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Full Length Research Paper

Determination of earthquake park facilities in Kocaeli

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Earthquake parks are functional parks that meet recreational needs of people in daily life and urgent needs providing temporary shelters in case of a possible earthquake. In this study, earthquake park facilities were tried to be determined for Kocaeli, a densely-populated industrial city by the sea and situated on a first degree seismic zone. For this purpose, 17 big parks, with an area size ranging from 3000 to 587 000 m^2, were investigated in terms of their equipment elements, space use, and risk factors, and their conversion to an earthquake park was evaluated. According to the results obtained from the study, the existing parks in Kocaeli have low physical quality regarding standard elements of an earthquake park and their functional conversion is not possible. All the parks in the city are located on the fault lines and in the first degree hazard zone in case of a possible earthquake. For this reason, the construction of earthquake parks with adequate equipment elements in the safe parts of the city is needed.

Key words: Kocaeli, open-green space, park, earthquake park.

INTRODUCTION

A city can be defined as "a settlement unit that constitutes small neighbourhood units with low amount of agricultural activities and denser population than rural areas and that is under continuous development and meets the needs of the society like settlement, sheltering, commuting, working, and recreation" (Keleş, 1998). Cities are settlements having various technical, economical, social, political and cultural characteristics (Önem and Kilinçarslan, 2005). Due to these characteristics, cities have high risks against hazards, mainly disasters. These structural characteristics of the cities and geographical, physical, socio-economical and cultural characteristics belonging to the settlement increase the existing risks more along with urbanization problems such as rapid and disorderly urbanization and squatting (Genç, 2007). Today, cities show a fast development without considering damages to be caused by disasters and without conducting sufficient amount of researches (Jang et al., 2004). In the reconstruction system in Turkey, housing in cities is not carried out in accordance with the planning, engineering, health and environmental conditions. This situation dramatically shows itself in the earthquake zones (TMMOB, 2000). Due to its geological - topographical characteristics and climate, Turkey is one of the countries frequently facing natural disasters that cause great loss of life and property.

Over the last 60 years, when the statistics of structural damages caused by natural disasters were considered, 62% of damages occurred because of earthquakes (Limoncu and Bayülgen, 2005). The main reasons for physical vulnerability for natural disasters are as follows: 1) a large part of the country is in the first-degree earthquake zone; 2) most of the big cities are on or near the fault lines; and 3) a great amount of buildings and most people are settled in the unsafe regions (Geray, 1977a; Keleş, 2002). In parallel with the population that increased due to migrations, increase in the need for urbanization and housing can be seen as the greatest threat to urban open-green spaces. Technological developments, globalizing communication habits, changes in the social life styles as well as environmental problems caused by urbanization, preference of new life styles and places made the definitions of new open-green spaces in cities a current issue (Özdemir, 2009). In this context, after the 17 August 1999 Marmara and 12 November 1999 Düzce earthquakes, damage-reducing disaster management works started and "earthquake

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parks" became a current issue. Green spaces constituting an important part of urban planning are indisputable elements of urban ecosystem organization with its functions to build the balance of mass and space in ecological sense, create microclimas suitable for human life, and enable physical balance and organic integrity in terms of land uses with different characters (Altunkasa et al., 1995). Today, the most important open and green spaces are parks where people can stay away from their problems, rest, relax, get fresh air and join several acitivites (Kesim et al., 2006). Green spaces that play an important role in the organic bond to be established between human health with their recreational, ecological, physical, social and economical functions and living space before an earthquake play the role of physical structures to meet the urgent needs after an earthquake and function differently. Green areas where urgent needs of earthquake-stricken people are met, mainly their safety, interventions are made and urban services are shifted are the places where life re-begins. An earthquake park should response to the uses as a heliport during and after an earthquake, an open-door hospital, a temporary residential area and an evacuation area. Additionally, the sub-code of this park should be built in a way to be used for material and food supply. Standard elements of an earthquake park are as shown in Table 5 (Aksoy, 2001).

Each of these standards in the parks can undertake new functions in case of a possible earthquake. Generators will be used in case of a possible electrical fault during a possible earthquake. Ice-skating rings can be used as a material transfer area; playgrounds and a picnic sites can be used as a tent site; an amphitheatre can be used as an administration unit; a carpark can be used for the orderly parking of the cars during a crisis; a heliport can be used for urgent transport; and toilets and showers can be used to meet the needs of the people sheltering in the area. If there is a greenhouse, it can be turned into a hospital in case of a possible earthquake. Earthquake parks also have a function to prepare people for disasters. For this purpose, people could be taught first aid, methods to keep themselves safe, proper behaviors about search, rescue and intervention after an earthquake. With the presence of earthquake parks, there will no longer be problems such as chaos after an earthquake, selection of a settlement area lasting for days, opening up roads, providing services of electricity, water and sewage, environmental problems, unhygienic environment, flooding of the tents by rain and muddy roads especially during winter months. It will provide great contributions for the injured, mentally- depressed people who have no hope for future to heal the wounds of the financial and emotional damages of the disaster by meeting their social needs, helping them settle in a place with its prepared infrastructure, letting them have their own tent (Kara, 2007).

Kocaeli Province, which is the area of research, is located on the "North Anatolia Fault Zone (NAFZ), the most active earthquake belt in Turkey, and "Marmara Sea" depression. Therefore, it gets affected from the earthquakes that occur in the "North Anatolia Fault Zone and in the Marmara Sea to a great extent. Kocaeli Province is in the first-degree earthquake zone on the "Earthquake Zoning Map" of the General Directorate of Disaster Affairs (Anonymous, 2006). Aesthetic and environmental problems due to rapid urbanization in Kocaeli and seismicity increase the importance of the planned urban green spaces and parks. A big earthquake is expected at any time in the Marmara Region, which includes Kocaeli. Therefore, in this study, the current situation of the parks are tried to be determined in terms of their suitability to be used as earthquake parks in Kocaeli.

MATERIALS AND METHODS

The main material of the study is comprised of Kocaeli Province and the existing park areas in Kocaeli. Kocaeli neighbors Sakarya to the east and southeast, Bursa to the south, Blacksea to the north, Istanbul, Yalova, İzmit Gulf and Marmara Sea to the west (Figure 1). The area of Kocaeli Province is 350.527 ha and the area of urban area is 3505 km^2 dir (Anonymous, 2007). The study was carried out between the years 2009 and 2010 and 17 big parks including 3 neighborhood parks, 13 district parks, and 1 urban park, were investigated in terms of the standard elements of earthquake parks and risk factors. The sizes of the parks examined range from 3000 to 587 000 m^2. In order to evaluate whether these parks could undertake the function of being an earthquake park in case of a possible earthquake, information forms comprising maps, official documents and records, on-site observations, measurements and audits were used.

In the study, as a method, related scientific data were used by conducting a literature research in the first stage. The qualifications of earthquake parks and the required equipment in this area were determined. In the second stage, information about the seismicity of the city and its current situation were gathered from the related institutions, official documents, written sources, and the earthquake park need of the city was determined. In the third stage, a field information form was formed to determine the current situation of the parks. By obtaining concrete data with on-site investigations, observations, measurements and audits, it was evaluated whether the existing parks could undertake the function of being an earthquake park in case of a possible earthquake.

RESEARCH FINDINGS

Although Kocaeli is an industrial city, it has a forest land over the country average with a forest land of 146.566 ha (Küçükosmanoğlu, 2007). There is a park space of 120 ha, picnic and recreation site of 250 ha and a 14 km long walking path with a green space of 35 ha around it (Erkan, 2007). It has 810 ha of open green space excluding the forestland along with the plantations in the highway area, along the roads, roundabouts, and refuges. The amount of open-greenspace per person in the city is 6.7 m^2, and the amount of green spaces per person is 2.45 m^2 (Anonymous, 2008).

Seismicity of Kocaeli

92% of our country is under the effect of active earthquake belt and



Figure 1. Location of Kocaeli.

95% of the population lives in these regions (Anonymous, 2006). Kocaeli Province is located on an important techtonic belt that produces earthquakes as well. The regions along the coastline and within the İzmit Basin are in the 1st degree seismic hazard zone. They create an important seismic hazard within Kocaeli metropolitan area (TÜBİTAK, 2008). Kocaeli Province Earthquake map can be seen in Figure 2. Three big earthquakes have occurred over the last century in the region under the effect of the North Anatolian fault zone. These are 20 June 1943, 22 July 1967 and 17 August 1999 earthquakes (Anonymous, 2000). The regions where the population of Kocaeli Province is dense are situated on the fault line or nearby. Only Kandira district is away from the fault line and it lies in the 2nd degree earthquake zone. In this case, majority of the population of Kocaeli is in the first degree earthquake zone. Urban development areas of Kocaeli have shifted towards the north to the districts of Gündoğdu, Üçtepeler, and Topçular. There are permanent housings built by both the World Bank and Ministry of Public Works and Settlement, and the population of the city has shifted towards the areas with hard ground (Anonymous, 2006).

Kocaeli Province has not yet completed its development about housing due to the continuous construction of new settlement areas and continuous need for dwellings, especially after the earthquake and because of migrations (Anonymous, 2007). The province has a common settlement pattern which is found around İzmit Gulf. It is one of the most densely-populated cities in Turkey. 98% of the industry is in the areas with high earthquake risk. Since the province has rapidly been industrializing, the amount of green areas has reduced due to the continuous construction of factories, workplaces and housing (Anonymous, 2006).

Parks in Kocaeli

The parks evaluated in the study are big enough to be a meeting place in case of an earthquake and within an available distance. According to the data in Table 1, one of the parks, the smallest one3000 m^2 and the largest one is 582 000 m^2, is a city park, 13 of them are district parks and 3 are neighborhood parks. 6 parks are located in the city centre while 8 are situated in the coastline and 1 is within the available distance near the city. The neighborhood parks under the scope of the study and the other negihborhood parks not included in the study; since they show similar characteristics they are shown in Table 2 with their neighborhoods and field sizes. Small recreation places with an area of between 40 to 750 m^2, small parks and sports areas for kids are not included in this table. Also, although there is a piney park with an area of 45

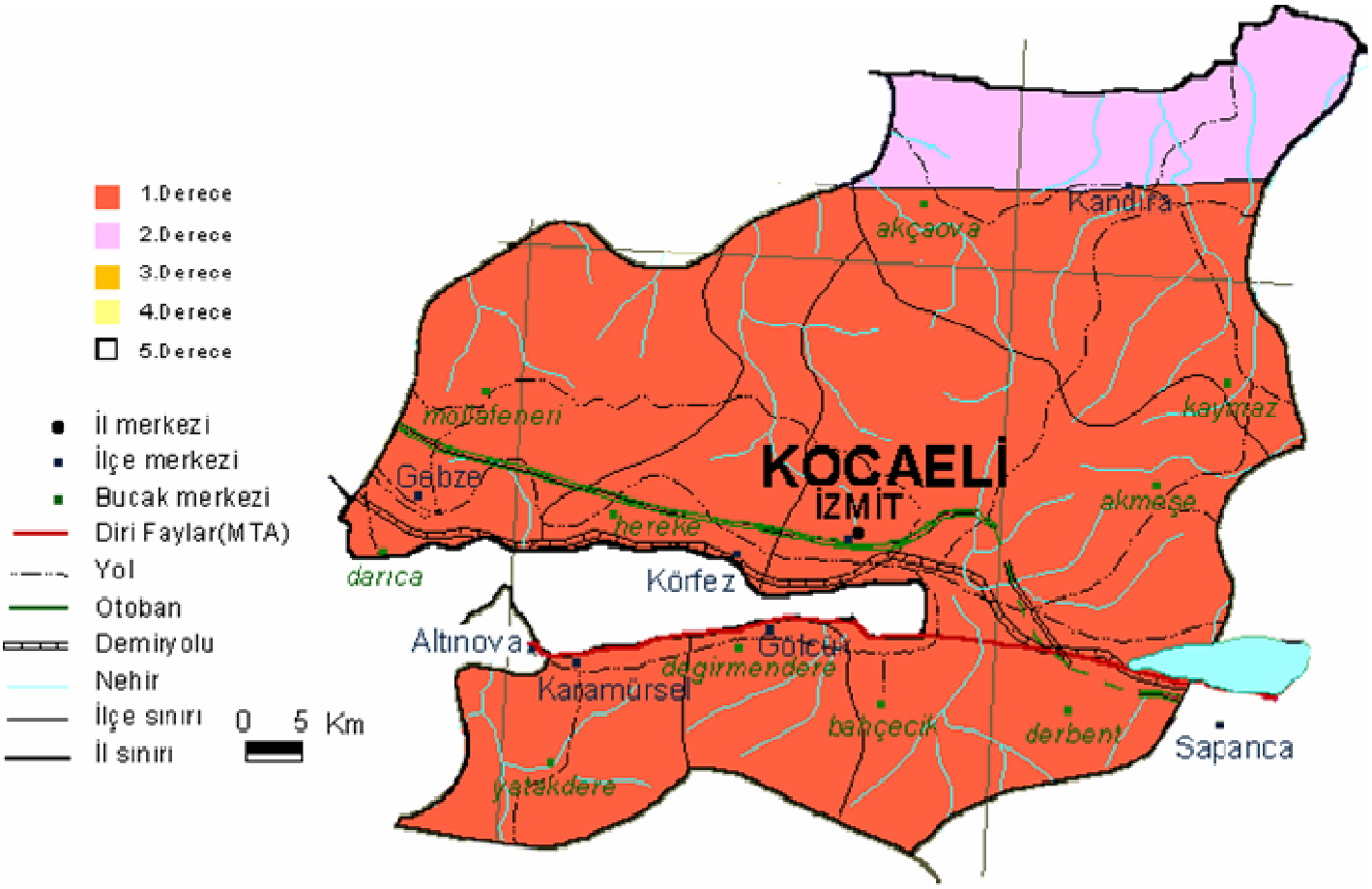


Figure 2. Kocaeli earthquake map (Anonymous, 2006).

Table 1. General information about parks.

Name of the park	The neighbourhood	Total area (m^2)	Location			Type of park
			In the city	Coast	Near the city	
Seka Park	Kozluk	582 000		+		Urban
Doğu Kışla Youth Park	M. Ali paşa	57 000	+			District
Derince Coast of Wonders	Yavuz Sultan	30 000		+		District
Anıt Park	Cedit	18 660	+			District
Marina Beach Park	Kemal Paşa	103 267		+		District
Kavaklı Beach Park	Kavaklı	45 643		+		District
Barbaros Hayr. Pasha Park	Gölcük Donanma	91 038	+			District
İhsaniye Beach Park	İhsaniye Mrkz.	100 000		+		District
Başiskele Beach Park	Cumhuriyet.	34 336		+		District
Nazmi Oğuz Park	Kemal Paşa	32 000		+		District
Demokrasi park	Cumhuriyet	88 225		+		District
Taç yaprak park	Arslanbey	20 000			+	District
Cumhuriyet Park	Hacı Hızır	8000	+			District
Bağçeşme Square Park	Bağçeşme	5000			+	Neighborhood
Malta Mahallesi Park	Malta	3785			+	Neighborhood
Akçakoca park	Akçakoca	3000	+			Neighborhood
Sabri Yalım Park	Ömerağa	4062	+			Neighborhood

Table 2. Other neighborhood parks which are not included in the study.

Name of the park	Neighborhood it is located	Total area (m^2)	Name of the Park	Neighborhood it is located	Total area (m^2)
42 Evler Park	Körfez	1924	Abdülhamit Han Cad. Park	Esentepe	1593
Özcan Tengiz Park	Ömer Ağa	1400	Fevziye Park	Tepecik	2470
Serdar Mahallesi Park	Serdar	3000	AcısuM.SadıkEfe Park	Tepecik	2453
Topçular Park	Topçular	1360	Mehmet Lüleci Park	Turgut	920
Şehit Cemil Fidan Park	Topçular	1150	Hüsamettin Civan Park	Veli Ahmet	1220
Gönül Caddesi Park	Y. Slt Selim	2650	Gültepe Park	Gültepe	1215
Tüysüz Park	Hacı Hasan	1450	İsmet İnönü Park	Kozluk	911
Müjdat Afşin Park	Hacı Hızır	1601	Savaş Dönmez Park	Kozluk	1625
Şehit Fahrettin Mümtaz Park	Karabaş	840	Hüsniye Eker Park	Kozluk	928
Yeni Cuma Park	Karabaş	4473	Erim Denizer Park	Yenidoğan	2112
Heykel Park	Kemalpaşa	9358	Barın Siteleri Park	Yenimahalle	794
Eriş Siteleri Park	Yenimahalle	1733	Hülya Sok. Oyun Alanı	Yenimahalle	1315
Esentepe Caddesi Park	Esentepe	1603	Dr. Ertan Okarçay Park	Zabıtan	1545
Balaban Siteleri Park	Yenimahalle	1210	3.Etap Park	İlimtepe	5600
Basri Tuğral Park	Yenimahalle	1850	Alaattin Şener Park	Hacı Osman	2230
Cezaevi Park	Yenimahalle	786	Milangaz Park	Hacı Osman	3378
Körfez Sokak Park	Hacı Osman	2177	Manolya Sokak Park	Mimar Sinan	1140
Hüseyin Avni Şirin Park	Atalar	2200	İğde Çıkmazı So. Park	Çamlıtepe	1750
Alaattin Yüksel Cad. Park	Atalar	2075	Fındık Sokak Park	Çamlıtepe	1330
Modül Çelik Park	Mimar Sinan	3255	Cemil Ayalp Park	Yeni Yalı	3535
Oymak Sokak Park	Mimar Sinan	2512	Gündoğdu Sokak Park	Yeni Yalı	2075
Belen Caddesi Park	Yeni Yalı	1367	Emek Sokak Park	Fatih	2900
Celal Atik Sokak Park	Yeni Yalı	2200	Salim Sokak Park	Fatih	2295
Seda Caddesi Park	Y. Slt. Selim	2107	Barış Park	Kuzey	1670
Fatih Sultan Meh. Park	Fatih	2800	Çenedağ caddesi Park	Kuzey	2390
Üstüner Sokak Park	Fatih	2156	Orhan Alimoğlu Park	Esentepe	3316

Table 3. Existing standard elements of earthquake parks in the parks.

Standard elements of earthquake parks in Seka Park			
2 Generators (42 m^2)	3 Basketball Courts (150 m^2)	1 Football Pitch (2400 m^2)	1 Amphitheatre (243 m^2)
2 tennis Courts (2000 m^2)	6 Car parks (10 000 m^2)	2 WCs (100 m^2)	2 Water Tanks (360 m^2)
16 Sofa Suites (320 m^2)	1 Heliport (250 m^2)	19 Fountains (19 m^2)	
Standard elements of earthquake parks in Doğu Kışla Youth Park			
1 Ramps (1099 m^2)	4 WCs (200 m^2)	7 Arbors (126 m^2)	1 Car park (2116 m^2)
2 Basketball Courts (1020 m^2)	Sofa Suites (1520 m^2)	1 Square (8756 m^2)	1 Fountain
2 Football Pitches (4340 m^2)	1 Computer Centre	1 Water Tank (180 m^2)	
Standard elements of earthquake parks in Derince Coast of Wonders			
1 Car park (9450 m^2)	Sound System	1 Shelter (3520 m^2)	2 WCs (350 m^2)
1 Amphitheatre (2450 m^2)			
Standard elements of earthquake parks in Marina Beach Park			
1 Volleyball Court (400 m^2)	2 WCs (100 m^2)	2 Tanks (360 m^2)	5 Car parks (3000 m^2)
24 Arbors (384 m^2)	Sofa Suites (480 m^2)	1 Water Tank (180 m^2)	5 Fountain

Table 3. Contd.

Standard elements of earthquake parks in Barbaros Hayrettin Pasha Park			
2 Volleyball Courts (1100 m^2)	2 Basketball Courts (1250 m^2)	2 Football Pitches (18000 m^2)	1 Amphitheatre (380 m^2)
2 Tennis Courts (1630 m^2)	6 Car parks (3700 m^2)	1 WC (140 m^2)	2 Fountains (2 m^2)
2 Showers for Sports Facilities (60 m^2)	33 Arbors (528 m^2)		
Standard elements of earthquake parks in İhsaniye Beach Park			
Sofa Suites (1200 m^2)	1 Basketball Court (365 m^2)	1 Football Pitch (9200 m^2)	1 Water Tank (350 m^2)
1 Tennis Court (260 m^2)	1 Car park (2856 m^2)	1 WC (160 m^2)	18 Fountains (18 m^2)
1 Heliport (1000 m^2)	10 Arbors (160 m^2)		
Standard elements of earthquake parks in Demokrasi Park			
Sofa Suites (760 m^2)	2 Basketball Courts (1080 m^2)	3 Fountains (3 m^2)	10 Arbors (86 m^2)
3 Tennis Courts (2268 m^2)	1 Car park (750 m^2)	1 WC (50 m^2)	1 Water Tank (4 m^2)
Standard elements of earthquake parks in Başiskele Beach Park			
1 Water Tank (10 m^2)	3 Arbors (48 m^2)	8 Sofa Suites (160 m^2)	1 WC (15 m^2)
2 Fountains (2 m^2)	1 Car park (750 m^2)		
Standard elements of earthquake parks in Bağçeşme Square Park			
3 Ramps (60 m^2)	1 Amphitheatre (13 m^2)	2 Arbors (36 m^2)	1 Fountain (2 m^2)
2 Sofa Suites (36 m^2)	1 Car park (500 m^2)	1 WC (55 m^2)	
Standard elements of earthquake parks in Kavaklı Beach Park			
1 Amphitheatre (710 m^2)	1 WC (35 m^2)	6 Arbors (96m^2)	
Standard elements of earthquake parks in Anıt Park			
Sofa Suites (560 m^2)	3 Fountains	6 Arbors (108 m^2)	2 WC (70 m^2)
Standard elements of earthquake parks in Taç Yaprak Park			
1 Basketball Court (120 m^2)	8 Sofa Suites (160 m^2)	2 Arbors (38 m^2)	2 Fountains (2 m^2)

408 m^2 near Kocaeli, this area is only characterized as an afforestation area due to the lack of infrastructure and equipment.

Equipment elements in the parks

There are standard uses of space and equipment elements for recreation in all the parks of Kocaeli. These are playgrounds for kids, sports areas, picnic sites, a pool, indoor and outdoor sitting areas, lightning equipment, banks, trashcans etc. In this part of the study, the parks having the standard elements of an earthquake park were investigated and the results were shown in Table 3. Malta Neighborhood Park, Akçakoca Park, Cumhuriyet Park, Nazmi Oğuz Park and Sabri Yalim Park have only one or two of the standard elements of an earthquake park. According to the data in Table 3; Seka Park, an urban park of Kocaeli, and Doğu Kişla Youth Park, used as a temporary residential area after the 17th August 1999 Earthquake, are more equipped in terms of standard elements of earthquake parks. District parks on the coastal part of the city are the parks whose functional conversion of the area and equipment elements are possible since they have been rebuilt after the 17th August 1999 Earthquake. A heliport, one of the standard elements of vital importance in case of a possible earthquake is only found in Seka Park and İhsaniye Beach Park.

Risk factors in the parks

Even if the spaces and equipment of the parks are suitable for a functional conversion in case of a possible earthquake, the location of the park in the city being under several risks of hazard is a very important factor for use after the earthquake. Therefore, in the study, parks were investigated in terms of the risks of hazard and the results were indicated in Table 4. According to the data in Table 4; each park has a risk factor which puts it under high risk. All the neighborhood, distrcit and city parks in Kocaeli do not show a feature of a safe place in case of a possible earthquake mainly because they are on the fault line. Since the district parks and beach parks that have spaces and equipment that could undertake the function of being an earthquake park, are under the effect of tsunami because they are situated along the coast, these parks are partly or fully on the made-up ground and they are unsafe. Aside from these risks of hazard, some parks in the city are situated in the high risk areas with the effect of densely constructed buildings and traffic.

RESULTS AND SUGGESTIONS

Earthquakes come first among the several natural

Table 4. The risks of the parks and their levels.

Name of risk	Seka Park	Doğu Kışla Youth Park	Derince Beach Park	Anıt Park	Marina Beach Park	Kavaklı Beach Park	Barbaros Hayr. P. Park	İnsaniye Beach Park	Başiskele Beach Park	Malta Neighborhood Park	Demokrasi Park	Akçakoca park	Bağçeşme Square Park	Taçyaprak Park	Cumhuriyet Park	Nazmi Oğuz Park	Sabri Yalım Park
Their being along the coast	***		***		***	***	***	***	***		**					***	
Harmful environmental effect	**					*	*										
Near high voltage power lines	*				*					*	*	*	*				
Explosive substances being under the impact area	*				*					*		*	*				
Fire risk	*		*	*	*	*	*	*		*	*	*			*		**
Their being around dense structures		**		**						*	*	*	*		**		***
Their being on the natural gas pipelines	*	*	*	*	*					**	*	*	*		*		*
Their being on the earthquake fault lines	***	***	**	***	***	***	***	***	***		***	*		***	**	***	***
Difficulty in transport								*		*							
Dense traffic	*	**		***	**	**	**		***	**					***		***
Their being under the effect of landslides												**					
Their being under the effect of flooding	*		**	**	*	**	*	*	*	*		**	**	**		**	
Air pollution	**	**		**	**	**	**	*	**		**	**	*				
Shortcomings of infrastructure	*		**	**	***	***	**	**	**		**	**	**	***		***	

*** High risk; ** moderate risk; * low risk.

disasters occurring in Turkey. The Marmara earthquake which occurred on 17 August 1999, caused very serious damages and losses socially, physically and economically; thus showing that the “construction planning system” should be reformed together with disaster-sensitive approaches. The loss of life and property caused by the earthquake was bigger due to the wrong construction implementations and land use and unplanned urbanization. It is impossible to fully prevent earthquakes. Therefore, it is necessary to take necessary measures, prevent and lessen damages and be ready. For this purpose, it is necessary to select the proper technology and materials for building construction, determine the number of storeys, and build earthquake parks with prepared infrastructures in the large open areas within the settlement areas. Earthquake parks should be the planned areas whose location is determined before, according to the risk size of the disaster and amount of population.

Table 5. Standard elements of an earthquake park.

Generators	Sports facilities	Wasteyards
underground tanks	Sofa suites	Heliport
Ramps	Food distribution unit	Toilets, laundry
Aid turnstiles	Computer centre	Meeting area for the missing
Vehicle parks	Sound system	Bath
Ice-skating rings	Flashers	Dishwashing area

No buildings should be constructed, sold or transferred to various institutions for the other purposes. Parks which are well-planned and designed and possible for functional conversions, have positive effects on the city and city dwellers.

In this study, it was emphasized whether the existing parks for recreation in Kocaeli, which is situated in the first-degree earthquake zone and shows very fast but disorderly urban sprawl, were suitable to be used as earthquake parks in case of a possible earthquake and the following results were obtained:

1) Because the district parks that could be meeting places are rather located in the coastal part of the city, their impact areas are unbalanced;
2) The existing neighborhood parks are inadequate in terms of their area size;
3) Physical quality of the existing parks is low in terms of the standard elements of an earthquake park and their functional conversion is not possible,
4) All the parks in Kocaeli are located on the fault lines. Therefore, they are under the first-degree effect in case of a possible earthquake;
5) Kavakli coast is one of the areas that was affected most by the collapse occuring after the earthquake. İhsaniye beach park and Kavakli coast are not safe becuase they are situated on an area filled with rubbish;
6) The parks with the most suitable area size to be used as an earthquake park are located along the coastline and they are the ones to be affected most in case of a possible earthquake. İhsaniye Deniz Neighborhood, Gölcük Kavaklı and Değirmendere are declared as disaster-prone areas.

Even if the existing parks in Kocaeli show functional conversion in terms of infrastructure with their equipment, elements and area, they are not found suitable to be used as earthquake parks due to several risks. It is impossible to live by ignoring earthquakes. Therefore, it is necessary to determine earthquake park spaces that offer good conditions considering geomorphological, geological and geotechnical characteristics on the "settlement suitability map" in Kocaeli. Earthquake parks should be constructed in the areas that are protected from the environmental threats to be caused by hazardous wastes in the areas where industrial plants are dense. Also, there are large landslide areas apart from earthquakes in Kocaeli. This kind of disasters should also be considered while selecting earthquake park spaces.

REFERENCES

Aksoy Y (2001). The Determination of Green Area Situation in İstanbul, PhD Thesis, ITU Institute of Science.

Altunkasa F, Uslu C, Doygun H (1995). Solutions And Recommendations Provided to Reach the Ideal Amount of Green Area Per Capita in Adana, The First National Black Sea Forest Congress, Trabzon, 1995, 1: 136-142.

Anonymous (2000). The local Government of Izmit, The Report of The Geological and Geotechnical Investigation of The Saraybahce Area, GEOS Geotechnical Drilling Company.

Anonymous (2006). The Report of The Environmental Situation of Kocaeli, The Governship of Kocaeli, Directorate of Environment and Forestry. Kocaeli.

Anonymous (2007). Kocaeli Provincial Administration 2007-2011 Strategic Sectors Plan. Kocaeli.

Anonymous (2008). Kocaeli Metropolitan Municipality, Parks And Gardens Management Office, Data Of Open And Green Area (Unpublished).

Erkan HT (2007). The Importance of Poplar Tree In Landscape Planning Activities of Kocaeli. Kocaeli City Symposium, Proceeding Book, pp. 418-423, Medianet Visual Presentation, Kocaeli.

Genç FN (2007). The Urbanization In Turkey and its connection With Natural Disaster Risks, Disaster Symposium, TMMOB, Organisation of Civil Engineers. 6/12/2007. Ankara, Turkey. 0.349 to 357 s

Geray C (1977). Precautions Against Disasters in Turkey and Organisations in This Matter, J. Public Administration, 10 (3): 92-114.

Jang N, Li G, Zheng X, Zhang Z (2004). Lessons of Urban Disaster Prevention from Japanese Experience -A Case of Urban Park CNKI-2004-4.http://en.cnki.com.cn/Article_en/CJFDTOTALSJDJ200404006.htm

Kara H (2007). Plan of disaster-center establishment in cities. 5-7 December 2007. pp. 279-288. Ankara.

Keles R (1998). Keles R (1998). "Urban Science Dictionary" Publication of İmge Bookstore, p. 75, Ankara. Turkey.

Keles R (2002). Keles R (2002). Urbanization Policy. Public: 7, Ankara: İmge Bookstore.

Kesim GA, Demir Z, Kutay E, Örnekçi S, Yerli Ö (2006). The evaluation of the functionality of a park in the New Düzce Settlement. Düzce University Faculty of Forestry. J. For., 2(1).

Küçükosmanoğlu F (2007). Kocaeli and Forestry, Kocaeli Urban Symposium, Proceeding, Medianet Visual Presentation, Kocaeli. pp. 134-141.

Limoncu S, Bayülgen C (2005). The Housing Problems in Turkey After Disasters. YTU Arch. Fac. E-J. (1)1.

Önem AB, Kılınçarslan İ (2005). Urban Identity and Environmental Perception in Haliç, J. İTÜ/A, Archit. Plan. Design, 4(1): 115-125.

Özdemir A (2009). The Role Of Public Green Space On The Formation Of Participant Urban Identity. Journal Of Suleymen Demirel University, Faculty Of Forestry, Serial:A, Issue:1, Year:2009, ISSN:1302-7085, pp. 144-153.

TMMOB (2000). TMMOB (2000). 17 August 1999, 12 November 1999 East Marmara Earthquakes. Turkish Engineers and Architects Union. Technical Reports Series: 2, Ankara, Turkey.
Tübitak (2008). Tübitak (2008). The Scientific and Technological Research Council of Turkey Marmara Research Center. Earth and Marine Sciences Institute. Soil Classification for Kocaeli Province and The Project Final Report of Seismic Hazard Evaluation Project. Gebze, Kocaeli, Turkey. ISBN 975-395-388-7, p. 125.

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