DISASTER SCIENCE AND ENGINNERING

2018 - Volume: 4 Number: 2
Page: 65-79

Received: 19 Mar 2018 Revised: 9 May 2018 Accepted: 11 Jul 2018

EARTHQUAKE AND EVACUATION AREA ASSESMENT FOR ISTANBUL AVCILAR DISTRICT

Gül Yücel[1*]

[1] Department of Architecture, Faculty of Engineering and Architecture, Istanbul Gelişim University, Istanbul, Turkey

ABSTRACT

In this study, available open areas are evaluated as an emergency evacuation area in the existing settlements for earthquake. The study is based on the assessment of existing evacuation areas for earthquake which is identified by Istanbul Avcılar Municipality. In the study, "assembly area" within the scope of evacuation area for earthquake is evaluated in the district of Avcılar in Istanbul on neighborhood level. Methodology of the study is to review the related literature and assessment of existing evacuation area. In the evaluation of evacuation areas, their location within settlement area, size, existing usage status, population to be served, safety conditions, infrastructure features, and accessibility are discussed at neighborhood level. According to the case study results, there are inequalities according to the population to be served in the numbers and sizes of the places which are determined as the assembly area.
Keywords: Disaster, Earthquake, Evacuation area, Avcılar

1. INTRODUCTION

Global natural disaster statistics covering the near past (1970-2013) show that most losses of lives occur in case of tsunami and earthquake disasters [1]. In this period due to the disasters nearly 650 thousand people have lost their lives, while 28 million people were evacuated and more than 6 million people have relocated. During the same period, more than 7.5 million housings were collapsed and damages were incurred in nearly 19 million houses and total economic loss had reached to 8,5 billion USA dollars [1]. Need for relocation was most seen in case of flood disaster, while this has been ranked in the third raw among natural disasters following floods and extreme rain situations regarding evacuations [1].During East Japan Earthquake that occurred on 11th of March, 2011, which is accepted as the fourth biggest earthquake that took place in world history with losses of 15879 lives and missing of 2712 people as December 2012 when second biggest nuclear accident has also taken place, due to earthquake and tsunami, 450 thousand people were evacuated and due to nuclear accident 170 thousand people were evacuated. With the after-earthquake warning and tsunami alarm, community first settled in schools and municipality buildings and then, they moved to temporary shelters and temporary housings which were established with government support [2].

In Turkey within a period of 60 years, earthquake originated disasters rank as the first with a ratio of %55, being followed by landslide and water floods with ratios of %21 and %8 respectively. During this period, 3942 settlement unites and 159 thousand people in 53 cities are affected [3]. According to the data of Ministry of Public Works and Settlement, together with the structures that have collapsed due to

* Corresponding Author: gyucel@gelisim.edu.tr

1999 Marmara earthquake, as 75 thousand buildings were damaged in total, whereas more than 300 thousand housings and 45 thousand workplaces were damaged, emergency sheltering, temporary sheltering, and temporary housing requirements of people being influenced has created an important problem [4]. During Van Earthquake which took place on 23rd of October, 2011, more than 100 thousand housings and 15 thousand workplaces were damaged at various levels and 13 tent cities were established for providing emergency sheltering and for the central city of Van and the influenced districts [5]. During the period of transition to permanent housings, 35 container cities were established in each of which 5-6 people were sheltered whereas 176 thousand disaster victims were sheltered and during the same time, nearly 30 thousand disaster victims were settled in public facilities [5]. The sheltering issue is one of the important topics to be evaluated before disaster. Also suitable areas for emergency evacuation are important in the settlements. According to settlement needs, such as areas should be planned before disaster.

2. THE PROBLEM STATEMENT

Especially in Istanbul, news published in newspaper with the emphasis on *"no assembly area left"* [6], public attention is drawn to the local authority works related on disaster preparedness. With 1999 Marmara Earthquake, park and the availability of green areas has raised to the forefront more for possible evacuation usages. After that it's existing capacities in the city have been checked and begun development work. According to Turkish Statistic Institute TSI population projections of Turkey's population is expected to exceed 100 million in 2040. For Istanbul, where 15 million people live today, it is predicted to be 16 million in 2023 [7]. In terms of global disaster risk indicators, Istanbul ranks first rows in terms of earthquake risk [8]. Due to approximately 40% increase in the Istanbul population over the last two decades, additional work to address related disasters is needed. At the same time, there is a need to reconsider the availability and capacity of existing suitable areas and determine the current situation in the district level.

The health parameter is come to forefront with in green areas relation at urban planning in the 21st century. Under the press of high population, low rate green areas in urban areas, especially in urban areas with high disaster risks, led to problem for deficient open space that can be used after disasters. This situation related to urban planning is an important issue both in terms of health and probable disasters.

The green areas have a contribution to the city and its inhabitants in many social, cultural, aesthetic and ecological aspects [9, 10, 11]. The green strategy on the New City Agenda predicts that green spaces contribute to a healthy lifestyle and prevent physical and mental health problems [11]. There are many studies on the positive impact of green areas in the city on human health [10]. The key issue in health-related research on green space use is access, entry and public space [9]. Health priority planning and green space emphasis in cities are also closely related to availability for disasters [9] [12]. The walking distance in the settlement and the availability of accessible green space is also of vital importance in terms of disaster use.

The evacuation areas determined as the assembly area for disaster are directly related to the social infrastructure areas within the city. Social infrastructure in urban planning are include parks, recreation areas and urban forests. This kind of areas in the urban planning is important in terms of health. Open space requirement is significant after disaster for settlements which are under treat of earthquake hazard, even if there are risk reduction studies.

Green area strategies in cities are determined by relevant laws and regulations. Rapid population growth and urbanization, along with criteria evolving in line with world standards, can affect green area ratios in existing settlements. The amount of green space per capita differs from country to country. The rate of green space in the city to Istanbul in Turkey seems to be a need to develop. The primary measure for

Europe is a minimum of 0.5-1 hectares and 300 m walking distance for places considered health priority green area [9, 13]. Likewise, the amount of green space per person is expected to be over 10m². According to Regulation on Preparation of Spatial Plans (Official Gazette dated June 14, 2014, No: 29030), at different levels within the park, green space, including sports fields have to be allocated per person in urban planning for the areas identified as social infrastructure has been identified as 10m². There are cases where these criteria cannot be met in the existing city. According to Istanbul Metropolitan Municipality IMM 2010 data, per capita amount for Istanbul is 6.05m² [14]. In some recent studies carried out in the district level in Istanbul reveals that the different values [15]. In addition to spatial sufficiency, detailed research on the availability of such areas for disasters and the establishment of minimum requirements are important work in the disaster preparedness.

3. EARTHQUAKE AND EVACUATION SITUATION

In case of a disaster, evacuation is one of the primary actions to be taken for protection [16]. Searching for a safe place is important both to be protected from secondary disasters and to avoid losing of lives that may occur during aftershocks that may take places after the earthquake. After an earthquake both with respect to damaged structures and safety outside the buildings, open areas on the settlement area which are closed to houses and workplaces where everyone can be safe and facilities that can provide shelter and meet the basic requirements for a certain time until solutions can be provided to those whose houses are damaged, should be considered [17]. After a disaster, sheltering is applied in different ways and stages. Quanterelli (1995) has grouped sheltering during disaster period in groups of four stages as being emergency sheltering, temporary sheltering, temporary housing, and permanent housing [18]. Emergency sheltering takes places during the first 72 hours of emergency case situation starting from the first hours. Safe open areas, stadium, park, school, sports hall and similar areas that are situated close to houses and workplaces can be used. Temporary sheltering after a disaster constitutes people's being settled in public facilities or in the houses of their relatives for a temporary period as being away from their region. Even if emergency and temporary sheltering are overlapping, the main feature is that in temporary sheltering, it is also considered where and how the population being evacuated shall be taken care of. Permanent housing is a period during when disaster victims return to the houses which are rebuilt or to other regions [18].

Evacuation and sheltering topics are part of response stage that can take place in 3 days or 1-2 months depending on the magnitude of disaster and they are part of the recovery stages that can expend to two years after occurrence of disaster, while they are among the subjects to be evaluated within the scope of works to be realized during the preparation stage for disaster [19]. Population that becomes homeless due to disaster situation is confronted with serious economic problems. Since it is also required to solve food problem together with housing problem, during the recovery stage after disaster occurrence, provision of sufficient housings for those losing their houses represents an important urban planning and designing problem area [20].

3.1. Defining Evacuation Area for Disasters

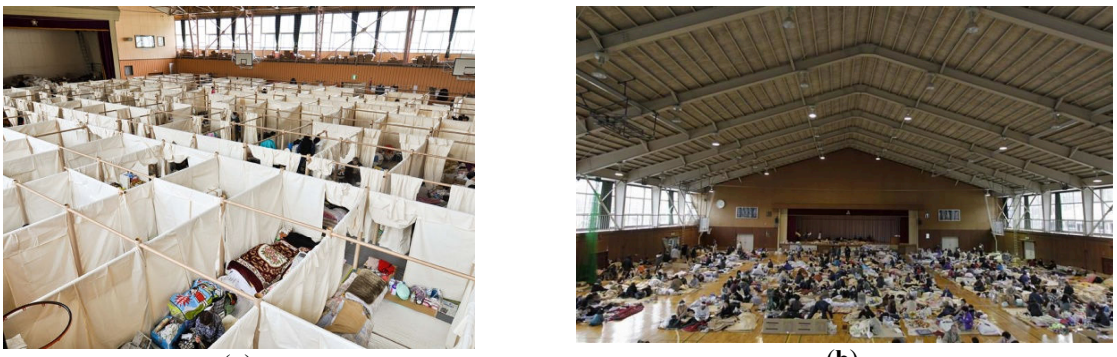
Disaster and Emergency Case Management Presidency AFAD, defines evacuation within scope of disaster as: *"Within scope of disaster and emergency case and civil protection services, evacuation of structures or a region that needs to be discharged by using predefined ways in a fast and proper way and the process of transferring the people and living creatures to safe places."* [21]. In another statement, evacuation is defined as: "*The organized, phased, and supervised withdrawal dispersal, or removal of civilians from dangerous or potentially dangerous areas, and their reception and care in safe areas."* [22]. In another definition in which disaster process is also included, it is defined as*: "Moving people and assets temporarily to safer places before, during or after the occurrence of a hazardous event in order to protect them"* and it is emphasized that *"Evacuation plans may include plans for return of evacuees and options to shelter in place"* [23]. While the key topics relating with

evacuation are seen as place-evacuation area and safe evacuation ways to enable transportation to these places, it should be considered that the process could also include taking care of the related people.

(**a**) (**b**)

Figure 1. 2011 Van Earthquake evacuation areas [24] (a) Emergency shelter area with tent; (b) Temporary shelter area with container units.

For Turkey, safe evacuation areas after a disaster are defined under two groups as “assembly area” and “temporary sheltering area” [25]. Assembly areas could be parks, sports areas, and similar areas on neighborhood scale. Emergency sheltering areas are places where temporary sheltering takes places in tent or containers or similar structures. Structure of after disaster evacuation area and sheltering forms that may include staged process that may be intertwined, can show variations depending on practical applications in the country and the user structure. For emergency sheltering, schools, religious structures, sports halls and similar places where it can be stayed safely overnight can be used for this purpose. Solutions can be different especially regarding emergency and temporary sheltering topics. While existing large scale public building can be used, temporary settlement areas such as tents or temporary sheltering unites can also be used. Temporary settlements made of tents and containers for emergency sheltering are widely used in Turkey as seen in Figure 1. But sustainability of temporary settlements is important issue after disaster. In Japan there are three different types as evacuation center, evacuation area, and temporary evacuation area to be used after an earthquake and safe buildings are used collectively as emergency and temporary sheltering areas as seen in Figure 2 [26].



(**a**) (**b**)

Figure 2. Evacuation Center, East Japan Earthquake 2011 (a) Evacuation center with partition [27]; (b) Sport hall as evacuation center [28].

Temporary evacuation area is a place where neighbors and families in the region can find out that they are safe. Parks and school areas are places which are used for this purpose. If these areas are dangerous, it can be passed on to evacuation areas with bigger area. Evacuation areas with wide area and big scale are big open areas where groups of people can be evacuated for being protected from fire and fume during big fires. Generally big park areas or big empty lands are can be used. Evacuation area/center for long duration, secondary evacuation area at the secondary stage which is also named as safe evacuation

buildings, are areas where people can protect themselves for a long period. In such instances, structures such as schools and big halls are being used. These are generally centers that can be used by people, whose houses have been damaged and who have difficulty in continuing their lives [26]. Similarly, disaster prevention parks with different scales which can be used as evacuation area for disaster and operation center in the city of Tokyo, include a ready sewage infrastructure on which many toilets can be established by covering them with canvas in case of a disaster, ovens where cooking can be done at places which are normally sitting banks, illumination that operates with solar energy, usage water tank that can be manually pumped in case of fire and similar fittings as seen Figure 3 [29, 26, 30].

(a) (b) (c)

Figure 3. Facilities for Disaster Prevention in the park [30], (a) Disaster prevention toilet, (b) Kamado Bench (stove bench), (c) drawing up water pump

4. EVACUATION AREA IMPROVEMENT STUDIES AND RELATED REGULATIONS

1999 Marmara Earthquake is the important point for risk reduction studies. Within this scope, as including Turkish Republic, city of Istanbul Seismic Micro Zoning, Disaster Prevention/Reduction Basic Plan Study JICA Report and Istanbul Earthquake Master Plan have been prepared [31, 32]. Evacuation after a disaster and the evacuation areas have been evaluated in JICA Report (2002) and required evacuation areas are determined as per neighborhood level. In the same report, safe evacuation during an earthquake for Istanbul is proposed as having two stages such as local (preliminary evacuation area) and regional evacuation areas. Local evacuation, which is the first stage, is defined as preliminary evacuation area and it is recommended to be selected from public lands and facilities (park, school, mosque etc.) so as to be in each neighboring unit and as 1,5m²/person. Due to concerns about earthquake safety regarding facilities such as schools and mosques, parks and open spaces with areas of 2000m² (minimum 500m²) are determined as the most appropriate places. The seismic rehabilitation of schools within the scope of Istanbul Seismic Risk Reduction and Emergency Case Preparation Project ISMEP (2006) has been almost completed and at the required points, schools can be considered to be used as preliminary evacuation areas [33]. Within the scope of gathering areas to be used in disaster, in IDMP as relating with sufficiency and functioning of open areas, “Earthquake Park” and “Urban open-green area system” projects have been developed. It is foreseen for “Earthquake Park” project, the purpose of which is to develop spaces at accessible points with adequate numbers to be used as safe evacuation areas, to be executed by provincial municipalities and for “Urban open-green area” project to be executed by Istanbul Metropolitan Municipality IMM [32].

For settlement under the earthquake risk, structural measures and regulations for avoiding physical damages and losing of lives within scope of risk reduction studies, considering earthquake factor in urban planning, improving public awareness and similar works bear importance. For having a world with more endurance against disasters, with international studies realized by using the experiences from the past and strategies and action plans which are prepared, disaster preparation and planning studies of countries are being guided. Within the scope of fourth priority actions in The Sendai Framework for Disaster Risk Reduction 2015-2030 where actions for preventing disasters are emphasized at national and local levels as being the most important one among these studies; *“In the process of effective response and recovery period, for establishing a better infrastructure, improving the capacity of local managements for evacuating people living in regions where there is probability of occurrence of*

disasters, for realizing preparations for disasters on national and local level and providing preparations and applications to ensure healthy provision of all requirements after occurrence of a disaster (evacuation, temporary sheltering, food, requirements other than food)" (article 33/sub-clauses h and m), importance and requirement for evacuation and temporary sheltering and continuation of lives are being revealed [34].

Strategy and action plans relating with after disaster gathering areas and temporary shelter areas which are stated in Integrated Urban Development Strategy that is prepared by Ministry of Environment and Urbanization, in Action Plan KENTGES (Strategy 11. 5), National Earthquake Strategy, and Action Plan, UDSEP (Target C.3 Provision of Fast and effective response on time to earthquakes and other disasters), reveal importance of evaluating and completing topics that are important for response after a disaster with respect to earthquakes, before a disaster takes place [35, 25]. According to the frame defined by UDSEP, after a disaster it is aimed *"To established evacuation corridors, assembly areas, temporary shelter areas, disaster support centers, emergency case facilities, and similar structures"*. It is revealed that definitions should be made in this area, standards should be defined as per the population and requirements, and all of these should be considered in spatial planning [25].

4.1. Disaster Evacuation Area Requirements

Conditions for being an assembly area and a temporary shelter area for earthquake in existing settlement places can be evaluated as per sufficiency in various topics. It may also differ according to countries. However, ownership is one of the most important parameters in terms of possible future usage. Transportation is important another parameter, with in relation pedestrians and all other vehicles. The size of area is another important parameter which is related with capacity.

Table 1. Parameters of evacuation areas for disaster [31, 32, 4, 36, 26, 37, 38, 9, 39].

	Parameter	Evaluation parameters	Standards
1	Size	First level	10000 m² and over
		Secondary level	2000-10000 m²
		Third level	500-2000 m²
2	Ownership	Private / Public	
3	Availability	Existing use	School, sport facility, green areas, playgrounds, outdoor sport areas, open areas
		Topography	0-12 degree slope
		Plant	Tree, shub, hardscape
4	Capacity	Assembly Area	1.5 m²/person
		Temporary Shelter area	9-10 m²/person
5	Infrastructure	Water supply, sewage system, electricity, all communication system, renewable energy sources	
6	Transportation	Pedestrian access	Walking time (5-20 minute)
		All type vehicle access	Evacuation road connection and helicopter landing
7	Accessibility	Providing accessibility as physically	
8	Safety	Possibility of secondary hazard	Fire, tsunami, flood, building risks
9	Environmental protection	Protection of natural resources and environmental values	

Common headings relating with this subject are compliance regarding integrity, ownership, usability, capacity, infrastructure, transportation, accessibility, safety, and environmental protection as seen Table 1 [31, 32, 4, 36, 26, 37, 38, 9, 39]. However, for disaster types where different hazard could arise, additional topics could also be evaluated. But some specification for climate conditions may be added. According to disaster related with earthquake, buildings are may secondary evacuation area due to safe

structure condition. But open sport complex as stadium or open bazaar area may potential area during disaster in settlement.

5. MATERIAL AND METHOD

The study is based on the assessment of existing evacuation areas for earthquake which is identified by Istanbul Avcılar Municipality. In the study, "assembly area" within the scope of evacuation area for earthquake is assessed in the district of Avcılar in Istanbul on neighborhood level. The other type of evacuation area named "Temporary shelter area" is excluded of the evaluation. Only general information is given for temporary shelter areas in Avcılar district.

Methodology of the study is to review the related literature and assessment of existing evacuation area. Evacuation area parameters are evaluated on the identified by Municipality as evacuation area in Istanbul Avcılar District, neighborhood level. In the study, literature review includes evacuation area standards for emergency evacuation areas and also the regulations which are related with evacuation areas in Turkey. Avcılar Municipality disaster information system ABİS, zoning plan, air photos, and site investigation data have been used in the assessment for disaster evacuation area [40, 41]. In the evaluation of assembly areas, their location within settlement area, size, existing usage status, population to be served, safety conditions, infrastructure features, and accessibility are discussed at neighborhood level as seen in Table 2. The suitability research of existing evacuation areas was carried out May-June period of year 2017. In total 48 assembly areas are examined. In case study area, seven of the assembly areas which are planned area such as residential, educational, social facility area is excluded. Such as places are take in account number and total size during the evaluation only.

Table 2. Evaluation Parameters of case study area for assembly area specifications in scope of disaster evacuation area

Parameters	Evaluation parameters
Size	500-2000 m²/2000-10000 m²
Ownership	Private / Public
Availability	Existing use : School, sport facility, green areas, playgrounds, outdoor sport areas, other open areas
Capacity	For Assembly Area: 1.5 m²/person
Infrastructure	Water supply, sewage system, electricity
Transportation	Pedestrian access: Walking time (5-20 minute) 300m
Safety	Possibility of secondary hazard: building risks

5. CASE STUDY AREA

6.1. Istanbul Avcılar District Location and General Specification

The study area Istanbul Avcılar district is bordered with Başakşehir district in the north, Esenyurt and Beylikdüzü districts at the west, Küçükçekmece Lake and Küçükçekmece district at the east as seen as Figure 4. Istanbul Avcılar district is including ten neighbourhoods as seen as Table 3.
Almost 1400 buildings have been damaged at different levels due to 1999 Marmara earthquake in Avcılar district [4]. After the earthquake, for providing temporary emergency shelter, in the region 32 school buildings and four university dormitories have been allocated and the regional community who could not enter their homes by fearing from aftershocks, have established shelters on open areas near their homes by using their own materials [4].

Figure 4. Evacuation Istanbul Avcılar district location

Population of Avcılar district is 430.770 as per 2016 data [42] and total number of buildings in the district is 26.426 according to 2015 data [43]. In the district of Avcılar within last 15 years, building stock and population have almost doubled. In the district, the neighbourhoods which are most dense with regards to the population are Yeşilkent, Tahtakale and Cihangir.

6.2. Evaluation of Evacuation areas in Avcılar District

In the evaluation of assembly areas, their location within settlement area, size, existing usage status, population to be served, safety conditions, infrastructure features, and accessibility are discussed at neighbourhood level as seen Table 2. According to Table 3 the highest number of assembly area are in Firuzkoy neighbourhood which has also second the lowest population after Üniversite Neighbourhood in the Avcılar district.

Table 3. Avcılar District population, number of evacuation place and area [41, 42]

No	Name of Mahalle (Neighbourhood)	Number of evacuation area	Total area (m^2)	Population (TUIK, 2016)
1	Ambarlı	7	33081	38642
2	Cihangir	8	36735	61320
3	Denizköşkler	6	15942	45601
4	Firuzköy	14	53919	22102
5	Gümüşpala	4	9174	41279
6	Merkez	7	23631	31515
7	Mustafa Kemal Paşa	2	2851	46681
8	Tahtakale	2	24216	50695
9	Üniversite	3	6461	21135
10	Yeşilkent	2	10271	71800
	Total	**55**	**216281**	**430770**

Three of neighbourhoods have only two assembly area as seen Table 3 and Table 4. The smallest assembly area size is in the Mustafa Kemal Paşa neighbourhood where population level is very high as seen Table 3, Figure5 and 7. With regards to the numbers and sizes of evacuation areas, Mustafa Kemal Paşa, Tahtakale and Yeşilkent neighbourhoods are ranking on the last row. According to usage status %55 of assembly areas in the district of Avcılar is selected from park areas. Most of it is selected from park areas. That means, most of is public ownership at the same time. Outdoor-indoor sports facility areas are ranking as second one with a ratio of %14. One of Sports complex which is selected as assembly area is big stadium in Firuzköy neighbourhood. It is public ownership and it may use as disaster management center during the disaster. Assembly areas that are specified for Firuzköy

neighborhood is ranking in the first row as seen Table 3 and 5. It seems that there is enough assembly area for during disaster. Also location of them should be checked for population to be served.

Table 4 Avcılar District number of evacuation area with size and existing function [41]

Type of area	Total Number	Total Area (m²)
Park	34	119226
Park Area	2	10271
Playground	6	13726
Sport Areas Indoor&Outdoor	3	29124
Residential Area	1	5864
Commercial Area	1	9558
Municipality Area	1	2013
Socio-Cultural Facility Area	1	480
Pedestrian Area	2	9345
Vocational Facility Area	1	5395
Sport Areas	1	3922
Educational Area	1	6928
Special Project Area	1	430
	55	216282

While Cihangir, Ambarlı and Merkez neighbourhoods are ranking in second row with regards to the number of assembly areas, it is still required to develop additional evacuation areas as there is too much population and there is need to meet the requirements as seen in Table 5.

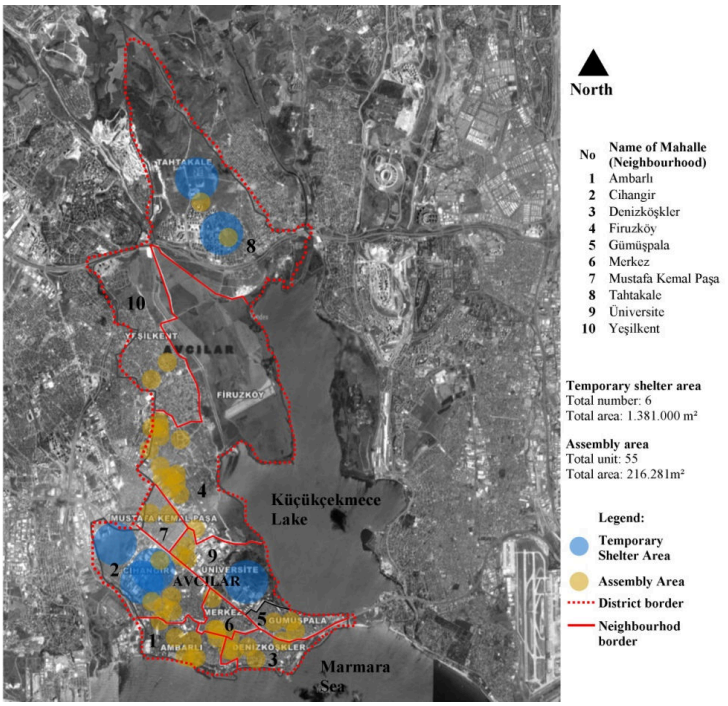


Figure 5. Istanbul Avcılar district satellite view with evacuation area (prepared by using Avcılar Municipality City Guide) [44]

For the pedestrian areas that are determined as evacuation areas, building nonstructural risks should be considered in Merkez neighbourhood. The pedestrian area is surrounded commercial places as seen as Figure 7. It may not using efficiently during disaster. Even if there is an infrastructure that can be reached around the all evacuation areas, it is required to control usability during the disaster period. Also green energy sources may consider for lighting. And water reservoir should be planned in park areas. Mustafa

Kemal Paşa neighborhood is ranking at the bottom row with respect to the assembly areas that are allocated as being proportionate to the population of neighborhood. Also some places such as school gardens may be using as assembly area for disaster.

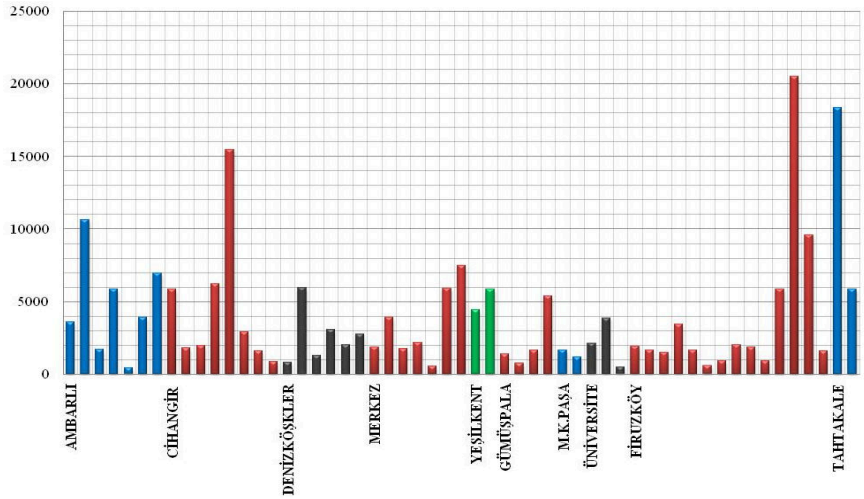


Figure 6. Istanbul Avcılar district evacuation areas according neighborhood level with size (m²) [41]

The largest area being allocated is situated in the Firuzköy neighbourhood. In the district of Avcılar, the highest population is seen in Yeşilkent and Cihangir neighbourhoods. There is an unproportional situation considering assembly area with sizes. For this reason new areas should be progressing before disaster.

Table 5 Avcılar District assembly areas according neigbourhood [41].

Name of Neigbourhood	Park	Park Area	Playground	Indoor/Outdoor Sport facilities	Residential area	Commercial area	Municipality Facility Area	Social-cultural facility area	Pedestrian area	Occupant facilities	Outdoor sport area	Educational facility area	Special project area	Total area (m²)
Ambarlı	18225		3576								3922	6928	430	33081
Cihangir	30032		6702											36735
Denizköşkler	11893		1292	2757										15942
Firuzköy	16011			20473	5864	9558	2013							53919
Gümüşpala	3779									5395				9174
Merkez	6237		2155	5894					9345					23631
Mustafa Kemal Paşa	2851													2851
Tahtakale	24216													24216
Üniversite	5981							480						6461
Yeşilkent		10271												10271
Total Area (m²)	119226	10271	13726	29124	5864	9558	2013	480	9345	5395	3922	6928	430	216281

Disaster preparedness studies should be in accordance to the population profile. Demographic specification and distribution of it in district should be considered for updating assembly areas. Being the light industry in Firuzköy and business center in Merkez neighbourhood is showing that different population profile by each neighbourhood. Experiences obtained from past periods and probable earthquake risk in the future; require more detailed studies to be made relating with evacuation areas for disaster. Regarding the areas which are determined as evacuation areas, it is important to specify the needs relating with disaster and to notify the community accordingly. Due to rapid population rise,

disaster preparedness should be refreshed frequently. Even though majority of parks that are stated on existing zoning plan are specified for disaster evacuation area, the residents of the region are faced with insufficient green areas.

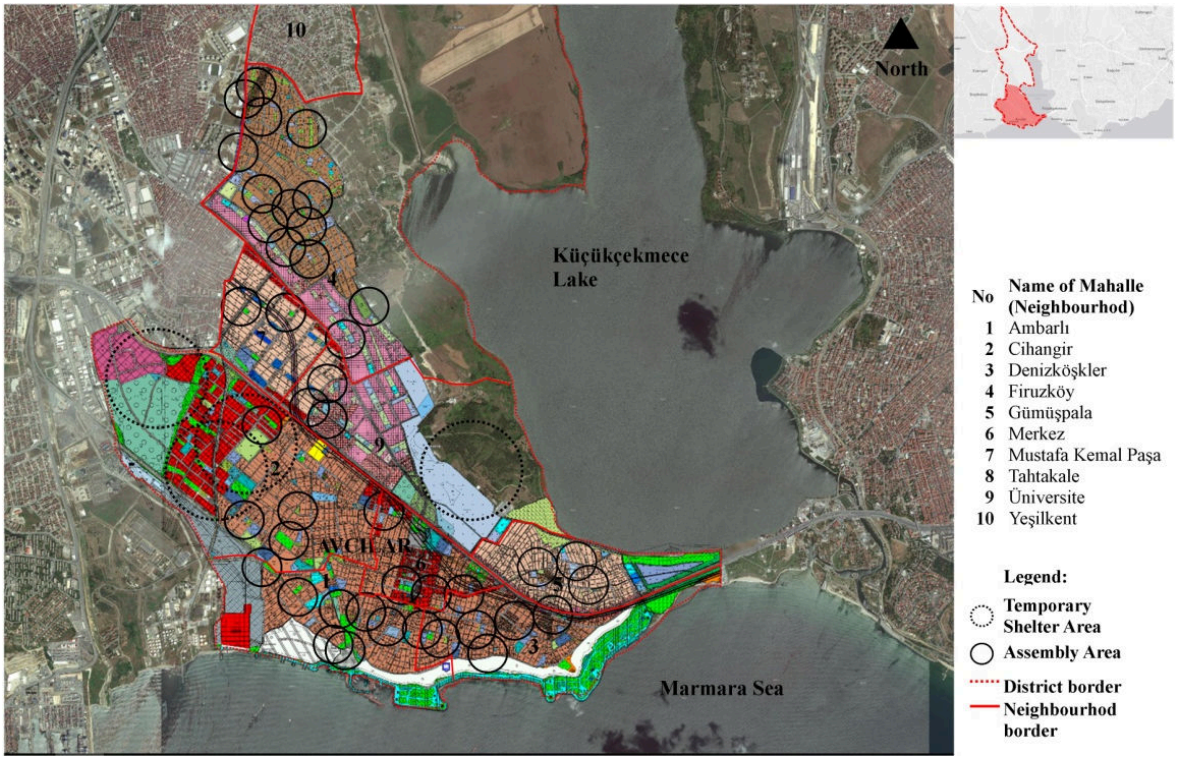


Figure 7. Istanbul Avcılar district satellite view with evacuation area (prepared by using Avcılar Municipality City Guide and zoning plan) [44].

In the district of Avcılar within the scope of evacuation areas, emergency shelter areas in six different placements have been determined. In general total, in all the emergency shelter spaces with area of 1381000m² there is infrastructure support [41]. These areas are mainly determined from privately owned areas. The ownership status of emergency shelter areas may create problems in the future with regards to the usages. Besides the emergency shelter areas that are determined in the district of Avcılar, planning works that are made in the region for reducing risks also bear importance.

7. DISCUSSION AND CONCLUSION

According to the case study results, there are inequalities according to the population to be served in the numbers and sizes of the places which are determined as the assembly area. As the location evaluation, the majority of the neighborhoods are into lack of available evacuation area within the walk distance. Most of the assembly areas were selected from public spaces such as parks. For this reason, there is no problem which can be regarded as important about ownership. Park areas selected as assembly area are actively in daily use. The ultimate goal is the need for a minimum evacuation area for a any disaster situation. At the same time with this goal is to create a social infrastructure which is accessible for everyone in urban planning.

The next step is to search for disasters for disaster in places designated as areas for disaster recovery. There is need for studies on removable or multifunction urban furniture, drinkable water sources, and ready use infrastructure for sanitary and renewable energy resources for existing assembly areas. The flexible usability of public open spaces in settlements is the next step of these studies.

During the response stage of disaster, besides search and rescue operations, providing safety after the disaster and requirements for evacuation and safe sheltering during this period are also among the important topics relating with settlement areas. Improving the resilience of settlement as physically is one of the important prevention studies before disasters. Need for disaster evacuation areas in the settlement during probable disaster can be minimizing in this way.

Regardless of the type and scale of a disaster, communities that are faced with disasters leave their places for a certain period. Relocating and temporary sheltering have impact on land usage, establishment of new living conditions, and existing settlement and usages. For this reason, risk reduction studies should have priority regarding disasters and minimum level of damages should be targeted. Assembly areas and emergency shelter areas for disaster evacuation should be sufficient for everyone in the settlement. Within this scope, instead of reserved areas, providing livable environment should have priority at plans.

REFERENCES

[1] Desinventar. (2015). GAR Global Assessment Report on Disaster Risk Reduction. Retrieved June 17, 2017, from Desinventar: http://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=g15&continue=y

[2] Esnard, A.-M., & Sapat, A. (2014). Displaced by Disaster: Recovery and Resilience in a Globalizing World (Disaster Risk Reduction and Resilience). Newyork: Routledge.

[3] Gökçe, O., Özden, Ş., & Demir, A. (2008). Türkiye'de afetlerin merkansal ve istatiksel dağılımı afet bilgileri envanteri. Ankara: Bayındırlık ve İskan Bakanlaığı Afet İşleri Genel Müdürlüğü, Afet Etüt ve Hasar Tespit Daire Başkanlığı. Retrieved from https://www.afad.gov.tr/Dokuman/TR/97-2014061215307-abep_kitap_matbaa_final_04122008_small.pdf

[4] Yücel, G. (2009). Earthquake and Physical and Social Vulnerability Assessment Model for Settlements:Case Study Avcılar District. Istanbul: Yıldız Technical University, Graduate School of Science, Engineering and Technology, Department of Architecture. Unpublished PhD thesis (in Turkish).

[5] AFAD. (2014). Müdahale, İyileştirme ve Sosyoekonomik Açıdan 2011Van Depremi Raporu. Ankara: T.C. Disaster and Emergency Management Presidency.

[6] Habertürk. (2017, August 17). İstanbul'da toplanma alanları AVM oldu çadır kuracak yer kalmadı. Retrieved May 12, 2018, from http://www.haberturk.com/gundem/haber/1600983-istanbul-da-toplanma-alanlari-avm-oldu-cadir-kuracak-yer-kalmadi

[7] TUIK Turkish Statistic Institute. (2018, February 21). Nüfus Projeksiyonları, 2018-2080. Retrieved May 26, 2018, from Türk: http://www.tuik.gov.tr/PreHaberBultenleri.do?id=30567

[8] Lloyd's. (2015). Lloyd's City Risk Index 2015-2025. Retrieved May 16, 2018, from Lloyds: https://www.lloyds.com/cityriskindex/threats/earthquake

[9] WHO Regional Office for Europe. (2016). Urban Green space and health: a review of evidence. Retrieved May 25, 2018, from WHO Regional Office for Europe: http://www.euro.who.int/__data/assets/pdf_file/0005/321971/Urban-green-spaces-and-health-review-evidence.pdf?ua=1

[10] WHO Regional Office for Europe. (2017). Urban Green space interventions and health: a review of impacts and effectiveness . Retrieved May 25, 2018, from WHO Regional Office for Europe: http://www.euro.who.int/__data/assets/pdf_file/0010/337690/FULL-REPORT-for-LLP.pdf?ua=1

[11] WHO World Health Organization. (2016). Health as the pulse of the new urban agenda: United Nations conference on housing and sustainable urban development. Genova: World Health Organization.

[12] World Health Organization & UN-Habitat. (2016). Global report on urban health: equitable healthier cities for sustainable development. Retrieved May 20, 2018, from World Health Organization & UN-Habitat: http://www.who.int/iris/handle/10665/204715

[13] CABE Commission for Architecture and the Built Environment. (2009). Open space strategies: best practice guidance. Retrieved May 20, 2018, CABE Commission for Architecture and the Built Environment: https://www.designcouncil.org.uk/sites/default/files/asset/document/open-space-strategies.pdf

[14] IMM Istanbul Metropolitan Municipality. (2010). İBB Park ve Bahçeler Müdürlüğü 2004-2010. Retrieved May 12, 2018, from IMM Istanbul Metropolitan Municipality: http://www.ibb.gov.tr/tr-TR/BilgiHizmetleri/Istatistikler/Documents/bldhizmetleri/2010/parkvebahceler_mud_2004-%202010.pdf

[15] Istanbul95. (2017). İstanbul İlçe Belediyelerinde Çocuğa ve Aileye Yönelik Hizmetlerin İncelenmesi ve Haritalanması Projesi. Retrieved May 15, 2018, from Istanbul Studies Center, Istanbul95 web site: http://belediye.istanbul95.org/#

[16] Sorensen, J. H., & Sorensen, B. V. (2007). Community Procesesses:Warning and Evacuation. E. L. Editor. havidan Rodriguez içinde, Handbook of Disaster Research (s. 183-199). Springer.

[17] [15] Coburn, A., & Spence, R. (2002). Earthquake Protection. İngiltere: John Wiley&Sons Ltd.

[18] Quarantelli, E. (1995). Patterns of sheltering and housing in US disasters. Disaster Prevention and Management: An International Journal, 43-53.

[19] Kadıoğlu, M. (2008). Afet Zararlarını Azaltmanın Temel İlkeleri. M. v. Editör: Kadıoğlu içinde, Modern, Bütünleşik afet yönetiminin temel ilkeleri, (s. 1-35). Ankara: Japonya Uluslarası İşbirliği Ajansı JICA Türkiye Ofisi Yayınları No:2.

[20] Lagorio, H. J. (1990). Earthquakes: An architect's guide to nonstructural seismic hazards. New York: Wiley-Interscience John Wiley.

[21] AFAD. (2014, November). Açıklamalı Afet Yönetimi Terimleri Sözlüğü. Ankara: T.C. Disaster and Emergency Management Presidency Press.

[22] FEMA Federal Emergency Management Agency . (2008). FEMA Web Site. Retrieved, May 10, 2017, from Guide to Emergency Management and Related Terms, Definitions, Acronyms, Programs and Legislation:https://training.fema.gov/hiedu/docs/terms%20and%20definitions/terms%20and%20definitions.pdf

[23] UNISDR United Nations Office for Disaster Risk Reduction. (2017). Terminology. Retrieved October 10, 2017, from UNISDR United Nations Office for Disaster Risk Reduction: https://www.unisdr.org/we/inform/terminology

[24] AFAD. (2016, January 15). Van Earthquake. Retrieved May 31, 2017, from AFAD T.C. Disaster and Emergency Management Presidency Web Site: https://www.afad.gov.tr/tr/2284/Van-Depremi

[25] AFAD. (2013). UDSEP National Earthquake Strategy and Action Plan 2012-2013 (in Turkish). Ankara: AFAD T.C. Disaster and Emergency Management Presidency.

[26] TMG Tokyo Metropolitan Government. (2015). Disaster Preparedness Tokyo. Retrieved May 21, 2017, from Tokyo Metropolitan Government web site: http://www.metro.tokyo.jp/ENGLISH/GUIDE/BOSAI/index.htm

[27] SBA Shigeru Ban Architects. (2016). PPS set up in an evacuation center, in East Japan on 2011. Retrieved, May 31, 2017 from SBA Shigeru Ban Architects: http://www.shigerubanarchitects.com/works/2016_Amatrice_02/index_en.html

[28] Reuters . (2011, March 22). Japan's Evacuation Centers . Retrieved June 03, 2017, from Reuters Web Site: http://in.reuters.com/news/picture/japans-evacuation-centers-idINRTR2K7YQ

[29] Toshikazu, U., & Takumi, H. (2015). Operational Management Regarding Disaster Prevention Parks in Tokyo Metropolitan Parks. World Urban Parks Congress 2015, 9th Ibero American Congress of Parks and Public Gardens. Parjap.

[30] Tokyo Metropolitan Park Association. (2017, September). Handbook for Disaster Prevention Parks. Retrieved May 20, 2018 from Tokyo Metropolitan Park Association: http://www.tokyo-park.or.jp/special/bousai/english/

[31] JICA Japan International Cooperation Agency. (2002). The Study on A Disaster Prevention / Mitigation Basic Plan in Istanbul including Seismic Microzonation in the Republic of Turkey. Final Main Report.

[32] IMM Istanbul Metropolitan Municipality. (2003). İstanbul Deprem Master Planı. İstanbul: Istanbul Metropolitan Municipality, Plan ve İmar Dairesi, Zemin ve Deprem İnceleme Müdürlüğü.

[33] Istanbul Valiliği. (2006). ISMEP İstanbul Seismic Risk Mitigation and Emergency Preparedness Project (in Turkish). Retrieved May 31, 2017, from IPKB İstanbul Project Coordination Unit: http://www.ipkb.gov.tr/tr/ismep

[34] UN United Nations. (2015). Sendai Framework for Disaster Risk Reduction 2015–2030. Retrieved May 21, 2017 from UN United Nations web site: https://www.unisdr.org/files/43291_sendaiframeworkfordrren.pdf

[35] ÇŞB Republic of Turkey Ministry of Environment and Urbanisation. (2010). KENTGES Integrated Urban Development Strategy and Action Plan (in Turkish). Ankara: Çevre ve Şehircilik Bakanlığı.

[36] Sphere Projesi. (2011). Sphere Projesi, İnsani Yardım Sözleşmesi ve İnsani Yardımda Asgari Standartlar . May 05, 2017 tarihinde Sphere Projesi: http://www.sphereproject.org/handbook/ adresinden alındı

[37] Anhorn, J., & Khazai, B. (2015). Open Space Suitability Analysis for Emergenys Shelter After an Earthquake. Natural Hazards Earth System Sciences, 789-803.

[38] Çelik, H. Z., Özcan, N. S., & Erdin, H. E. (2017). Afet ve Acil Durumlarda Halkın Toplanma Alanlarının Kullanılabilirliğini Belirleyen Kriterler. 4.Uluslararası Deprem Mühendisliği ve Sismoloji Konferansı. Eskişehir.

[39] Özcan, N. S., Erdin, H. E., & Zengin, H. (2013). Kentlerde Açık ve Yeşil Alan Sistemlerinin Afet Yönetimi Bağlamında Kullanılabilirliğinin Değerlendirilmesinde Coğrafi Bilgi Sistemleri (CBS): İzmir Örneği. TMMOB Coğrafi Bilgi Sistemleri Kongresi. Ankara.

[40] AB Avcılar Municipality. (2017). ABİS Afet Bilgi Sistemi. February 05, 2018 tarihinde Avcılar Municipality web site: http://avcilar.bel.tr/Icerikler/Abis adresinden alındı

[41] AB Avcılar Municipality. (2017, May 05). Toplanma ve Geçici Barınma Alanları. Istanbul: 05.05.2017/ 69384616-663.09-E.325-14067. Avcılar Belediyesi Web Site. adresinden alınmıştır

[42] TUIK Turkish Statistical Institute. (2016). Avcılar İlçesi 2016 Nüfusu Adrese Dayalı Nüfus Kayıt Sistemi. May 22, 2017 tarihinde TUIK Web Sitesi: https://biruni.tuik.gov.tr/medas/?kn=95&locale=tr adresinden alındı

[43] AB, Avcılar Municipality. (2017, May 17). Plan ve Proje Müdürlüğü. Kentsel Dönüşüm İşleri. Avcılar: Avcılar Belediyesi 17.05.2017/ 43583371-310.14.01-E.580-15411.

[44] AB Avcılar Municipality. (2018). Avcılar Belediyesi Kent Rehberi. Retrieved June 10, 2018, from http://keos.avcilar.bel.tr:8081/keos/