable populations as people with disabilities and elderly individuals has been established by Ministry of Public Works and Housing [Baris and Uslu, 2009].

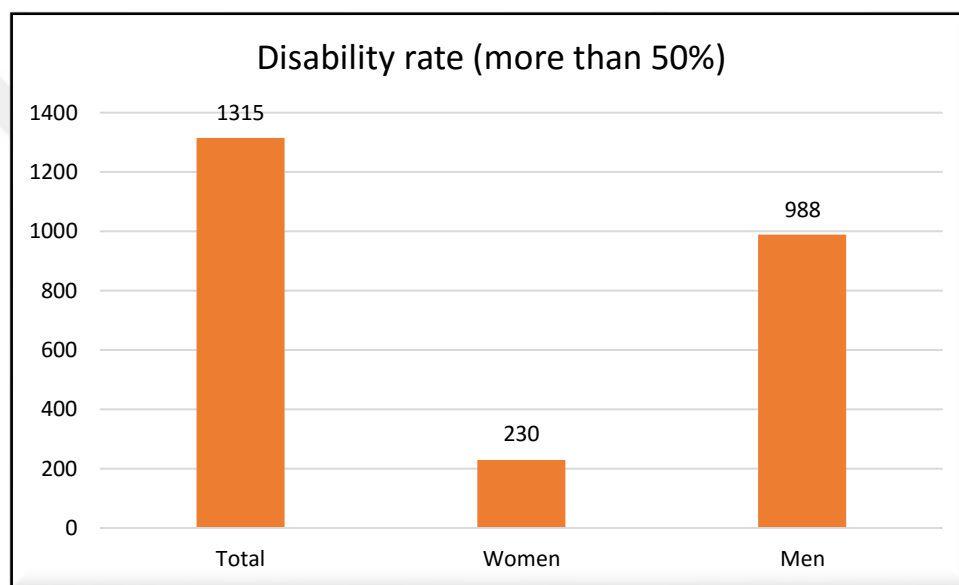
According to ISEM (2016) general census, there are 67 people with physical disability, 289 people with chronic diseases, 484 mentally disabled people, 7 people who has numbness on hands and feet, 143 people with hearing impairments, 400 orthopedically disabled people, 122 people with visual impairments, 113 unknown disability and 115 other disabilities in Kadikoy. When the distribution of disabled people by genders has been examined, the majority is men with 80% of 1686 people. The classified disability types, gender ratio and disability rate more than 50% are given with the figures in the following.



Graph 1. Classifying the disability types in Kadikoy according to disability ratio [Source : ISEM,2016; Graph : Author]



Graph 2. The ratio of genders of disabled people in Kadikoy [Source : ISEM,2016; Graph : Author]



Graph 3. The ratio of genders of people with disabilities whose disability ratio is more than 50% [Source : ISEM,2016 ; Graph : Author]

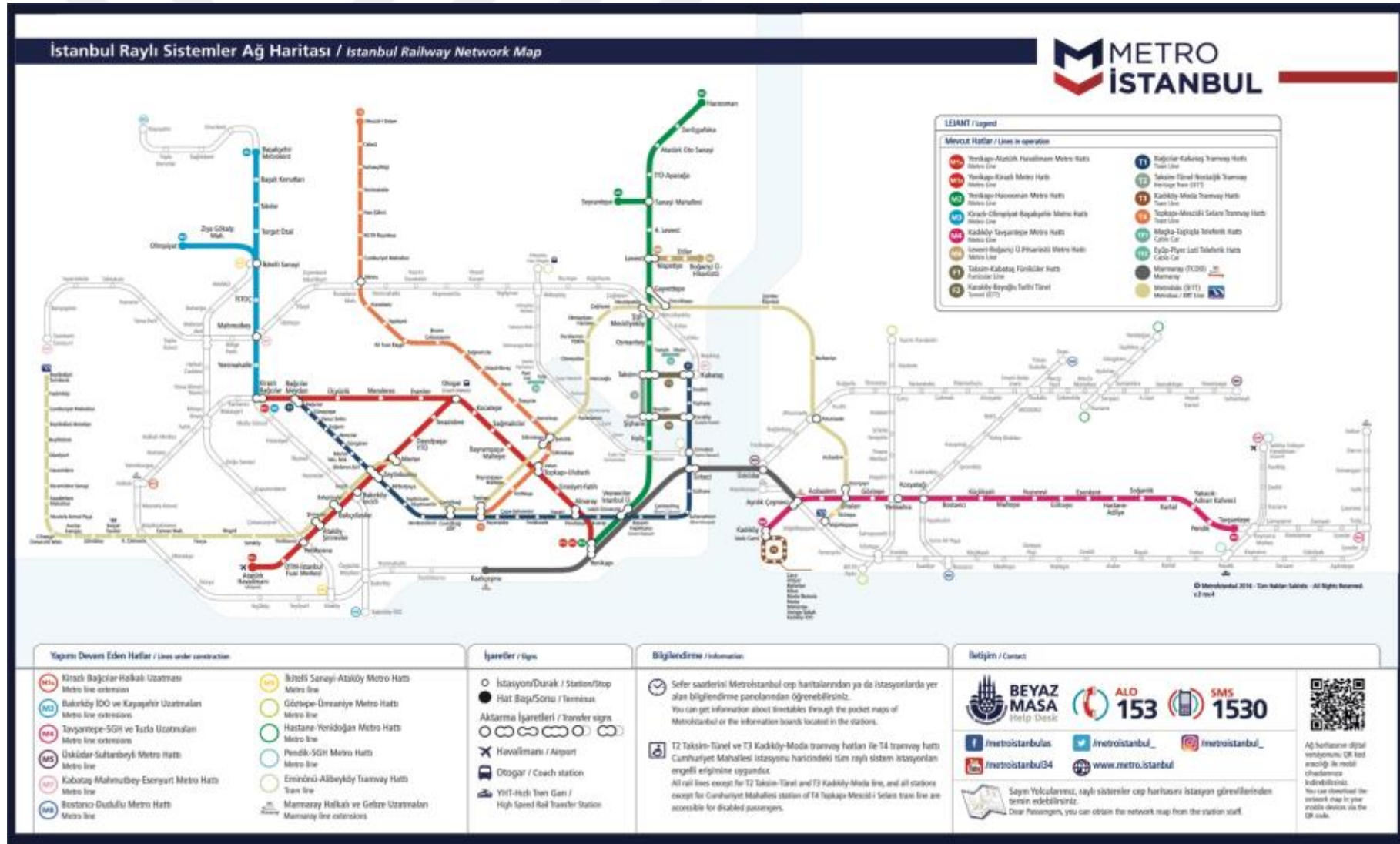
4.2.1 Transportation infrastructures for people with disabilities in Kadikoy

When an earthquake occurs in the city two main aspects should be considered road network point of view. The one aspect is occurring a break in the entire network due to an individual structural damage. The road network has a critical role in evacuation activities, firefighting operations and medical services [IMM&JICA, 2002].

The major Haydarpasa Terminal of the Turkish State Railways is located close to Kadikoy's center, having served east and south-bound international, domestic and regional trains until 2009. Haydarpasa Terminal was opened in 1908 as the terminus of the Istanbul-Baghdad and Istanbul-Damascus-Medina railways. The Sogutluceme railway station, the next station to Haydarpasa Terminal, is located also in Kadikoy. The terminus of the Metrobus line to European side of Istanbul is situated next to the railway station. The M4 line of the Istanbul Metro runs from Kadikoy to Kartal daily.

The center of Kadikoy today is the transportation hub for people commuting between the Asian side of the city and the European side across the Bosphorus. There is a large bus and minibus terminal next to the ferry docks. Ferries are the most dominantly visible form of transport in Kadikoy, and the central market area is adjacent to the ferry dock.



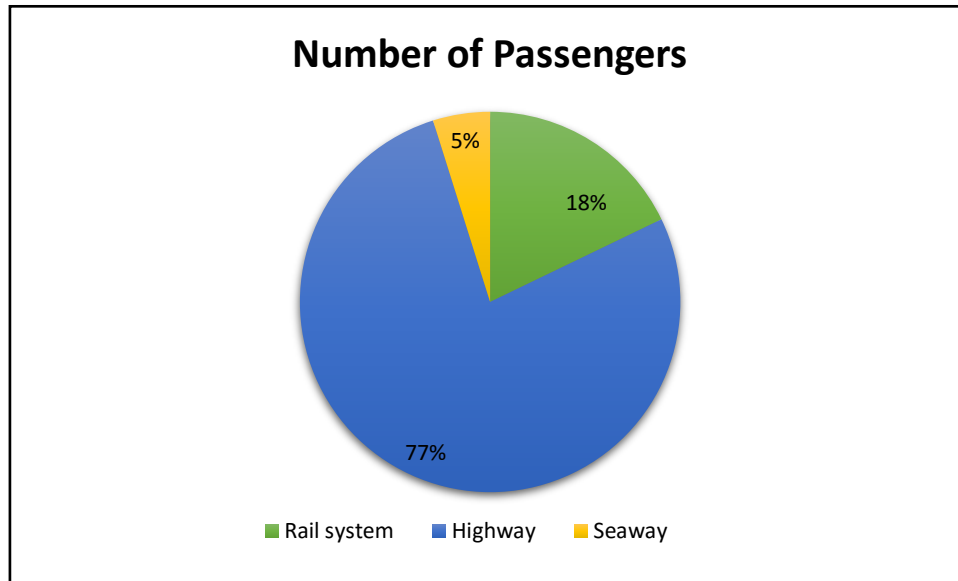


Picture 6. Istanbul Rail Transit Network Map [Source: Metro Istanbul, 2017]

Rail system	Metro	982.807
	Light Metro	472.377
	Tram	572.830
	Funicular	52.552
	Cable car	8.491
	Marmaray	209.983
	Total	2.299.040
Highway	IETT Bus	747.981
	Metrobus	830.426
	Private Bus	1.378.096
	Bus A.S	833.018
	Minibus	1.832.544
	Taxi-Dolmus	1.660.830
	Service vehicle	2.673.852
	Total	9.956.747
Seaway	IDO	209.453
	City line Ferry	271.735
	Private Boat	144.325
	Total	625.513
Total		12.881.300

Table 14. Number of daily passenger in Istanbul transportation system [Data:IETT,2015]

The number of daily passengers using transportation infrastructure systems in Istanbul are presented in Table 14. In Kadikoy this number is approximately 400,000 people in daily use and almost 80% of these population is using highways (metrobus and bus services). In the evacuation plans these numbers should be taken into account from the standpoint of both passenger and capacity of vehicles. Moreover the number of disabled people are not specified in either Table 14 or 15 which means in the case study area, the number of disabled evacuees is not certain.



Graph 4. Number of daily passengers in Istanbul transportation system [Data: IETT, 2015; Modified data by Author]

4.2.1.1 Subway

First of all, the subway line (M4) opened in 2012 with 15 stations in Asian side. It is running between Kadikoy and Tavsantepe on 26.5 kilometers with 144 vehicles and each service takes approximately 4 minutes. The one-way travel is fulfilled in 29 min while one complete service is done in 64 min. The hourly capacity of the metro line is 70.000 people/hour/one-way.



Picture 7. Stations on M4 metro line [Metro Istanbul, 2017]



Picture 8. Metro stations in Kadikoy [Source: Istanbul City Maps, regulated by Author]

Secondly, the metrobus, fast bus transportation started operating in 2007 with 45 stations and it is running between Avcilar (European side) and Sogutluceme (Asian side, in Kadikoy district). This system works as metro lines, as closed, but instead of working underground it operates on the highway in a separated lane.



Picture 9. Ayrilikcesme Metro Station [Source: Author, April 2016]



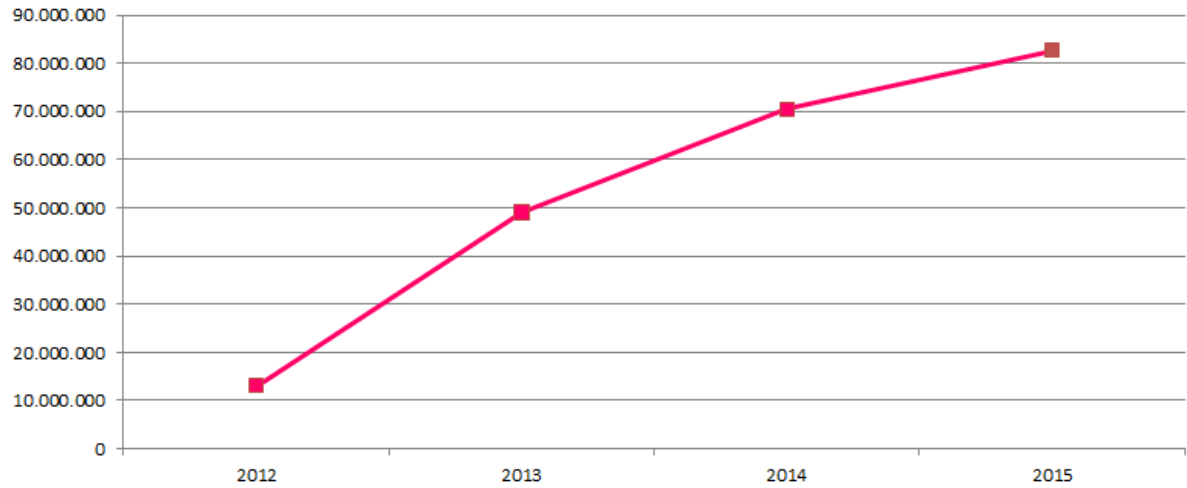
Picture 10. Ayrilikcesme Metro Station [Source: Author, April 2016]



Picture 11. Unalan Metro Station [Source: Author, April 2016]



Picture 12. Unalan Metro Station [Source: Author, April 2016]



Graph 5. Number of passengers used M4 Metro Line in 4 years [Source: Metro Istanbul]

4.2.1.2 Pedestrian ways

In the Statute about Disabled People (2005), on the 50th provisional clause it is mentioned that road, pavement and pedestrian ways should be accessible for the people with disabilities in eight years. This means that in 2013 all these infrastructures should have been developed due to the special needs of disabled people. The statute makes compulsory accessibility of people with disabilities and tactile surfaces, ramps, cross ways, audible announcements and barrier free pathways are necessary for the accessible environment.



Picture 13. Tactile ground surfaces in Moda Street, Kadikoy [Author, April 2017]

4.2.1.3 Tram

Istanbul has two separate tram lines which one on the European, between Taksim and Tunel, and the other is on the Asian side, between Kadikoy and Moda. When Istanbul was the capital city of the country, it had a wide railway transportation network but in the 1966 tram use ended in the city.

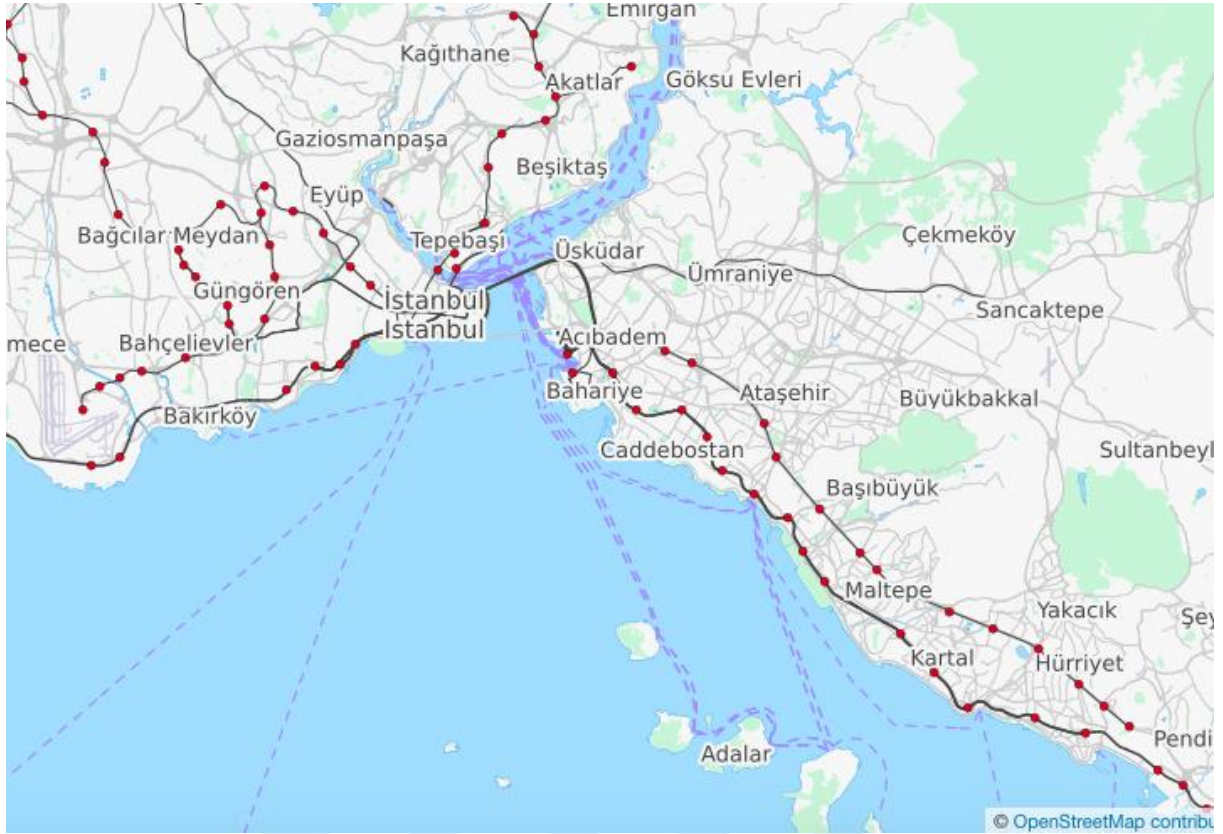
Then, firstly Taksim-Tunel Nostalgia Tramway (T2 line) returned to operate in 1990 and in 2003 Kadikoy-Moda Nostalgia Tramway (T3 line) returned. The length of T3 line is 1.6 kilometers and with 10-20 minutes' period it is working every day.



Picture 14. The stations of T3 Nostalgia Tram [Source: Metro Istanbul]

4.2.1.4 Sea Transportation

The sea transportation is in interaction with M4 metro line in Kadikoy. Everyday there are ferry services from Kadikoy, Anatolian side, to Eminonu, Besiktas and Karakoy which are located in European side. In addition that from Kadikoy the ferries carry passengers to Adalar which are the island area in Marmara Sea.



Picture 15. Transportation system in Kadikoy [Source: Open Street Map]

4.2.1.5 Analysis of transportation infrastructure systems

Subway: In April, 2016 one of the station, Ayrilikcesme, of this line selected to be examined according to usability by people with disabilities. The importance of this station is being transfer station between metro and marmaray lines. Moreover, Unalan station was observed with a special permission by Istanbul Metropolitan Municipality Ulasim A.S because of being a transfer station between metro and metrobus lines. It has been observed in the fieldwork that tactile surfaces inside the stations are well constructed due to completing tin 2012.

Pedestrian ways: Today still in Kadikoy some lacking or faulty sidewalks are attracted attention. The reason of this poor construction and low maintenance is tendering the construction. In the tender, perceivable road is under 5 years maintenance guarantee. When the entrusting conditions finish, the repair of the damaged area. Poor construction shows up the placing of lamp posts after the execution of perceivable roads. Besides in the lack of the bollards, cars can park on the pavements and they can block the use of perceivable roads by people with visual impairments.



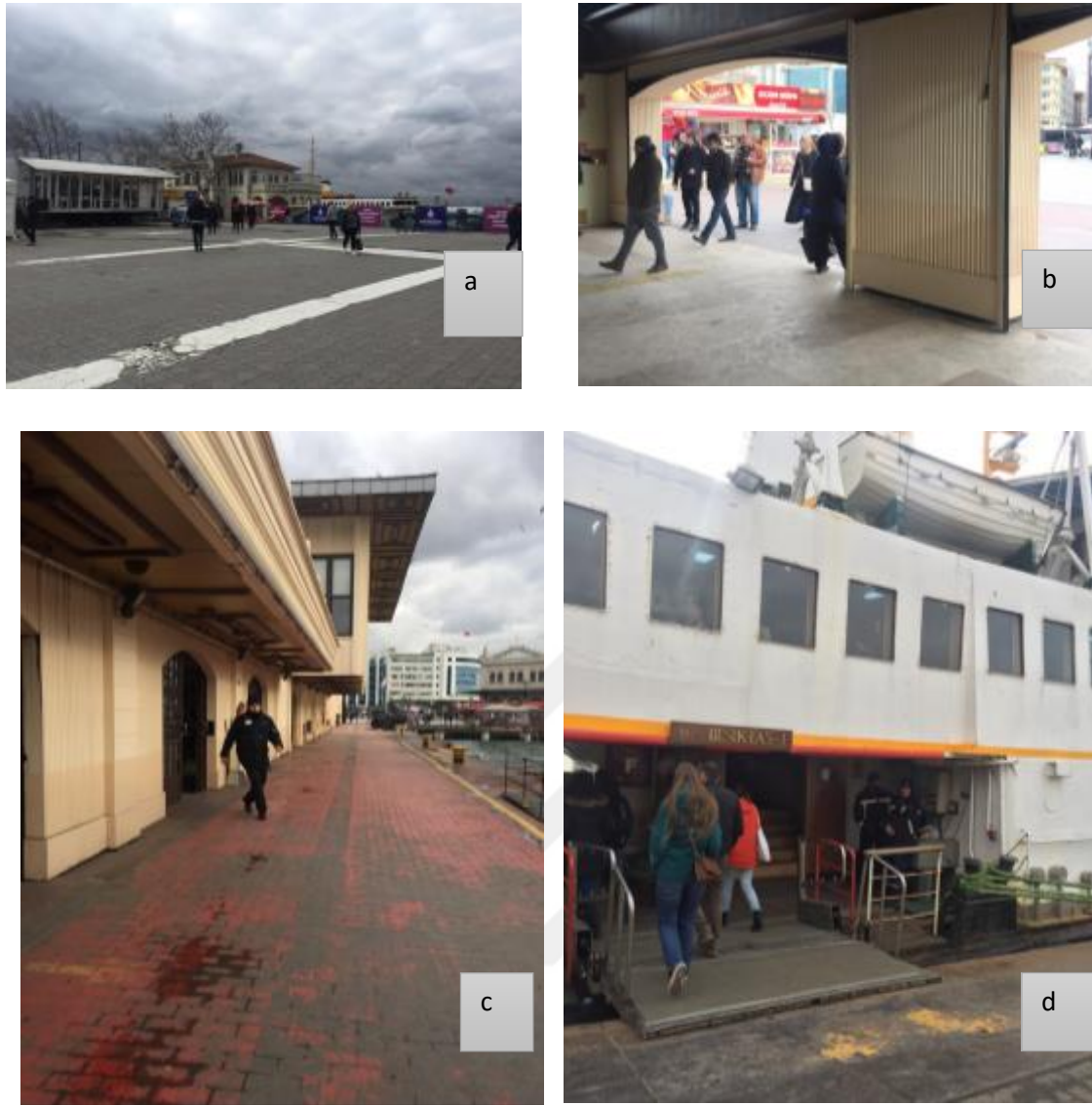
Picture 16. Perceivable road example from KUSDILI Street, Kadikoy (Source: NTV 2012)

Tram: The legislation for the reconstruction of infrastructures for needs of people with disabilities has been established after the return of tram. This is seen in the operation route and the design of the vehicle such as there is no stop to wait or to check the time of the tram (Picture 17.a), tram steps are not on the same level with the ground or pavement (Picture 17.b) which can create obstacles for a disabled or an elderly person. The entrance and exit steps are designed for abled-body people (Picture 17.c), the stop buttons are not easily accessible for a disabled person or children (Picture 17.d), there is no route map inside the vehicles and the announcements such as stops and next stop names are not performed. Due to these barriers, Kadikoy-Moda T3 tram is not appropriate for use of either people with disabilities or elderly individuals and children.



Picture 17. a) Tram stop, b) Another Tram stop, c) Tram door, d) Stop button inside vehicle [Author, April 2017]

Sea transportation: Due to reconstruction of the square in front of the ports of Kadikoy, the perceivable roads are removed and not built again (Picture 18.a-b). The reason of this deficiency is ending the entrusting circumstances before this renewal. Also in front of the ferry port, the tactile roads are destroyed and they are not renewed (Picture 18.c-d).



Picture 18. a) The square in front of the ports, b) The entrance of the ticket area of Kadikoy-Eminonu and Karakoy lines, c) The port of Kadikoy-Karakoy line, d) The entrance of the ferry [Source: Author, February 2017]

4.2.2 Application : Inclusion of people with disabilities to the emergency plans

Between three objectives, the third one aims to advice to organizations about people with disabilities who should be involved in disaster preparedness plans and not staying behind in emergency evacuations. After 1999 Kocaeli earthquake, instead of neglecting people with disabilities their participation was provided. Almost 2,000 deaf people have been trained about disaster preparedness by deaf trainers. Some of them, about 8 people, completed the Basic Disaster Awareness course [Wisner, 2002]. This shows that when people with disabilities are trained and involved to disaster preparedness trainings, their effectiveness and help cannot be overlooked.

8 questions are asked to different disability groups and their organizations, they can be seen in Chapter 3 with the details, which are aimed to understand their needs and insights. The answers of questionnaire which was held for 4 different disability classes in different disability organizations are reported in this section in order to show the opinions of people with disabilities to organizations and associations who are working about inclusion of people with disabilities in emergency plans. The answers will be examined in terms of evacuation and disaster prepared plans in the following;

DISABILITY TYPES AND ASSOCIATIONS	ANSWERS
Physically disabled people 1- What are the difficulties that you experience when you are using the transportation systems in daily life? Can you categorize according to different vehicles? (e.g. ferry, subway, bus, metrobus and tram lines) 2- What kind of attitude and behaviour should be displayed to you in these transportation infrastructure systems in an emergency? 3- If you need to make evacuation in an emergency case, under which conditions can you evacuate on your own? 4- What do you need mostly during disasters and how should people approach to you? (For example, a person who is with a very heavy wheelchair can specify the chair should not be lifted because it may lead to a physical damage on the person who is trying to help him. What should be the first approach for you?). 5- How should be the behaviour of the field personnel in the transportation systems and how can this be improved? 6- How should be a 'disaster preparedness process' in which you will be actively involved? 7- What are the necessary equipment that you must find in the shelters when you are evacuated due to a disaster? (Drugs and devices can be specified.) 8- Is there something you want to add?	1- We have difficulties in busses and metrobus, especially in working hours it is almost impossible to get on and get off. Sometimes we wait several hours. 2- First of all, we expect them to not be panicked. Then help me to go out of the vehicle. 3-We can evacuate alone if the floor is plane, but generally it is not possible. 4- a. I want to carry a whistle to let my voice be heard. b. If I am at home, I know how to protect myself. c. If I am at work and I cannot go to a safe place, I want someone to help me. d. If I am in a transportation vehicle and there is fire, I want someone to help to evacuate otherwise I can burn there. 5- The personnel should be well-trained. 6- If I can participate to a preparedness process, I can suggest to prepare a tent for the needs of a disabled person. 7- Wheelchair, cannula, medicines, baby food.
People with visual impairments The questions are same as asked to people with physical disabilities.	1.a Buses and metrobuses: -Bus stops are not used as fixed points and close circle of the bus stop is accepted as the bus stop by drivers. It leads to difficulties to recognize the incoming vehicles. -Due to the lack of announcement systems that have started but can not be completed despite the long time passed, the bus lines are not accessible at the information stops, and it is not possible to separate the expected vehicle from the others. -Due to the interior design of vehicle which is not design according to standards, mistakes are made due to differences in seats, holdings and vacant spaces. This makes difficult to move inside the vehicle.

-Depending on the human factor: there are circumstances where the use of announcement devices is deactivated by driver. This causes the passengers to be mistaken about the place they want to land. Drivers, who cannot internalize free travel rights of disabled passengers, do not stop and passing the bus stop directly if there is not another passenger who is obliged paying bus fees. Lastly, due to the passenger density and the cultural level, the segregated places are occupied by abled-body passengers and even the appropriate method of warning is sufficient to give the place to the disabled passenger. This causes conflicts and disturbances in crowded vehicles: in general, this issue creates a conflict between other passengers and at the end it affects again disabled passenger as the main subject.

b. Metro: It is a new way of transportation in Kadikoy. These vehicles have a relatively uniform wagon and layout. The most important problem with subway transport is that there is a separate learning requirement for each stop because the stops are very large and the access requires a longer time than the use of the vehicle. Also, the deployment of the interior design and connection points are not uniform.

c. Sea transportation: There are different size of vehicles such as sea buses, ferries, and ferry-motors. However, the fundamental problem is due to not having any standard in design of piers.

3- Partially on vehicles which highway transportation is made.

4- The most needed information is a clear description of the surrounding environment and the situation. A visually impaired person with this information will be able to orient others about what he or she needs in that situation.

5- With the rational, knowledge-based information and trainings the desired outcome will be achieved. Despite of educational and socio-cultural levels, with the daily experiences the most appropriate behaviors are showed to visually impaired people by bus and metrobus drivers.

6- By teaching the disaster preparedness, the methods of protection against fire, flood and

	impacts, by teaching the first aid and with repeated drills during meaningful periods. 7- These are specific for each person. If the visually impaired person has no other health problem, the things that an abled person will need can be sufficient. 8- There is a need to create a real sense of natural disaster for disabled people. It is not possible to struggle with the disasters with hypothetical and limited information that does not even reflecting the real situation. The information given about the ways of protection arises from unnecessary memorization, not from a need. But if a disabled person who does not know the truth, he/she does not receive the information given in accordance with the consciousness of necessity.
People with hearing impairments The questions are same as asked to people with physical disabilities.	1- We do not have any difficulties in daily life regarding transportation infrastructures but there is stagnation when we want to talk individually. We are struggling to express ourselves. We have to memorize the places to go. 2- In case of emergency, warning light systems should be installed for hearing-impaired individuals. For example, when an emergency occurs on the ship, the warnings are made by audible alarm or announcement. But hearing impaired people are victimized because they cannot hear it. In case of emergency, warning system should be applied with warning light so that the hearing impaired person will be prepared for the evacuation. 5-The field workers in the transportation systems should learn sign language. 6- Our association has been involved in the project for disaster preparedness of disabled people that has been initiated by AKUT with EDUCEN Project. My project is to participate in the volunteer teaching activities and provide education in the schools. 7- In an evacuation, in case of presence a person who is using hearing device, the battery is needed for the device. Necessary communication networks should be established. 8- Preparation of the videos via sign language can be done with the support of the audio description unit. Videotapes prepared for

	hearing impaired individuals should be published. This will increase the consciousness. An interpreter system should be established for hearing impaired individuals to serve within 24 hours. Not just in disasters but in any situation they can call the disabled customer services.
Mentally disabled children – EPPO project 1- What are the difficulties that can be faced by people with mental disabilities in disasters? How should they be approached? 2- What are the problems that they face in daily life when they are using the transportation infrastructures? 3- What should be the behaviour and attitude towards people with mental disabilities in the transportation infrastructures during an emergency? 4- What is the proportion of people who can evacuate on their own if an evacuation is necessary? What should be the behaviour of people who are helping to people with mental disabilities for the evacuation? 5- Does the emergency education vary according to the disability rate? How can individuals with high disability rate be reached? 6- How can the people with mental disabilities be included actively in disaster preparedness process? 7- Which tools and equipment must be found for the mentally disabled individuals in the shelters when they have to be evacuated in a disaster? (Drugs and devices may also be specified.) 8- Is there something you want to add?	1- Their difficulties are mainly in communication and in following the instructions. The approach can be achieved through a specific training of people who are looking after them. 3- It depends on the type of mental disability. In any case, well-trained personnel are essential. Specific training programs in pre-disaster phase should take place in regular basis for the emergency practitioners. 4- It can be obtained by the lesson learnt from previous disasters around the world. Basically, they must act equally to everyone. 5- Yes. If you name mental disabilities, they can be reached by the individuals and their caregivers with proper methods of training. 6- This is an important issue. It can be done in pre-disaster phase as well, and by including them in decision-making boards.

Table 15: Questionnaire answers for different disability types [Author]

4.2.2.1 Emergency evacuation

The difference between evacuation and accessibility is the time factor which plays a significant role in case of emergency evacuations (Bendel and Klüpfel, 2011). The first factor influencing the evacuation time is people who select the familiar routes instead of emergency routes or exits. Besides, the other factors that affect the emergency evacuation are level of alertness, disability level, being alone or with a company, mental status, capacity of receiving information and role of responsibility for people with disabilities (National Disability Authority, 2008).

The first-time evacuation of disabled people, especially people who cannot move alone, became a current topic in 1993 bombing of the World Trade Center (WTC). Then on 9th of September, 2001, World Trade Center had been bombed second time and the evacuation of disabled people were not such different than the first time. According to NIST report, people with disabilities stayed beyond due to lack of evacuation information, being less prepared and being dependent to others [Steinfeld, 2006]. After 9-11 attacks, the next fail in evacuation was observed in Hurricane Katrina. However having an emergency to count on transportation systems in New Orleans, in 2005 Hurricane Katrina

the plans came unstuck due to inadequate equipment, presence of few drivers and absence of communication and orders [Skinner and Robert, 2009].

Problems according to disability types	Solutions
Visually impaired : the ability of gathering information is influenced.	A guide should be offered especially in the presence of the stairs. They should not be left without a company in the refuge point. Tactile surfaces and directional signs should be present.
Hearing impaired : the ability of gathering information is affected.	The evacuation information should be made with visual devices. They should not be left without a company in the refuge point.
People with physically disabled : speed of movement changes due to disability range.	Usable circulation path should be identified. Exit signs should be readable. In the presence of elevations, elevator or other evacuation instruments can be used or the person may be moved with a cradle carry or stair descent devices. Alternative routes and devices should be present.
Cognitive disabilities : capacity to process information and reactions are influenced.	Picture book can be provided for drills. Color coding and different symbols can be implemented for exits. Buddy system can be used.

Table 16. Solutions in evacuation for each type of disability [Manchester Metropolitan University, 2008; National Fire Protection Association, 2016; National Disability Authority 2008]

According to questionnaire, the common needs of people with disabilities for the evacuation process are the presence of well-trained personnel in the transportation vehicles, empathy of the other people and acting equally to disabled people. They can advise during preparation about which devices or equipment should be provided for their evacuation or how can personnel approach to them. The best way to organize the evacuation of a disabled individual is to pay attention to their requirements. For the sensory disabled people the situation shows different aspects than the others. Because hearing-impaired people needs an extra announcement way in emergency than other disability groups in order to evacuate the structure by themselves.

For 15 million people inhabitants neither public transportation infrastructures nor private cars are creating any solution to traffic congestion in this city. In an emergency evacuation, it cannot be expected to evacuate the territory, where the high damages are forecasted, in few hours due to the highly concentrated population. Litman (2006) estimates that although one highway lane's capacity per hour is 2,000 vehicles, under the evacuation conditions with overloaded vehicles, infrastructure failures, weather conditions such as rain or flood, car accidents and other mechanical problems each lane can be loaded by 1,000 vehicles per hour with 2.5 passengers average. If the highway is with 4 lanes, evacuate will be 10,000 people per hour. The city with 15 million citizens can be evacuated approximately in 63 days when only one evacuation road is used while it is not the reality. During the daily life citizens of Istanbul are a sufferer by the traffic which is increasing and becoming an ordeal in

rainy days. In a scenario, which takes into account this traffic issue is happened in daily hours will prove that emergency evacuation of this city is not possible in a short time.

Emergency transportations contain different aspects such as before, during and after the disaster evacuations are done, transmittal of food, medical care, emergency supplies and services, operations in searching and rescuing and transportation infrastructures' repairs. Despite, failures have been seen in evacuations of non-drivers, prioritizing to people with special needs to evacuate first, supplying free transportation, encouraging people who do not want to evacuate, supply public buses and employ the school buses, organize vehicles, services and fuel stations along the evacuation route [Litman, 2006]. In Kadikoy due to being a historical area it is specified as hazardous area in IMM&JICA Report (2002). Especially narrow streets corrupt the safety of evacuations and emergency operations when the debris disrupts and damaged buildings bank up along the street sides. In this case, the structural improvement and redevelopment measures are provided in the report to execute the evacuation. On the other hand, in underground transportation infrastructures during the examinations in Kadikoy, to take the permission some phone calls made and as the result of them it has been learned that there is no evacuation escalator or lift present for the use of people with disabilities in evacuation. There are some lifts which are designed as evacuation lifts that can be adopted for an evacuation of people with disabilities [Manchester Metropolitan University, 2008]. Besides escalators can be used as addition to stairs and lifts although the escalators cannot be used with wheelchair or by people who do not have confidence to use. If there is no alternative to be used, escalators can be turned off and used as stairs [Transport Scotland, 2015].

Depending on the disaster scale, evacuations vary such as while some disasters need mass evacuation others require from collapsed buildings to the hospitals and shelters. Emergency transportation and public services are essential for the disaster preparedness [Litman, 2006].

4.2.2.2 Disaster Preparedness

Before a disaster occurs, preparedness and risk reduction activities are operated. Till 1999 Kocaeli and Duzce earthquakes, *ad hoc* activities were held in conventional level after natural disasters by the state. Though the great losses in 1999 earthquakes, it is seen that State cannot cover the future disaster losses and Obligatory Earthquake Insurance (OEI) is put into action in which collects the premiums in a pool before disaster occurs in order to use after disaster. This insurance policy is controlled by Natural Disasters Insurance Authority (NDIA) in Turkey, the Turkish name is DASK, and the insurance money which is amassed in pool for the future disasters. This compulsory earthquake insurance is provided as DASK as an affordable allowance for owners of private property and this insurance is aimed to benefit improved construction in order to increase the building quality [Taylan 2010].

In addition, to improve the disaster management system after 1999 Kocaeli and Duzce earthquakes, IMM&JICA Report (2002) gives place to legal measures, organizational structure, planning, interviews and other management systems. In Istanbul, the community-based disaster preparedness organizations perform some researches to be prepared for the next disasters, especially earthquakes. Kadikoy Municipality is the one rare case which includes the civil organizations inside the disaster management plan process and operates the activities free of charge [IMM, 2002]. The best activity practice of Kadikoy Municipality is mentioned in two points in IMM and JICA report which are coordination arrangements and practical operation. The Municipality of Kadikoy clarifies that disaster management should be ensured by local municipal level with the cooperation of volunteers, civil

society and central government. The disaster management program has been initiated by the Research and Planning Coordination Directorate of the municipality which is managing before, during and after an earthquake. Additionally, not only strengthening of the school buildings but also preparation of teachers and directors are essential because most children are spending their most of time in school [IMM&JICA, 2002].

The Municipality of Kadikoy carries out the disaster preparedness actions with the participation of several volunteers and they improved a disaster prevention plan due to their ethic, 'to solve the problem with, and, by local people'. This plan contains the organizational plan, the management centers' and critical facilities' locations, plan of citizen participation, and ground tests. The critical facilities are appeared in as medical care centers like hospitals, pharmacies, doctor and nurse offices, fuel stations, military posts, fire stations and storage. Kadikoy Municipality has a disaster management center which works as district disaster management center and provides the communication between the district and government [IMM&JICA, 2002]. In April, 2016 the Disaster Settlement Plan of the district was obtained by Environmental Protection and Coordinate Directorate of the municipality.

According to questionnaire, the common aspect of people with disabilities for disaster preparedness process is to be involved. When disabled people are active in the process of the preparation of the plans, they can give advices about their needs for each level of a disaster, such as how should the personnel be trained or which kind of equipment should be provided for their requirements before and after the disaster. In the preparedness phase, audio description units can develop the emergency education videos for both hearing and visual disabled people. Besides the association of hearing impaired people states that 24-hour customer services should be provided with an interpreter system not just in disasters but also to simplify the daily lives.

PROCESS	INSTITUTION
7.3 Social Services	
7.3.1 Caring old/child/disabled people	
Planning	
<i>Estimating the number of old/child/disabled people that may need care after a disaster</i>	Ministry of Health and Social Ass., Social Services and Child Protection Association
<i>Planning of possible locations and centers to be founded to accommodate old/child/disabled people that need care</i>	Ministry of Health and Social Ass., Social Services and Child Protection Association
Reinforcement	
<i>Investigation of child and old people residences against seismic risk</i>	Ministry of Health and Social Ass., Social Services and Child Protection Association
<i>Reinforcement of child and old people residences</i>	Ministry of Health and Social Ass., Social Services and Child Protection Association

Table 17. One part of the 7th section of main processes and sub-functions of mitigation and preparedness – institution relationship [Source:IMM, 2003; organized by Author]

5 Understanding and proposed solutions

The aim of this research was to find an answer to main question which is investigating the organizations of transportation infrastructure systems inside emergency management plans for the current situation and needs of people with disabilities. Besides the main question involves three objectives under itself which are;

Q1: How are the disabled people affected by the disasters?

Q2: How can the transportation infrastructures can be predisposed for disabled people in any emergency?

Q3: How can the people with disabilities get involved in the emergency management plans?

❖ Q1: How are the disabled people affected by the disasters?

In the world 1 billion people experience various disabilities. In the literature, people with disabilities are grouped with their health statues such as people with motor disabilities, sensory disabilities, cognitive disabilities, learning problems, age-related problems, stroke or dependent on a person or life-support machines [Alexander, Gaillard and Wisner, 2012]. It is evident that a disabled person acts within the capacity in an emergency and it is seen common that they are more vulnerable and apt to be effected in a disaster. A person with hearing impairment cannot take the evacuation orders if the orders are not written, a person with physical disability cannot escape or face with a barrier such steps in evacuation route and a cognitive disabled person cannot understand or understands the orders in a wrong way. These people are dependent to other people in order to react in time and not staying behind in emergencies.

People with disabilities came into stage as the first time in 1993 bombing of the World Trade Center with staying behind due to lack of information during the evacuation [Steinfeld, 2006]. The second fail followed the first one in 2001, the evacuation of disabled people was not such different than the first attack. In 2005 Hurricane Katrina started as a natural disaster and it finalized as a fail in evacuation and deficiency of equipment in transportation infrastructure systems [Skinner and Robert, 2009]. The mostly affected population was who had disabilities in the evacuation area.

In 1999 Kocaeli and Duzce earthquakes, which are shown as the largest events since 1923 Tokyo earthquake [Erdik, 2001], 15 million people lost their lives [IMM&JICA, 2002] and more than half of this number, above 8 million people, died in Istanbul [Ural, 2001]. The event was resulted with more than 15 thousand destroyed buildings in disposed area [Parsons et al., 2000]. Till these earthquakes the 1997 building code was used and after these two earthquakes resulted in huge losses the building code was changed in 2007 due to the presence of highly damaged buildings which cannot resist to

another earthquake. In the new building code contains also the design conditions for buildings in earthquake prone areas. In Kadikoy, there are more than 31-thousand buildings which were constructed before 1997 and 2007 building codes [IMM&JICA, 2002] and it means that more than half of the population is under a great risk for a possible next earthquake.

- ❖ Q2: How can the transportation infrastructures can be predisposed for disabled people in any emergency?

In the previous researches elderly people due to not being able to drive anymore, children who are under legal driving age and poor people who cannot afford the self-transportation are seen inside the transit dependent group with people with disabilities [Bombom and Abdullahi, 2016]. This research has shown that the usability and accessibility of transportation infrastructures are not equally developed for people with disabilities in the case study area. With the development of transportation infrastructure systems, the urbanization has been started to develop and population has increased in Kadikoy. The findings show that increased population resulted in overloaded transportation vehicles and unavailable places in vehicles for people disabilities. The questionnaire in the methodology, Chapter 3, exhibits that in peak hours of the working days the disabled people should wait for hours to use the vehicles.

In addition, the different vehicles have different level of accessibilities in Kadikoy for disabled people because the systems which are built after 2005 Statue for Disabled People keep the obligatory construction standards for people with disabilities while the older transportation systems such as trams do not have any construction according to these standards. However in the same transportation system the vehicles can differ from others due to the year when it is provided or due to the design standards which can be changed in years.

The obstacles which are frequently seen in transportation vehicles are the presence of barriers such as high steps and stairs, the lack of tactile surfaces to be followed, the absence of audience and visual warnings and signs, the unequal behaviors of car and bus driver and last but not least the poor maintenance. Unexpectedly, the low maintenance in the transportation infrastructure systems are shown in the research which are seen after reconstructions of the stations, transfer stations and linkup points. When the renewal works are operated after the end of the entrusting conditions, the maintenance or reconstruction of removed accessible instrument is not promoted again till the new tender.

This poor construction and maintenance problem affects both daily life for people with disabilities while using transportation infrastructure systems and other critical infrastructures. The examples of Intelligent Transportation Systems (ITS) show that it is possible to overcome these obstacles with small and low cost changes in the transportation infrastructure systems. This system can create an efficient solution in terms of safety in the case study area for people who are not able to drive. Suen and colleagues express (1998) that ITS provides using smart cards which increase the safety while decreasing the complications for public transport users. Elderly and disabled people have difficulties while walking to stations or bus stops, waiting in the bus stops, climbing up steps, trying to find a seat, going down a ladder etc. which can be solved by the development of transportation infrastructure systems with the application of ITS. Besides on board systems serves audible and visual announcements, accessible stop buttons for seated passengers and easy readable payment cards which advances the accessibility and usability of transportation infrastructure systems for people with disabilities.

A breakdown or a difficulty in transportation infrastructure systems create crisis in emergency from view of both accessibility of disabled people and also evacuation of them. According to Skinner and Robert (2009) transit dependent people need assistance in the evacuations which should be provided by government or other associations. People with disabilities are shown varieties during evacuation such as sensory disabled people take the warnings later than others while people with physical disabilities take the evacuation orders but they may not evacuate alone due to the presence of barriers. On the other hand, people with cognitive or learning disabilities can hear or see the evacuation orders but they cannot react as expected or they may understand in wrong way [Wisner, 2002; Stough and Kang, 2015; Battle, 2004]. This is why, the priority of evacuation and the support of assistances should be given to disabled people in order to not leave them behind.

❖ Q3: How can the people with disabilities get involved in the emergency management plans?

The main finding of this research is people with disabilities who generate the one billion, in other words 15% of the world's population [WHO&World Bank, 2011] were overlooked in the disaster risk management processes in the world till 2006 the UN Convention on Rights of Persons with Disabilities. Then the Council of Europe Disability Action Plan 2006-2015, Hyogo Framework of Action in 2005-2015, UNISDR 2013 International Day for Disaster Reduction [Mechthilde, 2014] and the third Sendai Framework for Disaster Risk Reduction 2015-2030 followed it in order to decrease the loss of disabled people and to ensure participation of them to the disaster risk reduction activities.

In Turkey people with disabilities entered to researches of disaster preparedness with the action of blind people were trained inside rescue teams in 1999 Kocaeli and Duzce earthquakes. It was aimed to train people with disabilities in order to increase their presence in disaster preparedness and support educating other disabled people in schools by trained ones. In 2005 with the Statute about Disabled People, the legislations are established in order to create a usable and accessible environment for them. This law was published to involve 7-year preparation for the public areas then it has been extended one more year. In these time, public areas are organized and constructed for the needs of people with disabilities.

On one hand, the study area, Kadikoy has a limitation due to lack of census data on population of people with disabilities. The number of registered people who have disabilities is 1686. The people with congenital disabilities are registered in the Istanbul Metropolitan Municipality Systems if they were born in a hospital or if they declare their disability to the government. Unfortunately, some people who have disabilities after an accident or a disease or if they gave born a disabled child at home, they do not proclaim their situation and they are not recorded in the databases. In order to approach to these people, municipalities and muhtars should perform activities and create a census under Metropolitan Municipality or Disability Centers. The census which is prepared by Italian Civil Protection as draft can be a useful document for the related departments of Istanbul Metropolitan Municipality. The drafts have been supplied by Civil Protection authorities and the translated versions are in the following;

CENSUS OF THE POPULATION AND THE ESTIMATION OF THE IMMEDIATE NEEDS OF PEOPLE WITH DISABILITIES OR WITH SPECIFIC NEEDS	
Date	
Gathering Area	
Floor	
ID Number	
Evaluation Code*	1)Red 2)Yellow 3)Green
Name and Surname	
Number of people	
Date and Place of birth	
Address	
Phone number	
Pets	
Note	
*:Codes	Red: Who can co-work but with physical disabilities, requesting aids or assistance. Minor, not accompanied by parents or family members. Adults older than 80 years old. Pregnant women. Yellow: Adult between 65 and 79 years old. Stable chronic diseases but requires daily treatment. Green: Adult between 18 and 64 years old. There are no chronic diseases. Minor, accompanied by parents or family members.

Table 18. Example draft Census Document to register disabled people on municipality [Source: Italian Civil Protection, Organized and translated by Author]

FORM OF INVESTIGATION FOR THE IDENTIFICATION OF PEOPLE WITH DISABILITIES AND WITH SPECIFIC NEEDS TO CHOOSE THE RIGHT ACCOMMODATION	
Information of the user	
Person	☐ Cooperative ☐ Not cooperative ☐ Violent
Information provided by	☐ User ☐ Third person. Specify name, surname and the relation with the user and phone number
Medical doctor (name, surname)	
Contact person in case of an emergency (name, surname)	
Nominative	
Qualification	
Phone number	
Type of experienced disability	☐ Motor ☐ Visual ☐ Cognitive ☐ Hearing ☐ Others:
Complied by (name, surname)	
Association	

Table 19. Example draft Census Document to gather information about disabled people [Source: Italian Civil Protection, Organized and translated by Author]

SECTION WHICH HAS TO BE COMPILED BY THE HEALTH ASSISTANCE RESPONSIBLE OF THE GATHERING AREA	
FOCUS ON THE NEEDS OF DISABLED OR VULNERABLE PEOPLE	
Public service in charge	
Current pathology	
Use of medicine	☐ Yes: Provide the name of medicines or the function ☐ No:
Aids for movement	☐ Motorized chair ☐ Manual chair ☐ Postural system ☐ Cane ☐ Walking frame ☐ Artificial limb ☐ Others
Aids for incontinence	☐ Bladder catheter ☐ Stoma ☐ Diaper ☐ Others
Is it possible to find aids/medicines in place?	☐ Yes ☐ No
Considering the gathering area, is it possible to manage the person?	☐ Yes ☐ No
Suggested accommodation:	☐ Hospital ☐ Protected structure ☐ Hotel ☐ Private house
Responsible:	Name and Surname: Signature:
Controlled by the Major (or the delegate)	☐ Approved ☐ Not approved Signature:

Table 20. Example draft Census Document to gather information about needs of disabled people
[Source: Italian Civil Protection, Organized and translated by Author]

On the other hand, Kadikoy Municipality is one of the exceptional municipality which concludes civil organizations, volunteers and central government inside emergency management progress provides a disaster management program in order to manage the activities before and after an earthquake [IMM&JICA, 2002]. The municipality worked on the Disaster Settlement Plan of the district which contains the critical infrastructures such as medical storages, public and private hospitals, fuel stations, fire brigades, volunteer houses, security headquarters, governmental buildings, railways, military areas, education areas, helipads, tent areas and shelters and this plan is placed in Chapter 4. In the following table, Table 19, the normal situation and emergency case are examined for people with disabilities to find answers for the research question and the objectives;

- The first objective, the effects of disasters on disabled people, is placed inside the general actions according to typology of disabilities to sort the difficulties that are experienced in daily life and also to prevent the negative effects of disasters on people with disabilities.
- The second objective which seeks answers for the improvement of transportation infrastructure systems for people with disabilities in an emergency, the accessibility and usability of transportation systems, removing the barriers in normal situation and in emergency, the evacuation process and accessing the people with disabilities by using transportation.
- The third objective explores the methods of involving disabled people in emergency management plans according to their needs and requirements in order to develop the emergency preparedness, to not leave the people with disabilities beyond in emergencies and to be prepared the needs of disabled people in post-disaster phase.

Each objective is identified with a color in the table which are;

1. Purple: the first objective
2. Yellow: the second objective
3. Blue: the third objective

The suggestions made by using previous researches made by Italian Civil Protection, different researchers and the standards prepared by different organizations and governments are taken place. For the different disability classes, which are chosen in the beginning of this research, different solutions and improvements are suggested for both cases according the needs specific to them.

WHAT TO DO TYPOLOGY	NORMAL SITUATION WHAT TO DO	EMERGENCY WHAT TO DO
For all disability types	• Conduct activities for emergency • Review the plans (school, municipal, place of work). • Information on the location of main architectural barriers (steps, stairs, barriers, bottlenecks). • Install warning signals (acoustic, optical, mechanical and tactile) in buildings and infrastructure systems. • Understand why people reject evacuation orders. • Locate a possible escape route accessible to a safe place. • The escape route should be analyzed before because the structural designs can show diversities. • Identify the needs of people who are residents, people with special needs, children, transport dependent people and residents in special facilities.	• Activate warning signals (acoustic, optical, mechanical and tactile). • Locate at least one possible escape route accessible to a safe place, avoid to make up in time of danger. • Approach to people not to reject evacuation and assist them if they need. • Promote active participation of people with disabilities to emergency evacuations within the limits of their opportunities to accomplish their confidence. • Provide food, water, medicine and other needs for people with disabilities living shelters. • Provide more transportation vehicles because due to wheelchairs and luggage. • Ensure participation of people with disabilities, who have been trained, in emergency phase of a disaster to the missions such as rescue, assistance for other disabled people, coordination of disabled people, etc.

	• Provide accessible and usable transportation systems for people with disabilities. • Tactile, audible and visual information should be supplied. • Build perceivable surfaces and tactile grounds. • Train personnel working in transportation systems and develop empathy inside society. • To evaluate and reduce the risk these standards can be used; 1. ISO 14798:2009: Risk assessment and mitigation process for lifts and escalators. 2. ISO/TR 19083-1:2016: The role and use of Intelligent Transportation Systems during emergency evacuation, response and recovery phases for people with special needs and the actions of responsible agencies and organizations.	• Escalators which are operating on the way along the exit direction can be used while the others which are working on opposite direction be stopped to be used as stairs. • Provide transportation vehicles for evacuees and increase the number of vehicles in the districts that contain high number of disabled people. • Provide assistants in stations and ports during evacuations.
	• Predispose the shelters for requirements of people with disabilities. • Organize emergency plans to decrease loss of lives and satisfy the needs of disabled people. • Promote active participation of people with disabilities to accomplish their confidence, • Ensure participation of people with disabilities to disaster preparedness plans and organize the plans according to their requirements and needs. • Train people with disabilities to save their lives and also to be able to help in disasters as abled-body volunteers.	

For people with motor disabilities	• Remove obstacles and prevent parking the cars on pedestrian ways. • Build ramps and handrails.	• If person get away with the use of wheelchair, make sure that the path is barrier-free. • If person cannot get away with the use of wheelchair, help them to overcome the obstacles.
	• In transportation infrastructure system design these standards can be used; 1. TSE 9111:2011 : ramps, lifts, stop buttons, door and tactile surface dimensions 2. EN 81-70:2003 : lift design 3. EN 115-1:2011 : escalator design 4. TS 7937: Criteria for the pavements; curbs, width and ramps 5. TS 12127 and 12186: moving sidewalks, escalators, ramps, lifts and platforms 6. TS 12450: wheelchair use, entrance and exits of railway stations, horizontal and vertical movements and platforms	
For people with sensory disabilities	• Announce your presence and speak clearly. • Announce the presence of obstacles such as stairs, doors or other situations prevented. • Facilitate lip reading. • Improve and use the media to reach individuals with disabilities. • Develop a communication system with different alert systems and sign languages.	• Announce your presence and speak clearly. • Announce the presence of obstacles such as stairs, doors or other situations prevented. • Make the announcements via media organs with audible and visual broadcasts. • Do not leave the person once you get to a place out of danger.

	• In transportation infrastructure system design these standards can be used; 1. TSE 9111:2011 : coloring of handrails and buttons for visually disabled people 2. TSE 9111:2011 : written announcements for people with hearing impairments 3. TS 7635: traffic signs for sensory disabled people 4. TS 12574: signs and graphs	
For people with cognitive disabilities	• Provide instructions divided into simple stages. • Try to interpret the possible reactions.	• Make sure that the person has received how dangerous situation is and accept to evacuate. • Accompany to person if they need. • When facing aggressive behaviors, give priority to safeguard for the physical safety of the person. • Be sure that they do not understand the orders late or in a wrong way.
	• Use simple signals and symbols that can be easily understood.	

Table 21. The actions should be done in normal situation and in emergency according to different disability types [Author]

People with disabilities generate the one billion, in other words 15% of the world's population. Yet design of transportation infrastructure systems and emergency preparedness are not completely developed for people with disabilities. These developments are important in the life of a disabled person because transportation infrastructure systems will connect them to education, working and social life while involving the emergency preparedness provide them participation to preparedness of future disasters.

As stated in the Introduction, chapter 1, the main purpose of this research is investigating the organizations the transportation infrastructure systems inside emergency management plans and it contains three objectives. The first objective seeks how the people with disabilities are affected by disasters, the second objective is focused on predisposing of transportation infrastructure systems for the needs of disabled people and the aim of the last objective is inclusion of people with disabilities in the disaster risk management progress and plans.

In daily life people with disabilities are faced with several obstacles which have been focused on this research. In my view the results of the suggested solutions are an excellent step toward involving the vulnerable groups and disabled people in daily life also decreasing the vulnerability of these people by including them in disaster risk management plans. Children takes an important role in this action with expressing their views, participating to DRR activities and as the result improving their resilience [Mudavanhu et al., 2015].

The case study area, Kadikoy, selected in Istanbul due to being megacity with great earthquake risk. In the past, many earthquakes occurred with big magnitudes on North Anatolian Fault (NAF) and Istanbul was one of the city affected abundantly. It is because the urbanization is in the southern Istanbul and parallel to the NAF. Kadikoy is located in the southern Istanbul which is a coastal, job offerer and historical district. The research area started to develop in very early years and it became an important harbor in the city.

Today in the district there are 452,302 habitants [TUIK,2016] and according to census data there are 1686 people [ISEM, 2016] who experience the different type of disabilities. The mentally disabled people have the majority with 28% and orthopedically disabled people follows with 23%. The other type of disabilities with descending ratio are people with chronic disease 17%, hearing impaired 8%, others 7%, visually impaired 7%, unspecified in census data 6%, psychologically disabled 4% and numbness on hands and feet are less than 1% of the population.

This research evaluates the situation of people with disabilities in daily life and give ear to needs of disabled people living or working in Kadikoy. It is focused on the usability and accessibility of

transportation infrastructure systems for people with disabilities and their disaster preparedness. In order to develop these objectives, the attention is given to the requirements of these people. Interviews and questionnaire are made by author and the results are discussed. These interviews and information exchange have been carried out with the organizations working for disabled people, local government, municipality, disabled center of municipality, disaster management center and NGOs. Disaster Management Center of Istanbul, Italian Civil Protection Department and Earthquake Planning and Protection Organization have been participated to this research. Their progress about disaster preparedness for people with disabilities and the documents that they provided for disabled people are reviewed. In discussion, chapter 5, the suggestions have been placed by using these provided data. Emergency and disaster preparedness plans should be focused on people with disabilities before, during and after the disaster. Before the disaster, preparedness should be done in local levels by municipalities. For this preparedness census forms are suggested, which are obtained by Italian Civil Protection Department and regulated by author, for the declaration of disabled people resided under Kadikoy Municipality. The use of these forms will proclaim the presence of disabled people, their addresses, disability types, needs, evacuation process and requirements in emergency. This information should be kept in the database of both Istanbul Metropolitan Municipality and Kadikoy Municipality which are the first responders in emergency. During the disaster, in evacuation and transportation people with disabilities should not be left behind. Information and communication should be provided audible and visually also the personnel, volunteers or first responders, must be well trained. Disaster plans should also take into account the sheltering, accessibility of shelters and transportation of evacuees to shelters. All these facilities should be controlled before the disaster in terms of usability and accessibility with adjusting the plans. Although this study was conducted in one district in a metropolitan city, the results can be generalizable for the other districts in Istanbul. The findings suggest that this approach would also be beneficial in other branches which are mainly focused on the needs of disabled people in using transportation infrastructure systems and disaster preparedness process.

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8 APPENDIX

Date	Article/ReportName	Disabled people	Disabled children	Vulnerability	Transportation	Evacuation	Turkey	Examples	Emergency planning	Fails	Ignorance	Usability	Accessibility	Disaster preparedness	Literature	Infrastructure	Shelters	Measurements	Notes
02/12/2016	TransportationPlanningforDisasters:Accessibility							KobeItq					X					Loss/RecoveryandAccessibility	
02/12/2016	MeasuringPostDisasterTransportationSystemPerformance:the1995KobeEarthquake							KobeItq										EarthquakeLossassessment	
02/12/2016	LessonsfromKatrinaandRita:WhatMajorDisastersCanTeachTransportation				x	x		HurricanesKatrinaandRita		Katrina:evacuation, numberofbuses, Rita:trafficjam,back									
05/12/2016	TheKnowledgeHandbook: HazardsandRiskEvacuationFramingDisaster			X									ofstructures		DisasterRisk,hazard,sustainability, recovery,prevention,s				
05/12/2016	Thefirst22hoursafterearthquakefordisabled	X				X	X		X										
05/12/2016	The1999KocaeliandDuzceearthquakes:lessonslearnedandpossible remedies to minimize future losses						X	1999KocaeliandDuzce										EarthquakeData	
05/12/2016	Risk,RationalityandResilience							Duisburg		Pedestrianflows, dynamics,ifinas					Resilience				SecondaryExampleforEvacuationFails
06/12/2016	TowardsTheDevelopmentofStandardsforEmergency	Nothing							StandardEP										NothingaboutPWD
07/12/2016	TheRoleofKnowledgeinDRR							2002Ibaflood, 2005Katrina		notunderstandingtheffails,ignoringtheff	StormXynthiaff								
07/12/2016	ChildrenwithDisabilitiesandDRR:Review		x	x										involvingDRR	ConceptofDisability				Goodresources
08/12/2016	InfrastructureDisasterIndependenciesinExtremeEvents:powerbutage							1998IceStorm								electric poweroutages			conceptualbasisandapproach
08/12/2016	EvaluatingDisasterMitigations:MethodologyforUrbanInfrastructureSystems							Portlandwater system								x		ExtendedLifecyclecostanalysisframework	
08/12/2016	CommonCriteriafortheassessmentofcritical							2006blackbut-Iceland								nodesandhotspots			criticaltime,critical quantity
09/12/2016	ChildrenwithDisabilitiesinthecontextofDisaster:AsocialVulnerability		x			Fail													
09/12/2016	ChildrenwithDisabilitiesanddisaster:preparedness:thecaseofstudyofChristchurch	x	x					Christchurch,NewZealand					X						Goodresourcesandgoodarticle
10/12/2016	Natural hazards,human vulnerabilityanddisabling societies:Disasterfor societiesanddisasterfor societies	x		vulnerability andvulnerable groups				KatrinaandKianTsunami		9/11NewYork? Inaccessiblewarning signs			Lackofaccessb.				Shelter accessibility		
10/12/2016	IsEmergencyPreparedness? DisasterforPWDintheUS? Resultsfromthe2006-2012 BehavioralRiskFactor	x		x		Reasonsfor: notevacuating? (withdata)								x					Emergency? preparednessfor? householdsandPWD
12/12/2016	TravellingbyUrbanPublicTransportation:ExplorationofUsabilityProblemsforTravel	x										Usability? problemsfor Pwd							Goodarticle
12/12/2016	TravelPatternsandChallengesforPhysicallyDisabledPersonsinNigeria						Nigeria,las						x		Accessibilityandmobility				Generalitiesof barriers,casestudy, explanationofuseful station-busystem, MOBILUS
12/12/2016	IntelligentUrbanPublicTransportation: FosteringResilience to ExtremeEventswithin InfrastructureSystems: CharacterizingDecision	x			TransportforPWD, difficulties								Transportationaccessb						
12/12/2016	IntelligentUrbanPublicTransportation: FosteringResilience to ExtremeEventswithin InfrastructureSystems: CharacterizingDecision							Electricpower									Resilience ofinfrastructure systems		
12/12/2016	NFPA130,USStandard				x	x							x						
13/12/2016	UrbanTravel: IntelligentTransportSystemandtheSafetyforElderlyand	less		Elderly/people	transportationfor oldpeople														
13/12/2016	TheStudyonDisaster PreventionInvestigationBasic																		
13/12/2016	EvacuationofPeoplewithDisabilities	x				x				EvacuationFails: Katrina,Ritaand9/11									useofRits

Table A1. Literature Study (1/5)

Date	Article/Report Name	Disabled people	Disabled children	Vulnerability	Transportation	Evacuation	Turkey	Examples	Emergency planning	Fails	Ignorance	Usability	Accessibility	Disaster preparedness	Literature	Infrastructures	Shelters	Measurements	Notes
14/12/2016	Transportation performance in disaster vulnerability and long term effects on earthquakes				effects of long term transport			Kobe/eq								loss of ports			
14/12/2016	The built environment, evacuations and individual vulnerabilities	less				Emergency evacuations													
14/12/2016	Research on evacuation design: railway station as an example					evacuation of railway station		form (NFA) 130										Evacuation calculations	
14/12/2016	Human mobility in the Sendai framework for DRR			migrants															world humanitarianism
14/12/2016	Disaster Preparedness among medically vulnerable populations	x		x												x		survey and results	
14/12/2016	Disability inclusive DRR	x				less							x						discussion
15/12/2016	They did not figure: policy exclusion of people in India	x																	policies
15/12/2016	The Sendai framework for DRR and persons with disabilities	x	x	x		x				Linked with accessibility			XX						
15/12/2016	Taking children's voices in DRR as a step forward	x	x										x						
15/12/2016	Persons with communication disabilities in natural disasters, war and conflict	x	x			x				fails in emergency									disaster, war and conflict
15/12/2016	More than 5 years after Katrina, FEMA is not prepared to meet the temporary housing needs of people and others after a disaster	x						Katrina		Fails in FEMA			x				x		only about Katrina
15/12/2016	Measuring social vulnerability to natural hazards in the Yangtze River Delta region in China			social vulnerability				China											
15/12/2016	Health concerns of women and infants in times of natural disasters: lessons learned from Katrina			women and infants															
15/12/2016	Disability and disaster: victimhood and agency in Katrina	x		x			Example						x						
15/12/2016	Disability and disaster: a tale of two cities?	x		x									x			breakdown			recovery
15/12/2016	Children of Katrina: lessons learned about post-disaster symptoms and recovery patterns		x					Katrina					x						
15/12/2016	An examination of behavior hazards faced by physically disabled during the Loma Prieta eq	x																	
15/12/2016	Aging, disability and disabled older people in India	x		elderly people															
16/12/2016	Transport strategy to improve accessibility in developing countries	x			Transportation accessibility for					Barriers			Transportation accessibility						access for all
16/12/2016	The potential of intelligent transportation systems to increase accessibility to transport for elderly and disabled people	x		elderly people	ITS							warnings	pedestrians, bus users						
16/12/2016	ENB1-70 DDA Info												lifts						photos
16/12/2016	Earthquake master plan for Istanbul	Nothing					XX												JICA data
16/12/2016	Disasters and communities: vulnerability, resilience and preparedness			x											resilience				
16/12/2016	Disability and public shelter in emergencies	x								Fails in shelters							x		
16/12/2016	Design standards for accessible railway stations	x			transportable wheelchair dimensions								signs, announcements, lifts, ramps						very useful

Table A2. Literature Study (2/5)

Date	Article/Report Name	Disabled people	Disabled children	Vulnerability	Transportation	Evacuation	Turkey	Examples	Emergency planning	Fails	Ignorance	Usability	Accessibility	Disaster preparedness	Literature	Infrastructure	Shelters	Measurements	Notes
16/12/2016	Building evacuation module for urban underground passengers: subway station in Turkey						X											Model	The number of pedestrians
16/12/2016	BS EN 170-2003 Safety rules for the construction and installation of lifts												accessibility for lifts for pwd						Annex A accessibility Annex B
16/12/2016	An emergency evacuation planning model for special needs population using public			x	x	x													
16/12/2016	Accessibility for disabled in public transportation terminal	x											accessibility transportation systems					code	
16/12/2016	Access to transport for disabled people	x											accessibility transportation infrast					Standards	
16/12/2016	A preliminary investigation of the importance of site accessibility factors for	x		Disabled tourists									x						
20/12/2016	The Routledge Handbook of Hazards and DRR: CH26: Earthquake						Earthquake data							preparedness, early warning					
21/12/2016	World Report on Disability 2011	x	x	x														Data	
22/12/2016	A study on mobility problems of disabled people in Dhaka City																		
28/12/2016	Influence of the 7 August 1999 Izmit Earthquake on Seismic Hazards in Istanbul						X	1999 Kocaeli Duzce										Eq risks in future	Probabilities
28/12/2016	The Study on Disaster Prevention and Mitigation Basic Plan in Istanbul including seismic microzonation in the Republic of Turkey	Nothing					XX												Maps
09/03/2017	Slip-rate variability and distributed deformation in the Marmara Sea fault system.						Marmara sea	1999 Kocaeli Duzce											Picture
09/03/2017	Sustainable Livelihoods: Mobility and Access Needs	X											access needs						
09/03/2017	Accessibility and evacuation planning - similarities and differences					x							x						
09/03/2017	Evolution of seismic building design and construction practice in Turkey						Building codes												
09/03/2017	The history of development in Turkish seismic code design						Building codes												
10/03/2017	September 11, 2001: A Day to Remember New Mobility	X				9/11 failure													
10/03/2017	Organizational learning from seismic risk: the 1999 Marmara and Duzce, Turkey Earthquakes						X	1999 Kocaeli and Duzce											organization learning
15/03/2017	Gender and natural disasters			gender															
15/03/2017	Effective Emergency Management: Making improvements for Communities and People with Disabilities	X							emergency management for pwd										
15/03/2017	People with disabilities and older people	X		elderly people					in risk reduction, emergency response	inaccessibility information				in recovery					Disruption of health services
16/03/2017	Practical solutions for transport access of urban residents with disabilities	X			X					Barriers: bus/rivers (falls and)			Affordable access, low cost						very useful
16/03/2017	Socio-Technical Environments Supporting people with cognitive disabilities using public transport	X	Students with cognitive disab	elderly	Public transport BTS					Mistakes and failures in public									
16/03/2017	State of the art in Na-tech risk management						Natech												
17/03/2017	Report on 1999 Kocaeli and Duzce (Turkey) Earthquakes						Eq	1999 Kocaeli and Duzce											
17/03/2017	Improving the Life Chances of Disabled People	X		X															

Table A3. Literature Study (3/5)

Date	Article/Report Name	Disabled people	Disabled children	Vulnerability	Transportation	Evacuation	Turkey	Examples	Emergency planning	Fails	Ignorance	Usability	Accessibility	Disaster prepared	Literature	Infrastructure	Shelters	Measurements	Notes
17/03/2017	Improving accessibility for people in urban areas	X			X (door-to-door service)			Mexico City, Buenos Aires, San Paulo, Rio, Cape Town, Pune-India					accessibility solutions						infrastructure solutions (alint)
17/03/2017	Improving the provision of public transport information for people in the developing countries	Needs of each disability group in transport			pre-journey info			Countries with no law, no special transport agreements for people											Tables and belated (alint)
17/03/2017	Accessibility of Urban Transport for People with Disabilities and Limited Mobility: Lessons from East Asia and the Pacific	X			urban transport			East Asia and Pacific				X							
18/03/2017	Including Elderly and Disabled in ITS development and application	X		Elderly people	TELSCAN (EUROCOMIS)														Telcan Code for disability
19/03/2017	Frail Elderly as Disaster Victims: emergency management strategies			Elderly people					emergency management										
20/03/2017	Case Study: Izmir - WORLD BANK	Nothing	Nothing	Nothing	ITS		IZMIR ITS, Kent Kart												
20/03/2017	Summary of Istanbul Infrastructure Analysis Report	Nothing	Nothing	Nothing	X		Istanbul						X		X				
23/03/2017	At Risk (PG 3-16)	X		gender, migration, social vulner			developing country authorities												
24/03/2017	Handicap International Report	X											X						
26/03/2017	Disaster Risk Perception in Urban Context and for People in Chile	X		X			Chile							Disability and risk management					Article tables
27/03/2017	Natural Disasters Displaced More People than War in 2013, Study Finds			migration															
27/03/2017	Disasters and Forced Migration in the 21st Century			immigrants, gender		forced migration													
30/03/2017	Enabling Environments WHO	X		X	Flexible transport system, Sweden barriers	emergency evacuations							accessibility different disability groups						Barriers in transportation system, universal design
30/03/2017	The Role of Transit in Emergency Evacuation	X		elderly		emergency evacuations													
30/03/2017	The Routledge CH38 Case Ethnicity religious addition and disaster			X															
31/03/2017	Equity in Transportation for People	X			insufficient transport in rural areas								ramps, lifts, barriers						rail systems, lack of elevators
31/03/2017	Painful Steps of Progress from Crisis Planning to Contingency Planning: Changes for Disaster Preparedness in Turkey						X						X						
31/03/2017	Transportation Use Patterns of US Children and Teenagers with Disabilities	X	X		difficulties for children							Usability by people with disabilities							
01/04/2017	The Evaluation of Accessibility, Usability and User Experience	X										definition	definition						
01/04/2017	Case Study USA - WORLD BANK	X		X	ITS														
01/04/2017	Case Study Florence - WORLD BANK				ITS														
01/04/2017	Usability of Public Transport for Differentlyabled People in Sri Lanka	X			barriers in bus and trains			Sri Lanka											
01/04/2017	Accessibility, Usability and Universal Design-positioning and Definition of Concepts describing person-environment	X										X	X						useful article
02/04/2017	ISO 9341-11 Usability											definition							
03/04/2017	The Routledge CH31: preparedness, warning and evacuation					X								X					

Table A4. Literature Study (4/5)

Date	Article/Report Name	Disabled people	Disabled children	Vulnerability	Transportation	Evacuation	Turkey	Examples	Emergency planning	Fails	Ignorance	Usability	Accessibility	Disaster preparedness	Literature	Infrastructure	Shelters	Measurements	Notes
03/04/2017	Guidance Note on Disability and emergency risk management for health	X		X	X	X			X				X	X			X		WHO report
03/04/2017	All under one roof	X		X		X											shelter design		Red Cross report
16/04/2017	Accessibility for the disabled people to the built environment in Ankara	everyone can be disabled one day		elderly			Ankara, 2002 Turkey Disability Research			barriers from survey results		usability of open areas (cinema, restaurant)	Accessibility of pwd and elderly in public						Disability acts
16/04/2017	Emergency preparedness and response for disabled individuals	X							local emergency preparedness								X		
16/04/2017	Istanbul premeri: Bugünkü durum ve geçmişteki büyükprem						Previous earthquakes in Istanbul	1999 Marmara											Earthquake risk
16/04/2017	Estimation of economic losses according to the earthquake scenarios for Istanbul				Economic loss		EQ history of Istanbul	1999 Marmara								Economic loss			Characteristics of IAF
17/04/2017	Mobility for the Disabled Poor	X		poor	mobility														
17/04/2017	prevention/mitigation basic plan in Istanbul including seismic microzonation in the Republic of Turkey						Istanbul	Seismic zone											
18/04/2017	Earthquake hazard in Marmara Region							1999 Marmara											Maps
18/04/2017	Application of intelligent transportation systems to enhance vehicle safety for elderly and less able travellers	X		elderly	ITS														application
18/04/2017	Hightened risks of large earthquakes in Istanbul						EQ history of Istanbul	expected eq.s											
18/04/2017	Exploring impacts of road transportation on environment: a spatial approach				urban transportation development		Istanbul development												
18/04/2017	Evaluation of possible urban planning and insurance policies to create risk reduction culture in Turkey						DASK							before and after 1999					
20/04/2017	Emergency evacuation planning guide for pwd	X				For all disability types													National Fire Protection
20/04/2017	Evacuation of disabled people	X				For all disability types													Manchester Metropolitan University
22/04/2017	Promoting Safe Egress and Evacuation for pwd	X				For all disability types													National Disability Authority
22/04/2017	Accessibility and Evacuation Planning	X		elderly		Evacuation planning													
23/04/2017	Disasters and earthquake preparedness for children and schools in Istanbul, Turkey			children without disability			Schools in Istanbul	1999 Marmara						preparedness of children and					

Table A5. Literature study (5/5)

^[1] Disability Caucus: serves as a ground-breaking forum for Members of Congress 107th and their staff to discuss the many issues affecting people with disabilities.

^[2] Eskişehir is a Central Anatolian province with 764,584 population (2016)

