USAGE OF THE URBAN GREEN AND OPEN SPACES IN CASE OF EARTHQUAKE- KUCUKCEKMECE-CENNET DISTRICT AS A CASE STUDY

Hilay Atalay[1] , Ayşe Sema Kubat[2]

Abstract

Urban green and open spaces are getting more important day by day and these spaces which have really important functions in urban areas were destructed after 1950 by the urbanization development process of the cities without planning. After the Marmara Earthquake in Turkey in 1999, significance of the earthquake was understood more importantly that we are under risk and it pointed the green and open spaces which are used as a shelter, a evacuation after Marmara earthquake that we haven't got enough capacity. The purpose of this study is to find out a analytical method to determine the urban green and open spaces whether we have got enough or not which will be used in case of any earthquake risk. Initially on this study it was touched on the concept of urban and urbanization, the importance of the urban green and open spaces, the concept of earthquake and the relationship between earthquake and planning. It was advised methods to be able to determine areas which will be used as a shelter and evacuation points after earthquake and to examine their sufficiency according to the sample studies. The urban green and open areas which will be use as evacuation and shelter areas after earthquake in Cennet quarter, Kucukcekmece administrative district which was chosen as an example were determined and these areas were analyzed in terms of their efficiency. Within the context of being prepared for earthquake, determining the green and open spaces which will be used as shelter, evacuation areas and analyzing their sufficiency and giving advises in case of where these places are insufficient.

Keywords: Urban Green and Open spaces, Earthquake, Gathering Area, Sheltering, Evacuation Area,

1. Introduction

During the rapid urbanization in Turkey, urban population growth created by the migration to the towns has conduced to toward the urban deposition area in unplanned developing urbanization area. Due to the fact that the open and green areas in rapid urbanization process have been damaged and due to the increasing the population density, the green area amount per person has been decreasing. And the problem has faced with because of unawareness of the open-green areas in the unhealthy structured towns and the attention has not paid to the existence of the urban reinforcement area. On

the other hand, because of the earthquakes occurred in Turkey, usage of the open and green areas in the cities has become important and the problem has occurred because of the insufficiency of this area in the qualitative and quantitative terms. In this study, in case of any possible earthquake risk in Turkey where is located in the earthquake zone and the aim is to define the functions of the urban open and green spaces after the earthquake occurred, and to determine the urban open and green spaces to be used by the population after the earthquake and as well as to define an analysis method to measure the capabilities of these areas.

2. Disaster And Earthquake

The disasters are very difficult to cope with is natural, technological or man-made event that cause physical, economic and social losses and that interrupts ordinary life, social and economic activities or stops them as well as affects the societies indeed (Kadıoğlu, 2002). Among disasters, the most destroying and destructive one is earthquakes, which cause the loss of life and most. Because of crustal deformation, the earthquake occurs suddenly and it spreads and shakes the land accordingly.

Turkey is located in the most active region of Alpine-Himalayan earthquake belt. Northern Anatolian fault line affects all around Turkey from west to east. 96% of Turkish land and 98% of Turkish population are under the earthquake risk because of various earthquake risk (Palpal, 2000). The possibility of seismic earthquake risk in Istanbul has not finished after the earthquakes occurred in 1999. In accordance with the current researches, depending on the historical earthquake risk of the area, the most destructive earthquake has been expecting in the Marmara Sea that affected Istanbul several times (Kubat et al, 2008).

Due to the uncontrolled and rapid urbanization in Istanbul, the wrong applications of city and region planning and failure construction techniques and applications, lack of infrastructure and services, environmental degradation, the earthquake risks have achieved the highest levels. It is inevitable that the disaster preparation and emergency response methods must be defined and must be put into application before, during and after the earthquake in Istanbul if the disaster happens (İDMP, 2003). Natural disasters and particularly earthquakes induce disasters when occur in the large settlements such as metropolitan areas (Kubat et al, 2008).

3. Usage of Urban Open and Green Spaces After the Earthquake

When the disaster occurs, in parallel to the rescue and first aid activities, in spite of the fact that it takes long term to repair or reconstruct the buildings damaged by the disaster, the accommodation and basic needs of the earthquake victims should be covered within this process (Yılmaz, 2003).

During and after the disaster, people whose homes have damaged or destroyed should seek for sheltering alternatives until the permanent resident solutions will be determined. Temporarily sheltering could be considered as a step of re-sheltering process after the earthquake and a type of physical sheltering stock after the earthquake indeed (Johnson, 2007).

The urban open and green areas have undertaken a leading role in the urban sense by means of their usage and transformation before, during and after the earthquake. Open and green areas have been undertaking different functions before and after earthquake.

The open areas which is the indicator of a prosperity and life standard in daily life has become vital for emergency access, gathering, access by air, storage and distribution of emergency rescue materials, emergency tent using or temporary sheltering area. During emergency conditions, urban open areas have been required by many reasons. Security and temporary sheltering, temporary storing activities that are important for survival are more than important during and after the earthquake. Green areas, sport areas, car parking areas squares and etc. should have sufficient size and should be close to the population in order to serve them efficiently and effectively and these area must be empty. For this reason, these areas must be in proper size and close to the settlements and should be allocated these areas in the master plans. (IDMP, 2003).

After the major earthquake, many people have faced with great difficulties to find a place in a small evacuation center due to the fact that the damaged buildings have blocked the roads. In case of emergency evacuation, the large open and green areas as well as large evacuation roads are required. In the high-density housing areas, it could be more than difficult to find large open and green spaces. In the risk and disaster situation, in spite of the fact that it could not be known when and how the disaster occurs, it is vital to prepare relevant plants and area for emergency evacuation (Shiozaki et al, 2006).

In order to protect population in the earthquake-affected region, a new emergency evacuation system is needed because of the reasons below (JICA, 2002):

- To decrease the loss of lives resulted from second/third aftershocks,
- To decrease the loss of lives resulted from second disasters,
- In order to carry out the distribution of response teams and emergency materials etc. effectively, the relevant information about preliminary damage should be collected from the local community to be evacuated.

In the coming days after the earthquake, during the emergency process, the families whose houses have damaged are evacuated in different places. These areas are composed of empty public buildings, hotels, homes belonged to their families, tents and other arrangements. (Coburn and Spence, 2002).

3.1. Classification Of Urban Open And Green Spaces According To Their Usage Types After The Earthquake

After the earthquake, the urban green and open spaces can be used for different aims such as temporary gathering areas, tent areas and temporary settlement areas in different scales and in different timelines.

Temporary Gathering Areas

Immediately after the earthquake, people inside the buildings want to go out in order to protect themselves against the aftershocks and to protect from the major earthquake as well. In this situation, if there is any open area where the buildings are located, people will prefer these areas and if not, they have to go closest open public space.

The gathering areas and sheltering places which are close to the building and business places and where the information and organization could be found should be defined accordingly. These area should be publicized and should provide gathering area function to act as counter after the earthquake as well as should perform their functions for emergency mobilization. In the most density structure where the high rise buildings are located, it could not be so easy to find gathering areas Many towns do not have sufficient area for 1 m^2 per person to plan gathering places(Coburn and Spence, 2002).

It was suggested that the evacuation areas should be located in each neighborhood unit for the inhabitants of that region and all people (gross minimum area: 1.5 m^2/person).
The gathering areas should be equipped to enable people staying outside for hours. Particularly in the harsh weather condition, it could be difficult to prevent people from going back to their home and business places. For this reason, the relevant equipment should be provided against the extended evacuation process by including rest rooms, shelters, food, tents for sleeping and blankets. After one or several days, if such kind of equipments could not be provided, people would like to go back their homes for their clean clothes, shower needs and other requirements. If the requirements of the people could not be covered, it will be impossible to prevent them from going back to their homes accordingly. (Coburn and Spence, 2002).

Tent Areas

In order to provide emergency sheltering for great number of homeless people, the tent areas are most appropriate sheltering form. Because the tents could be easily stored, pitched-up and could be protected against the weather conditions. The tent areas are safe against the major earthquakes and aftershocks that could be occurred. Generally, people would like to pitch up their tents next to their destroyed homes or around their houses (Coburn and Spence, 2002).

Temporary Settlement Areas

It could take long time to carry out planning and implementation activities regarding the reconstruction and resettlement of the buildings affected by devastating earthquakes. In this process, it is considered that there are emergence sheltering and Temporary Settlement coordination activities as well. For the transitional process to the Temporary Settlement and regarding the reconstruction to be selected, the strategies generally take too much time and the problem could be faced in the next steps (Coburn and Spence, 2002). While organizing the land use plans in the earthquake risky region, the reservation area should be allocated to be used as Temporary Settlement and to be also used for the green area requirements in the existing situation (IDMP, 2003).

3.2. Classification Of Urban Open And Green Spaces According To Their Ownership

The urban areas will be used for the purpose of temporary gathering area after the earthquake, tent area, temporary settlement area and other management areas are made in three types as public, semi-private and public, private areas. Urban open and green areas are the public areas and these spaces that have been used actively and passively in the cities such as park area, children play grounds, sport areas, exhibition and festival areas, private thematic gardens (in small and large size), refuges, squares have been mostly used after the earthquake.

Neighborhood parks have been used as the temporary sheltering area during and after disasters as well as temporary health and other technical requirements. On the other hand, the neighborhood parks must have infrastructure and must be planned to provide service within the storing area for the relief material and food distribution after the earthquake (IDMP, 2003). In these areas, due to the fact that the infrastructures such as toilet, fountain, lights, recreation and sitting areas are available in the existing conditions, it would be more than easy to transform them into the tent towns (Orhon, 2002).

The squares that have been used in different purposes in the towns have become a resource in the establishment of disaster management center during the activities of relevant authorizations during the disasters. In spite of the fact that the squares have been representing the towns and each one, in case of shock and astonishment during the disaster, has very well known these could be a gathering area where everybody could meet easily. For this reason, after the earthquake, these areas have been undertaken very important roles to provide organization after the disaster and to collect relief materials for the victims of the earthquake as well as to distribute the relief materials. Besides, the exhibition and fairground could be used at the same purpose (Orhon, 2002). After the possible earthquake, the public areas could be transformed into the temporary meeting/evacuation, tent town and temporary settlement areas.

Semi-private and public spaces cover the open areas of the public buildings that are not completely open to the public use in the towns. Open areas or gardens of official, education, health and religion facilities among others which have been used after the earthquakes. After the earthquake, in these official buildings and their gardens, in order to continue vital activities of people ,the relevant materials and equipments for the victims of the earthquake should be stored before the earthquake. In order to continue the vital activities in the education buildings, these could be easily transformed to the gathering areas and tent towns for their evacuations. Religion facility areas are mostly important to provide the vital requirements such as toilet and water after the earthquake.

4. Definition of the Method

In the process of generating this method, It has been searched and analyzed different approaches and methods about determination and measurement of sufficiency of urban open and green spaces used gathering areas after earthquake

In the first step of the method, lands uses of the parcels are determined. By defining the current structure parcels, the urban open and green areas to be used as evacuation and gathering areas have been defined. In the process of defining open and green areas, the field trips, have been carried out and by defining physical specifications such as open area position and topographic situation. After the analysis the most suitable areas have been determine that will be used as gathering areas. The urban open and green areas to be used after the earthquake and their intention of purpose are defined as follows:

- Parking Areas
  - Neighborhood Parks: Gathering/Sheltering Places
  - District Parks: Gathering /Sheltering Places
  - City Parks: Temporary Settlement Area
- Open Areas/Gardens Of Education Facilities
  - Primary School: Gathering Area
  - Secondary School: Gathering Area
  - High School: Gathering Area
- Open Area Of Health Facilities: Health Services
- Open Area Of Public Facilities: Disaster Management Centers
- Car Parking Areas: Gathering Area
- Empty Spaces: Gathering Area
- Open Area Of Mass Housing Area: Gathering Area

Only education facilities among the public facilities have been accepted because the open areas of health facilities will be used for the purpose of treatment. On the other hand, the open areas of the official institutions will be used for the disaster management center indeed. During the determination process of urban open and green spaces, each

area has been reviewed on the site and the pictures of those areas have been taken as well as the risky position of the areas have been ascertained. Risky position of the open areas could be assessed in accordance with the building availability on the boarder of parcel by individual observance, the distance to the nearby buildings and height of the buildings as medium and low safety.

The areas where the buildings are not located on the parcel building are classified as high security areas. The areas where at most four layer buildings are located in the parcel border are classified as medium and the areas where more than four layers are located are classified as low security indeed. As a result of the analysis made in the site, the obtained data are associated with ArcGIS program. Data of gathering areas prepared on the basis of parcel, by associating with the gathering area number as Tn, classification information and name of the place, current land use, risk status through the A, B and C symbols as well as risky situation and total parcel area information through ArcGIS program, the tables that show the gathering area information have been established.

- High security areas: A
- Medium security areas: B
- Low security areas: C

In the second stage, the structure parcels that will provide services as the gathering areas have been defined and in accordance with the population. By carrying out the sufficiency analysis of the areas based on the structure parcel, the structure parcels where the gathering areas could not provide service are defined in accordance with the distance to the structure parcel. As the movement distance from the city block to the gathering area, the maximum walking distance has defined as 200 meter. For this study, in the first step, by means of gathering areas associated with the ArcGIS program, the city blocks are defined accordingly. For the measurement of areas, firstly, capacity of open and green areas are calculated. For each gathering area, the structural elements of the area have removed from total parcel area and total open area for each area could be determined. Depending on the area standards per person, it is defined as 1,5 m^2. The number of people to be served that is the capacity of the gathering areas are calculated by dividing the open area to 1,5 m^2. The calculation of each gathering areas capacity is as follows:

- Ct: Capacity (person)
- Et: Total parcel area (m^2)
- Eu: Total built-up area (m^2)
- Ex: Open area (m^2)
- Size of gathering area per person: 1,5 m^2
- $Ct = (Et – Eu) /1,5$

Calculating the capacity of gathering areas and defining city blocks within 200 meter sphere of influence, the city blocks that will serve for the each gathering areas and number of people have been defined accordingly. The process of the method can be seen In Figure 1.

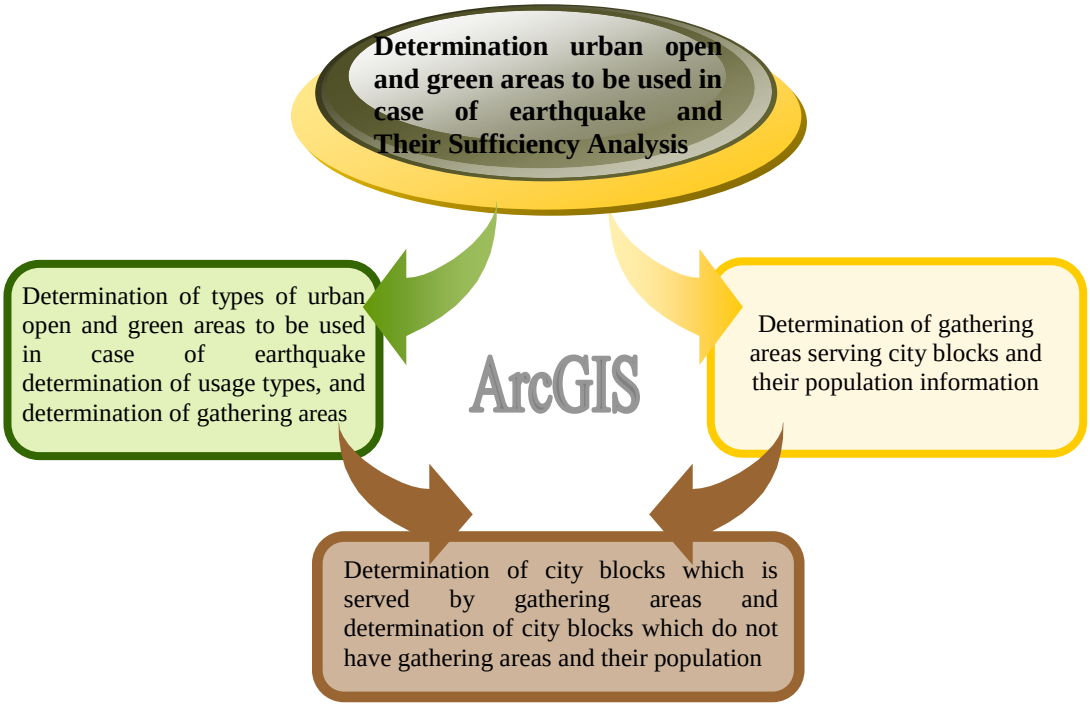

Figure 1. Scheme of the Method

As a result of the study, it has been defined that which person will use which gathering area and the city blocks that the gathering area could not provide service. By means of the calculations associated with ArcGIS program, the analysis could be organized as map and tables. The information could be seen regarding each gathering areas as mentioned in Table 1.

Table 1. Gathering Area Information

Area no	Name of the Area	Function of the Area	Total parcel area	Total Building Area	Open Area Amount	Capacity	Risk Status	Served Population amount	Served city blocks
Tn	-	-	Et	Eu	Ex	Ct	A,B,C	Number of people	City block number

For the definition of gathering areas and analyzing their sufficiency, the data in the Table 2 has been used.

Table 2. Data used in the analysis method

Parameters	Data
Spatial distribution of the population	Numerical value in the table in the city block data
Road routes that help people to access safety areas	The access roads to the open area, the evacuation roads that must be open at all times for the emergency
Risk status of the open areas	Symbol A-B-C that characterized the risk status in the feature table of the open areas
The gathering area size per person	The value of the open area in the feature table ; 1,5 m^2
Capacities of open areas	The numerical values of open areas in the feature table (capacity)
Option right for the safety place	Symbol in the feature table
Maximum distance from their homes	The numerical value defined for every going-200 m

5. Usage Of The Urban Green And Open Spaces In Case Of Earthquake-Kucukcekmece-Cennet District-Case Study

In order to determine the urban open and green areas that will be used after the earthquake and to analyze the sufficiency of these gathering areas, the Cennet Street of Küçükçekmece country is selected as s. The reason of this selection is that Küçükçekmece is one of the ten districts under the earthquake risk in accordance with JICA studies. On the other hand, due to the fact that Cennet Street that is located in the southern part of the district are among the risky neighborhood unit according to the JICA studies and the organized and disorganized structure are combined together, the urban open and green area sizes are not sufficient.

5.1.Cennet Neighborhood in Küçükçekmece District

Cennet neighborhood is neighbor with E-5 highway in the southern part of Küçükçekmece district. In the South of the street, Bakırköy district and in the east, Yeşilova neighborhood, in the West, Fatih neighborhood and in the North, Yenimahalle is located accordingly. The information and datas about Cennet neighborhood was collected in 2008. The location of Cennet neighborhood in Küçükçekmece district is

seen in Figure 2. Cennet Street is at the size of 88 ha and it is composed of 2.35% of the district. The population of the district is 38.460 persons.

Figure 2. Location of Cennet Neighborhood in Küçükçekmece District

Cennet Neighborhood is one of the central commercial area of Küçükçekmece. In the working area, it is considered that urban social infrastructure areas such as education, health, religion facilities are not sufficient according the population of the area. In the area, there is totally 4 park areas with 1.4 ha and only one park area is over 5000 m^2 . The 3 park areas are under 5000 m^2 and the park areas are not sufficient for the population. There is approximately 3.1 empty areas in the working field.

Active green areas, health facilities, primary school- secondary school areas, religion facilities and technical infrastructures have been compared with their normal ground sizes as per the population defined in the planning regulations. As it is seen in Table 3 active green areas, urban social infrastructure areas and urban technical infrastructure areas are not in the proper size as much as they are.

Table 3. The Amount Of Facilities According to Planning Regulation and Comparison with the Current Conditions in Cennet Neighborhood

Land Use	Area (ha)	Standards in Planning Regulation m^2/person	Necessary Area for population in Planning Regulation (ha)	Areas Covered in Existing Situation (%)
Park Areas	1,4	10	39,0	%4
Health Facilities	0,2	1	3,9	%6
Primary School	2,1	4	15,6	%14
Secondary	-	3	11,7	-
Religion Facilities	0,8	0,5	1,9	%42
Technical Infrastructure	0,2	2	7,8	%3

Urban open and green areas that are one of the most important indicators for the urban prosperity and quality of life are not sufficient in terms of urban social infrastructure areas and this case has decreased the life quality of the Neighborhood.

5.2.Defining Urban Open and Green Areas to be used in Cennet Neighborhood after the earthquake and Analyzing its Sufficiency

In case of possible earthquake, the gathering areas that will provide sustainability of vital activities and will cover the sheltering needs of the affected population who could not go back their homes and whose homes were damaged by the earthquake are composed of urban open and green areas. In Cennet Neighborhood that is faced with the earthquake risk within the preparation activities against the possible earthquake, the gathering areas where 38.460 population will use have been defined.

The study of definition of gathering areas are not only for people whose homes have damaged or lost their homes but also assessed for all population. The proposed method has been used to define the urban open and green areas and to analysis, their sufficiency's in Cennet Neighborhood after the earthquake.

5.3. Determination of Urban Open and Green Areas to be used after the Earthquake

In case of possible earthquake, while the gathering areas have been defining to cover the requirement of entire population in Cennet Neighborhood, urban open and green areas have been used. The following current areas in the site have comprised of urban open and green areas:

- Parking areas
- Open sport areas
- Training areas
- Open car parking areas
- Empty areas.

The religion facilities in the site have not been proposed as gathering areas because of structural specifications of the mosques and also public facilities have not been suggested, because these areas could be disaster management center in case of earthquake. In the Cennet Neighborhood, the urban open and green areas which are able to be used as gathering areas have been analyzed according to their physical specifications such as topography, open area status and these areas selected among others having at least 100 m^2 unstructured areas. One empty area available in the field has very much plant area and because of its curved structure could not be proposed as gathering area.

Afterwards, the risk position of the gathering areas have been defined depending on the proximity to the building having risk and height of the buildings by individual observations. The areas that do not have any building on their parcel border are classified as high security, the areas that have at most 4 layer buildings on the parcel border are classified as medium security and the areas that have more than 4 layers are classified as low security.

- High security area: A
- Medium security area: B
- Low security area: C as classified.

In the neighborhood, Total 14 gathering areas have defined. 3 of them are composed of primary school are, 1 is for secondary school field and 4 of them are composed of education facilities, 4 empty areas, 4 parking areas, 1 open sport area, 1 car parking area have been proposed. Gathering areas which belong to private ownership are suggested to be publicized. Name, current position, total parcel areas, security levels and their explanations of the gathering areas are submitted in Table 4.

Table 4. Gathering Area Information

Name of the Gathering Area	Explanation	Function of the Area	Risk Status	Et (Total parcel area) m^2
T1	Marmara High School	Education	B	5439
T2	Remzi Yurtsever Primary School	Education	B	2683
T3	Yeşilyuva Primary School	Education	B	6980
T4	Empty Space	Empty Space	A	6903
T5	Empty Space	Empty Space	A	6685
T6	Antikalar Park	Park Area	A	3890
T7	İ. Gaffar Okkan Park	Park Area	A	5373
T8	Open Sport Area	Sport Area	A	7483
T9	Sevgi Park	Park Area	B	1212
T10	Empty Space	Empty Space	A	6026
T11	Behiye Selim Pars Primary School	Education	B	6269
T12	Open Car Parking Area	Car park	A	4694
T13	Şair Nedim Park	Park Area	A	4018
T14	Empty Space	Empty Space	A	3385

There are not any low security areas in the proposed gathering area in the site. Due to the fact that there are not any buildings in the parcels of park areas and car parking areas. Only Sevgi Park has 1212 m^2 area has been assessed as medium security due to the fact that it is close to the building on the parcel next to the Park. Within the parcels of the education facilities defined as gathering areas, in spite of the fact that there is not any high structures more than 4 layers , they have been defined as medium secured structures.

It is seen that the gathering areas in Cennet neighborhood have not been dispersed homogenously. Gathering areas in field of study locational distribution and land use in the current status and total areas have been seen in Figure 3.

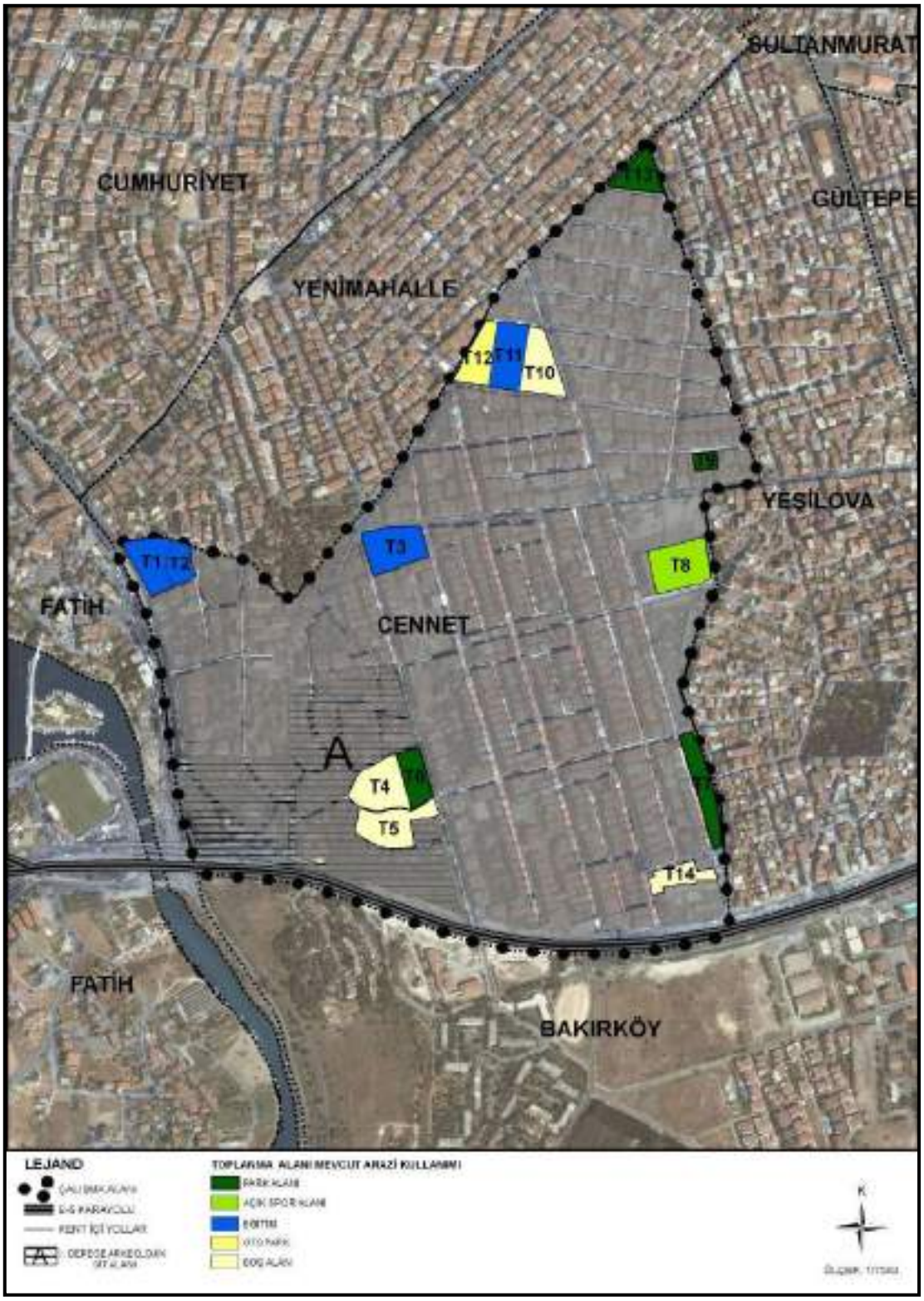

Figure 3. Location of Gathering Areas and Their Functions

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5.4.Measuring the Sufficiency of The Urban Open and Green Area to be used in case of Earthquake in Cennet Neighborhood

After defining the gathering areas, as the second stage, measuring the sufficiency of these areas have been carried out. Firstly, in order to determine the city block which will be served by gathering areas and population, 200 meters of influence area of every gathering area and city blocks which are in this influence area has been identified. In figure 4, 200 meters of influence area for the gathering areas could be seen. In case of that more than 50% of city blocks areas are in 200 m influence area and when 200 meters maximum distance have not been exceeded, these city blocks have accepted as city blocks in the influence area. The capacity of gathering areas and population amount to be served has been calculated as 1.5 m^2 per person. The capacity of the gathering areas are calculated with follows:

- Ct: Capacity (person)
- Et: Total parcel area (m^2)
- Eu: Total Building area (m^2)
- Ex: Open area (m2)
- Size of gathering areas per person: 1,5 m^2
- Ct = (Et – Eu) /1,5

After calculating the capacity of gathering areas, considering city blocks within 200 meters sphere of influence, city blocks which gathering areas will serve have been determined according to capacity of them.

As a result of analysis, it has been identified that the gathering areas for the population in any case of earthquake and city blocks that do not have any gathering areas. As it is seen in Figure 3, the color of gathering areas and served city blocks are the same. Thus, it could be defined which gathering areas have been served for which city blocks. In case of possible earthquake, the connection between the evacuation corridors and gathering areas that must be open at all times has established accordingly. The total capacity of defined gathering areas are composed of 42.979 people and the total population to be served is 29.444 people. The information about gathering areas is seen in Table 5.

As a result of analyses, the city blocks which do not have gathering area have been determined. In the current situation, it has been also determined that the gathering areas for 9016 persons in 19 city block are not available after the earthquake. It is seen that the city blocks that do not have gathering areas are located in four different locations that are next to each other. In the case study, some city blocks could not benefit from the service from gathering areas, although these city blocks have been located are in the 200 meters influence area of gathering areas, due to the fulfilling the capacity of the gathering areas. On the other hand, although some gathering areas have the capacity to provide service for the more population, they could not provide any service to the city blocks due to fact that they are not located are not in the 200 meters influence area of gathering areas. As a result, in the analyzing the sufficiency

of the gathering areas, there are two important criteria's so that the cross correlation of these two variables could be seen.

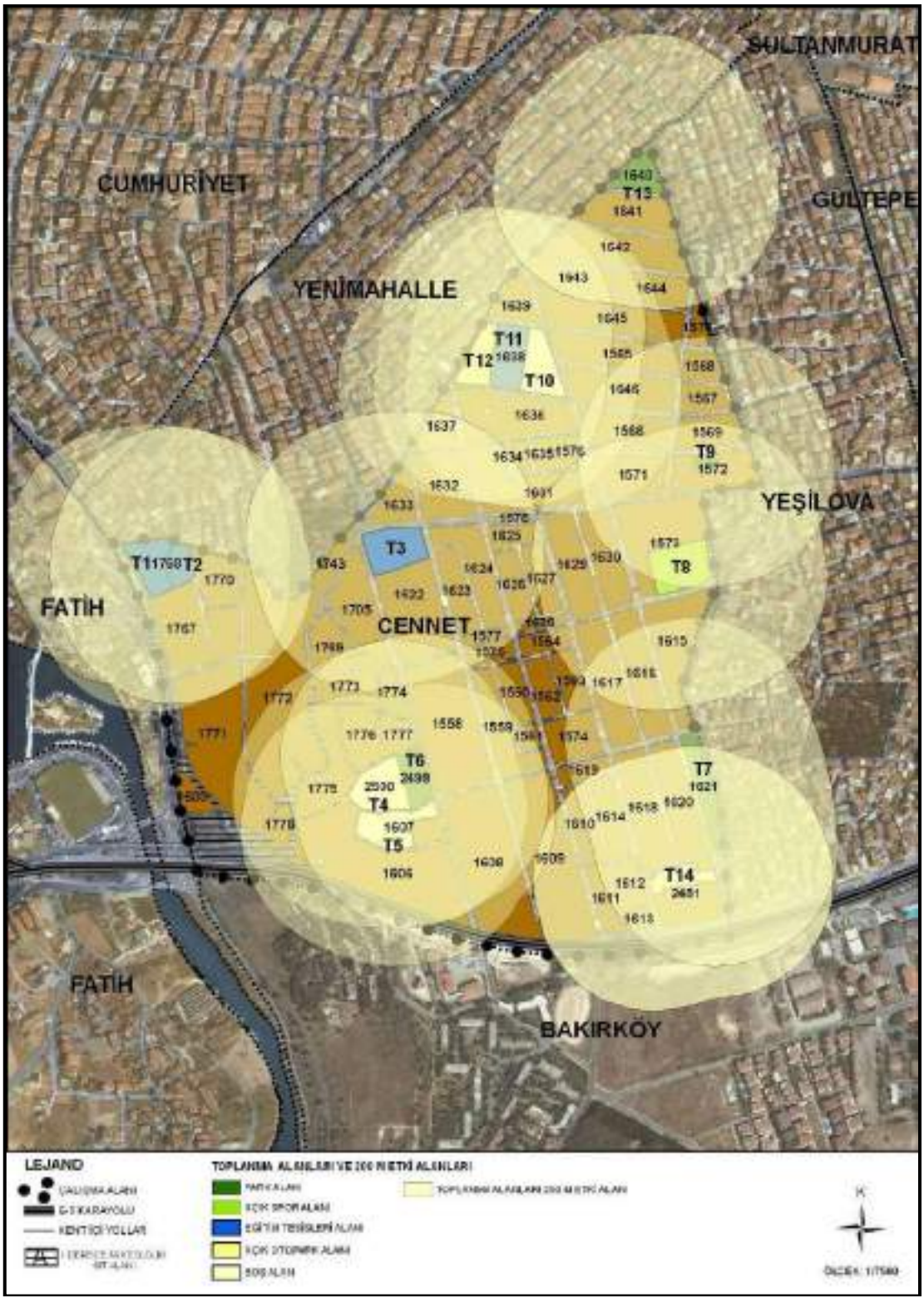

Figure 4. 200 Meter Influence Area Of Gathering Areas

Table 4. Gathering Area Information

Area no	Name of the Area	Function of the Area	Et Total parcel area	Eu Total Building Area	Ex Total Open Area	Ct Capacity	Risk Status	Served Population amount	Served city blocks
T1	Marmara High School	Education	5439	834	4605	3070	B	810	1767
T2	Remzi Yurtsever Primary School	Education	2683	972	1711	1140	B	184	1770-1768
T3	Yeşilyuva Primary School	Education	6980	2026	4954	3302	B	3224	1743-1705-1622 1623-1624-1577-1633
T4	Empty Space	Empty Space	6903	0	6903	4602	A	2510	1558-1606-1777-1774-1773-1776-1775-
T5	Empty Space	Empty Space	6685	133	6552	4368	A	1478	1607-1608
T6	Antikalar Park	Park Area	3890	601	3289	2192	A	1624	1559-1560-1561-2499
T7	İ. Gaffar Okkan Park	Park Area	5373	0	5373	3582	A	3032	1612-1618-1619-1620
T8	Open Sport Area	Sport Area	7483	432	7051	4700	A	3926	1629-1630-1616-1617-1573-1615
T9	Sevgi Park	Park Area	1212	0	1212	808	B	525	1572
T10	Empty Space	Empty Space	6026	0	6026	4017	A	3357	1645-1639-1565-1646-1566-1571
T11	Behiye Selim Pars Primary School	Education	6269	1253	5016	3344	B	2478	1631-1632-1638
T12	Open Car Parking Area	Car park	4694	211	4483	2988	A	2449	1576-1634-1635-1636-1637
T13	Şair Nedim Park	Park Area	4018	52	3966	2644	A	2096	1641-1642-1643-1644-1640
T14	Empty Space	Empty Space	3385	51	3334	2222	A	1751	1610-1611-1612-1613 2481

As a result of analysis for entire population in Cennet district, there is not any sufficient urban open and green areas that will be used for gathering/sheltering purpose after the earthquake. The city blocks that do not have any meeting areas and their population could be seen in Table 6 and Figure 5. It can be said that 19 city blocks and 9016 will not be able to use any gathering areas.

Table 6. City blocks that do not have any gathering areas and their population

City Block Number	Population of City Block
1772	1034
1769	228
1771	989
1605	8
1575	236
1574	619
1564	305
1627	468
1578	12
1625	370
1626	411
1628	171
1563	326
1562	399
1570	8
1568	204
1567	220
1569	411
1609	2597

Figure 5. City blocks that do not have any gathering areas

6. Results And General Assessment

Because of sudden occurrence of the earthquakes, the panic could be experienced mostly after the earthquake and immediately after the earthquake, people generally could not decide on what they should do in the short time. It is essential that the towns should be prepared for the earthquakes.

The urban open and green areas that have very important functions such as ecological, recreational, economic and social functions have been acted as key elements to continue for vital activities after the earthquake. In case of possible earthquake, urban open and green areas could be evacuation areas. After the earthquake, people whose homes have been damaged and could not go back their homes because of earthquake risk have been sheltered in such kind of areas until the problem will have been solved. After the earthquake occurred, the several problems occurred in the gathering/sheltering areas and particularly in Turkey where such kind of places are not sufficient, it has been seen that any planning activities has not been carried out before earthquake.

For this reason, urban open and green areas that have been used as gathering points, temporary sheltering and tent areas should be handled to prepare for the earthquakes and to mitigate the earthquake losses and must be planned systematically in case of earthquake. When the earthquake occurs, these areas must be ready in accordance with the number of population. The qualification and numbers of these areas should be analyzed if these are sufficient or not in case of disaster.

As a result of defining the gathering areas to be used after the earthquake in Cennet neighborhood and analyzing its sufficiency, it could be seen that the urban open and green areas that are insufficient to cover the needs of the affected population will be insufficient in case of the earthquake indeed. In order to make urban open and green areas ready after the earthquake, the more reconstruction activities must be allowed accordingly.

The temporary gathering and tent areas have been defined as gathering areas must be reorganized. In order to provide livelihood and to cover the needs of food, water, sheltering etc., the storing areas and infrastructure systems should be established. The park areas should be organized to transform into the earthquake park after the extraordinary situations.

The evacuation corridors must be organized in case of possible earthquake to be used for life supports and open in each time for the access. The Evacuation corridors must provide access to the gathering areas and the access between the gathering areas and city blocks accordingly.

The temporary settlement areas and tent towns have been handled in the city scale and associated with the neighbor regions as well as assessed in the town integrity. In the short term gathering points/areas, in the middle term temporary settlement areas

and tent locations must be defined previously and their sufficiency's must be measured.

In the regions where the gathering places are not sufficient, the urban open and green areas must be produced to be benefited from entire population and to raise the life conditions in the towns. First, by determining the urban open and green areas that have proposed in the master plans, which have not been applied, the relevant actions must be taken for these green areas. In addition, taking into the consideration of possible earthquake risk in the new the plans, and these new plans must be integrated with disaster plans.

Active functions must be added to such kind of areas defined before the earthquake occurred in the daily life and the relevant infrastructure should be provided to be used after the earthquake. On the other hand, these areas must be announced to the local people before the earthquake and the information must be conveyed to the people to find these places easily during the earthquake.

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