

## Evaluation of Disaster and Emergency Assembly Areas in Fatih District (Istanbul) in Terms of Security and Functionality

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### Abstract

Disasters occurring in populous and socioeconomically significant cities such as Istanbul can have national and global impacts. Therefore, disaster management in these areas must be well-designed and effectively implemented. Proper positioning and preparedness of disaster and emergency assembly areas an essential component of disaster management are crucial for ensuring the safety and meeting the needs of people during potential disasters. This study aims to evaluate the assembly areas in Istanbul's Fatih District in terms of secondary hazards (energy infrastructure, soil liquefaction, and damaged structures) that may arise during disaster scenarios. Hazardous structures and elements, as well as areas at risk of soil liquefaction within the study area, were identified using Remote Sensing (RS), secondary data sources, and field studies. Subsequently, using GIS, the assembly areas were classified into four groups based on their proximity to these hazards. In Fatih District, 185 assembly areas were identified, unevenly distributed across neighborhoods. Among them, 49 are located within the impact zone of structures that may pose risks during earthquakes, 20 are situated near hazardous elements, and 32 are located in areas prone to soil liquefaction. Additionally, 12 neighborhoods lack any designated assembly areas, while some existing areas are situated near or within Istanbul's iconic tourist sites. The findings are expected to contribute to the disaster management mechanisms of Fatih District and raise disaster awareness. Addressing the identified issues is of critical importance for preventing potential complications during disaster situations.

**Keywords:** Disaster, Disaster and Emergency Assembly Area, Disaster Management, Fatih, Remote Sensing.

### 1. INTRODUCTION

Disasters are sudden events that can lead to significant economic and social losses (Atmaca et al., 2023). They are characterized by physical destruction and disruptions in social functioning that individuals cannot overcome on their own, and that prevent some or all segments of society from fulfilling their basic functions (Shaluf, 2007; Lindell, 2013). The frequency and impacts of disasters have been increasing due to factors such as global population growth, the expansion of settlement areas, intensified land use, and climate change. According to EM-DAT (2025) data, a total of 17,504 natural disasters occurred worldwide between 1990 and 2025, resulting in nearly 33 million deaths. The distribution of disasters over the years indicates an upward trend from past to present (URL 12). In East Asia and the Pacific, Sub-Saharan Africa, Latin America, and the Caribbean, the number of disasters per country is significantly above the global average, ranging from 837 to 3,833. At the national level, the United States and China recorded the highest frequency during the

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*To cite this article*

Bağcı, H. R., Çağırır, N. S., (2025). Evaluation of Disaster and Emergency Assembly Areas in Fatih District (Istanbul) in Terms of Security and Functionality. *Journal of Disaster and Risk*, 8(3), 809-828.

1990–2019 period, with each experiencing more than 750 disasters (Budina et al., 2023). In Türkiye, 92 disasters were recorded in EM-DAT over the past 25 years, resulting in 54,774 deaths and approximately 40 billion USD in economic losses (URL 12).

Effective disaster management processes can prevent certain disasters and significantly mitigate their impacts. Disaster management is a systematic process comprising strategies and policies designed to prevent hazards from escalating into disasters or to reduce their consequences. This process aims to safeguard human lives, property, and economic assets, while ensuring safe and sustainable living conditions for society (Sulphey, 2016). Many countries, including the United States, Japan, Germany, Spain, Finland, France, and Türkiye, continue to enhance their disaster management practices (Erkal and Değerliyurt, 2009). Disaster management, which consists of mitigation, preparedness, rescue, first aid, recovery, and reconstruction, includes practices such as ensuring the safety of disaster victims, carrying out search and rescue and first aid services, evacuating victims to safe areas and meeting their needs, assessing damage, and preventing secondary disasters (Spyridaki et al., 2009; Şahin and Üçgöl, 2019). Following the initial shock of a disaster, secondary disasters may occur, further aggravating the overall situation (Işık et al., 2012; İlerisoy et al., 2022; Bulut and Taşkın, 2024). Therefore, effective disaster management plays a crucial role in preventing such secondary disasters.

Disaster management efforts in Türkiye have generally gained momentum following major disasters. The foundations of disaster management were laid with the "Law on Precautions to be Taken due to Disasters Affecting Public Life and Assistance to be Provided" enacted in 1959 (Erkal and Değerliyurt, 2009). After the 7.8 magnitude Marmara Earthquake in 1999, disaster management efforts gained momentum, culminating in the establishment of AFAD (Disaster and Emergency Management Presidency) through the enactment of the "Disaster and Emergency Law" in 2009 (Önsüz and Atalay, 2015). Subsequently, AFAD Provincial Directorates, local administrations and Gendarmerie commands identified disaster and emergency assembly areas at the neighborhood level. This practice, common in many countries, involves creating safe areas where individuals can recover from the initial shock of a disaster and access essential needs such as first aid, food, electricity and water before evacuation (Aman and Aytac, 2022). In Türkiye, strategies for assembly areas were first developed within the scope of TAMP (Türkiye Disaster Response Plan), which came into force in 2014. TAMP aims to identify and assess the suitability of assembly areas, promote their use, and plan evacuation priorities and routes before a disaster (URL 1). When selecting assembly areas, locations that are distant from secondary hazards such as floods, tsunamis, soil liquefaction, and fires are prioritized, taking into account factors like population, accessibility, and infrastructure (URL 2). The suitability of assembly areas for use during disasters is assessed through analyses conducted by various disciplines (Şekkeli, 2020; Kalkan, 2022; Kart et al., 2023; Bağcı et al., 2024; Kuru et al., 2024). These studies commonly employ Multi-Criteria Decision-Making (MCDM) methods such as AHP, TOPSIS, and Vikor (Tsai et al., 2008; Ye et al., 2012; Omidvar et al., 2013; Gökgöz et al., 2020; Gerdan and Şen, 2020; Ekin and Sarıkaya, 2021; Luo et al., 2022; Arca and Çitiroğlu, 2023; Li et al., 2024; Abdelaziz et al., 2025).

Istanbul stands out in disaster management processes with its large population, socioeconomic structure, historical and cultural significance and vulnerability to various disaster risks. Potential disasters in the city are likely to affect vast numbers of people and trigger crises on a national scale. In this study, the assembly areas in Fatih District, commonly referred to as the historical peninsula of Istanbul, were evaluated in terms of safety, secondary hazards (such as soil liquefaction, hazardous structures and items), functionality and proximity to tourism assets. In this context, RS and Geographic Information Systems (GIS) were used, and field studies were conducted. In the literature, Fatih District has been analyzed from various perspectives (Avşar and Gönüllü, 2000; Kara et al., 2008; Aksoy and Akpınar, 2011; Kara and Egresi, 2013; Yumrutaş and İyınam, 2017) and evaluated in terms of disasters (İnce, 2009; Şenol Balaban, 2011; Kesik et al.,

2015; Yücel and Ciritci, 2020). However, the absence of research evaluating the assembly areas in Fatih makes this study unique and valuable. This research is expected to contribute to the identification of hazardous structures and items in Fatih District, support the implementation of precautionary measures during disasters, enhance the safety and functionality of assembly areas, and promote disaster awareness.

### 1.1. Location and Introduction of Fatih District

Fatih is located in the Çatalca Kocaeli Section of the Marmara Region, on the European side of Istanbul. It is surrounded by Zeytinburnu to the west, Eyupsultan to the northwest, the Bosphorus to the east, the Golden Horn to the north, and the Marmara Sea to the south. It has 57 neighborhoods, 441 avenues, 2323 streets, 42,455 buildings, 157,500 residences and 99,572 workplaces, and is 16.3 km<sup>2</sup> wide (URL 7). One of the oldest settlements in Istanbul, it is a historical peninsula surrounded by city walls to the west. The district serves as a tourism and trade center of Istanbul, renowned for its historical and cultural landmarks such as Hagia Sophia (Ayasofya-i Kebir Cami), Sultanahmet, Fatih Mosque, Grand Bazaar (Kapalı Çarşı), and Topkapı Palace (Figure 1).

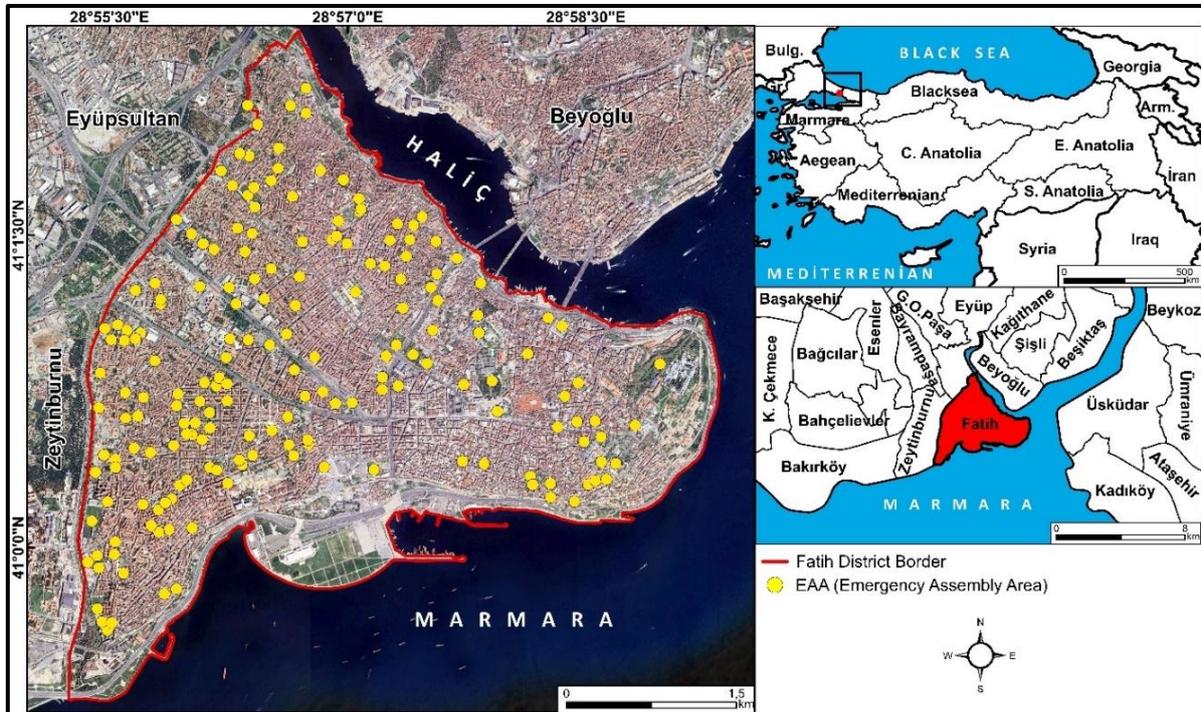


Figure 1. Location of Fatih District.

In Fatih, geological formations include rocks ranging from the Paleozoic to the Quaternary period, as well as alluvium, Upper Miocene aged Güngören, Bakırköy and Çukurçeşme formations and the Carboniferous aged Trakya Formation (Gedik et al., 2014). The coastal neighborhoods of Aksaray, Cerrahpaşa and Hocaşa in the district are generally considered high-risk areas in terms of soil liquefaction triggered by earthquakes (Üstün et al., 2022). Fatih is located 12.3 km north of the Central Anatolian Fault (CAF) and lies within the 1st-degree earthquake risk zone (URL 3). Over the past century, 10 earthquakes with a magnitude above 6 affected Fatih (URL 6). Fatih, which resembles a coastal plain with elevations of 40-50 m, has a relative elevation difference of 75 m and an average slope of 6%. The district experiences mild winters and hot and dry summers, with an annual precipitation of 728 mm and an average temperature of 15.1°C (MGM, 2024). The reclaimed areas along the district's coasts, such as Yenikapı and Yedikule, disrupt the natural landscape and weaken the connection between land and sea (Özkan et al., 2015; Ciritci, 2022). Furthermore, these areas are vulnerable to potential sea level rises caused by climate change.

Fatih, characterized by dense land use, has 74.2% (12.1 km<sup>2</sup>) of its area covered by residential and commercial areas and official institutional buildings, according to measurements from 2025 Google Earth images. The remaining area includes parks, parking lots and transportation systems. The district also houses land and railways with E-W extension, seven piers (Fener, Cibali, Yemiş, Boğaz, Harem, Fish Market, and Sea Bus Piers) and two lighthouses (Kumkapı, Ahırkapı).

Fatih, also known as "Suriçi İstanbul", is a peninsula surrounded by the Golden Horn, the Marmara Sea and the Byzantine Walls. With a population of 356,025, the district has a population density of 21,814 inhabitants per square km, with Akşemsettin (28,234) and Seyyid Ömer (27,796) being the most populous neighborhoods. Built on seven hills and rich in historical and cultural heritage, Fatih boasts 604 lodges, 258 mosques, 177 fountains, 47 baths, 29 madrasahs, 21 bazaars, 18 monuments, 18 historical gates, 16 museums, 9 cisterns, 9 palaces and 1 mansion (URL 7; URL 8).

## 2. PURPOSE, DATA AND METHODS

### 2.1. Purpose

This research is based on the hypothesis that *"Some disaster and emergency assembly areas in Fatih District are unsuitable for use during disaster processes due to issues with accessibility, safety and functionality. Identifying the potential hazards in these areas is crucial for effective disaster management in the district"*.

Within the scope of this study, the disaster and emergency assembly areas in Fatih will be examined through:

- Assessment of items that may create secondary hazards during disaster processes,
- Identification of potential impacts on areas of historical and touristic significance,
- Assessment of their suitability for use in disaster processes in terms of accessibility, infrastructure and facilities,
- Providing recommendations to eliminate identified hazards and to enhance the safety and functionality of the assembly areas.

### 2.2. Data

Some of the data required for the research were digitized from Google Earth images, while secondary data were obtained from relevant sources (Table 1).

Table 1. Data used in the study, their sources and intended use.

Data	Data source	Purpose of Use
Location of disaster and emergency assembly areas	AFAD Disaster and Emergency Assembly Area Inquiry Application (URL 4) 10.04.2025	Mapping of disaster and emergency assembly areas
Neighborhood and district boundaries		Assessment of assembly areas and hazardous items on a neighborhood basis
Hazardous structures and items: Transformer, natural gas network, gas station, minaret, multi-storey buildings, abandoned buildings, metro stations.	Google Earth Satellite Images, dated 11.03.2025	Determining the items that may create secondary hazards in disaster processes.
Land areas; residential, commercial and administrative areas; green areas and parking; transportation systems		Brief introduction of the research field
Earthquake risk levels and major earthquakes in the Marmara region	URL 3 (05.12.2024); URL 6 (10.04.2025)	Explanation of Fatih's seismicity
1/100,000 scale F21c3 and G21b2 geology sheets	Gedik et al., 2014	Used in the brief introduction of the district.
Fatih Meteorology Station observation data	MGM, 2024	
Soil liquefaction susceptibility data	Üstün et al., 2022	Identification of areas prone to liquefaction

### 2.3 Method

The study started with a research design aimed at evaluating the assembly areas in Fatih as accurately and comprehensively as possible in terms of safety and functionality (Figure 2).

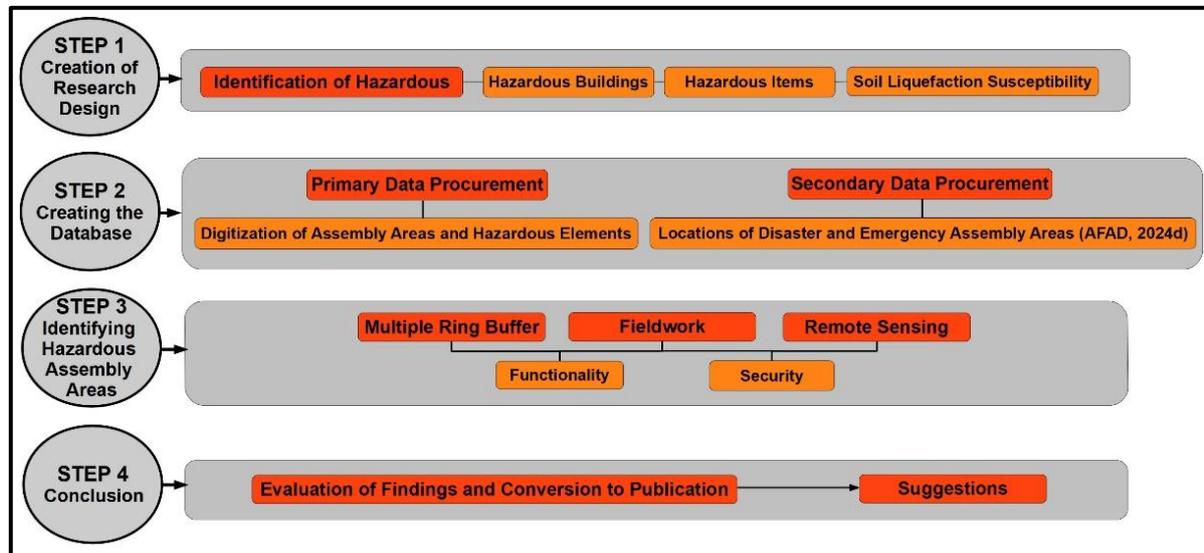


Figure 2. Research Design.

Identifying items that may pose secondary risks during disaster processes is a key work package of this study. For this purpose, the criteria used in similar studies in the literature were first examined, and then the items that may pose hazards to the assembly areas were identified through remote sensing (RS) and field studies. In the literature, it was observed that location in relation to hazardous structures and items is one of the most frequently used parameters in determining the suitability of assembly areas for use in disasters (Table 2).

Table 2. Case studies and criteria used.

Article	Criteria
Omidvar et al. (2013)	Accessibility, Water supply, size of camp site, camp location, security and protection, topography and drainage, soil conditions, vegetation and fuel resources, culture and tradition, climate conditions, local health and other risks, public opinion, economic considerations, earthquake damage assessment criterion.
Gerdan and Şen (2020)	Accessibility, infrastructure, capacity; Facing the main street, distance to the sea (>200 m), tall buildings (>30 m), pedestrian, disabled path, electricity, water, WC, area per person greater than 2 m <sup>2</sup> .
Ekin and Sarıkaya (2021)	Infrastructure, environmental safety, area, transportation, area type, distance; Electricity, water, sewage, distance to surrounding structures, building height, land transportation, pedestrian transportation, disabled transportation.
Kalkan (2022)	Transportation, infrastructure, capacity; Facing the main street, pedestrian and disabled path, distance to multi-storey buildings, water, sewer and electricity infrastructure.
Partigöç (2023)	Areal size, population, land cover, capacity analysis.
Erđin et al. (2023)	Usability, safety, accessibility; Property, slope, faults, geology, ground, energy transmission line, natural gas line, transmission line, bridges and viaducts, geothermal energy infrastructure, sewerage, hazardous facility, age of surrounding structures, number of floors, order, ground floor use, roads, proximity to health facilities.
Bağcı et al. (2024)	Distance to hazardous items, settlement density, distance to main roads, distance to health infrastructure, susceptibility to soil liquefaction, land cover, slope.
Zhang et al. (2024)	Social vulnerability, population coverage, evacuation capacity.
Boonmee and Thoenburin (2024)	Air purifier machine, air pressure system and air filter, activity area, area per person, medical kit, cleanliness, toilet, fan, air conditioner, air ventilation fan, media relations, dust alarm device, light, emergency exit signs, fire equipment, distance from community.

The locations of assembly areas and structures or elements that may pose secondary hazards during potential disasters were digitized using Remote Sensing (RS). A "Multiple Ring Buffer" analysis was conducted in ArcGIS to evaluate the proximity of assembly areas to hazardous structures and elements, a method commonly used to model the extent of settlements potentially

affected by hazards and to generate distribution maps (Junyar et al., 2020). Based on the study area and relevant literature (Şirin and Ocağ, 2020; Bağcı et al., 2024; Bağcı and Demir, 2025), assembly areas were classified into four distance-based groups from hazard sources: 0–50 m, 51–100 m, 101–150 m, and 151 > m. Field studies further identified issues such as limited accessibility, inadequate space and equipment, misuse, and susceptibility to soil liquefaction, which were incorporated into the analysis.

We anticipated that the lack of a numbering system for the assembly areas in Fatih would increase the volume of the study and create confusion in the narrative due to the frequent reference to assembly area names throughout the writing process. Therefore, the assembly areas were assigned numbers, which were subsequently used consistently in the text and visuals (Table 3).

Table 3. Numbering of Disaster and Emergency Assembly Areas in Fatih.

No	Name	No	Name	No	Name	No	Name	No	Name
1	İMÇ P.	38	Yedikule AL	75	Bezmialem O.	112	Yedikule Sur P 1	149	Muhtar O. Güven P.
2	Fatih C.	39	Aşık Paşa P.	76	Edirnekapı M.	113	Yedikule Sur P. 2	150	İskenderpaşa İÖO
3	Vezir P.	40	Engelliler P.	77	Binbirdirek P.	114	Aksaray Metro İ.	151	Silivrikapı Semt P.
4	Çapa FL	41	Nakilbent P.	78	Keyci Hatun P.	115	İbrahim Çavuş P.	152	Yenicami M. P.
5	Kırmılı P.	42	Fatih Anıt P.	79	Kariye Şehir P.	116	Veledi Karabaş P.	153	Yedikule Ekipler P.
6	Beyazıt M.	43	Vatan Cd. M.	80	Şenol Güneş P.	117	Gençosman İÖO	154	Seyyid Ö. Şelaleli P.
7	Kadırga P.	44	Saraçhane P.	81	Sefa Bostanı P.	118	Cerrahpaşa Cd. O.	155	Yedikule Zindanları
8	Kurtağa P.	45	Molla Aşkı P.	82	E. Belözoğlu P.	119	Karagümrük OO	156	Vedide B. Pars OO
9	Avcıbey P.	46	Muratpaşa P.	83	Hırka-i Şerif C.	120	F. Gelenbevi AL	157	Vatan Emniyet Cd.
10	Fatih RAM	47	Çarşamba M.	84	Çemberlitaş M.	121	G. Ahmetpaşa C.	158	Ayasofya-i Kebir C.
11	Şehzade C.	48	Davutpaşa C.	85	Fatih Cibali OO	122	Şht. Ast. F. Işık P.	159	Kâtip Şemsettin C.
12	Gülhane P.	49	K. Başaran P.	86	Tevfik Kut OO	123	Duhaniye Sk. O.	160	Bostan H. Sk. O.
13	Özgüven P.	50	Molla Şeref P.	87	Şehremini AL	124	Mustafa Nafi P.	161	Şht. Y. E. Ezer İÖO
14	Numune P.	51	Kadıçeşme P.	88	Kadırga MTAL	125	M. Akif Ersoy P.	162	Kadir Has Kavşağı
15	Emin Ali P.	52	Koyunbaba P.	89	M. C. Ökten M.	126	Tekfur Sarayı P.	163	Ramazan Efendi C.
16	Arkeoloji P.	53	K. Mehmet P.	90	İbrahim Paşa C.	127	Süleymaniye C.	164	Küçük Ayasofya C.
17	Derişali P.	54	Seyitömer O.	91	Haseki Külliye	128	Karagümrük St.	165	Şht. M. Çetinkaya P.
18	Şair Nabi P.	55	Selçuk MTAL	92	Çukurbostan P.	129	Kemikliburun P.	166	Kocamustafapaşa P.
19	Ese Kapı C.	56	Çağaloğlu AL	93	Mesneviyhane C.	130	Sultanahmet M.	167	Kocamustafapaşa M.
20	Bali Paşa C.	57	29 Mayıs İÖO	94	Üç Mihraplı C.	131	Büyük Saray M. P.	168	Ö. Topkapı Doğa İÖO
21	Seydibey C.	58	Taşköprülü P.	95	Mevlanakapı P.	132	Namık Sevik St.	169	Büyük Reşitpaşa OO
22	M. Akif OO	59	Mucit Sk. O.	96	Sultanahmet C.	133	Cambaziye Sk. O.	170	Küçük Mustafapaşa P.
23	Y. Selim P.	60	Ali Nar İHOO	97	Rekreasyon A.	134	Çapa Atatürk OO	171	Silivrikapı Set Üstü P.
24	Oktay S. T.	61	Kadırga İÖO	98	İBB Fatih S. K.	135	Y. Sultan Selim C.	172	Fatih Atatürk İHOO
25	Gazi İHOO	62	Eminönü M.	99	Dr. M. Alatlı P.	136	Aydın Kethüda C.	173	Karagümrük St. Yanı
26	Zigana S. T.	63	Oruçgazi OO	100	Davutpaşa AL	137	Hattat Rakım OO	174	Edirnekapı Kız AİHL
27	Çapa İÖO	64	Kariye M. P.	101	İstanbul Üniv.	138	Akşemsettin İÖO	175	Sultanahmet MTAL
28	Atikali İÖO	65	Hacıpiri Sk.	102	Karagümrük P.	139	F. Küçükefendi C.	176	İstanbul R.T.E. AİHL
29	Oruçgazi P.	66	M. Sinan St.	103	Cundi Sosyal T.	140	Ö. Oğuzkaan İÖO	177	Muallim Yahya İÖO
30	S. Sultan P.	67	M. Naci İÖO	104	Melek Hatun P.	141	İstanbul Erkek L	178	Sultan Selim MTAL
31	H. Hasan C.	68	Uzun Yusuf P.	105	Akşemsettin P.	142	Kâtip Çelebi İÖO	179	N. Mehmetpaşa C.
32	H. Alipaşa P.	69	Gülistanbul Anaokulu O.	106	Silivrikapı Alay İmamı P.	143	Kocamustafapaşa Hamamı	180	Fatih Atatürk Çağdaş Yaşam ÇPAL
33	Haşim İşcan P.	70	Piri Mehmet Efendi C.	107	Yedikule Yüzme Havuzu	144	Kocamustafapaşa İÖO	181	Fındıkzade Çukurbostan Şehir P.
34	Marmaray Yenikapı İ.	71	M. E. Tokadi Türbesi	108	Çarşamba Çukurbostan P.	145	Topkapılı Mehmet Bey İÖO	182	İ. A. Gövsaa OO Kara Ahmet Paşa İÖO
35	Ö. Sultan Fatih Koleji	72	Hobyarlı A. Paşa İÖO	109	Ayvansaray Mahkemealtı P.	146	Sultanahmet Suphi Paşa MTAL	183	Fatih Bld. Marmara Semt Konağı
36	Hekimoğlu Alipaşa C.	73	Hekimoğlu Alipaşa İÖO	110	Hadım İbrahimpaşa C.	147	M. Sinan İştme Engelliler İÖO	184	F. S. M. Uluslararası AİHL
37	Behruzağa Odabaşı C.	74	H. Süleyman Bey İÖO	111	Eminönü N. Mehmetpaşa C.	148	Cerrah Mehmetpaşa C.	185	Çağaloğlu Geleneksel Türk Sanatları MTAL

**Abbreviations**

<b>P</b>	Park	<b>L</b>	Lise	<b>St.</b>	Stat	<b>Şht.</b>	Şehir	<b>İHL</b>	İmam Hatip Lisesi
<b>C</b>	Cami	<b>Ö</b>	Özel	<b>Sk.</b>	Sokak	<b>OO</b>	Ortaokul	<b>İHOO</b>	İmam Hatip Ortaokulu
<b>B</b>	Bahçe	<b>A</b>	Alan	<b>Cd.</b>	Cadde	<b>FL</b>	Fen Lisesi	<b>AİHL</b>	Anadolu İmam Hatip Lisesi
<b>M</b>	Meydan	<b>S</b>	Spor	<b>İ</b>	İstasyon	<b>AL</b>	Anadolu Lisesi	<b>ÇPAL</b>	Çok Programlı Anadolu Lisesi
<b>O</b>	Otopark	<b>T</b>	Tesis	<b>K</b>	Kompleks	<b>İÖO</b>	İlköğretim Okulu	<b>MTAL</b>	Mesleki ve Teknik Anadolu Lisesi

### 3. FINDINGS

#### 3.1. Distribution of Disaster and Emergency Assembly Areas in Fatih

Fatih houses 57 neighborhoods and 185 assembly areas. The distribution of assembly areas across these neighborhoods is unbalanced. Dervişali, Mevlanakapı, Şehremini and Yedikule ranked first in terms of the number of assembly areas, while Emin Sinan, Hobyar, Hoca Gıyasettin, Hocapaşa, Kâtip Kasım, Mesihpaşa, Mimar Hayrettin, Mimar Kemalettin, Muhsine Hatun, Sarıdemir, Tahtakale and Taya Hatun neighborhoods have no assembly areas (Figure 3). The lack of assembly areas in 12 neighborhoods of Fatih with significant population and social mobility constitutes a major challenge for effective disaster management.

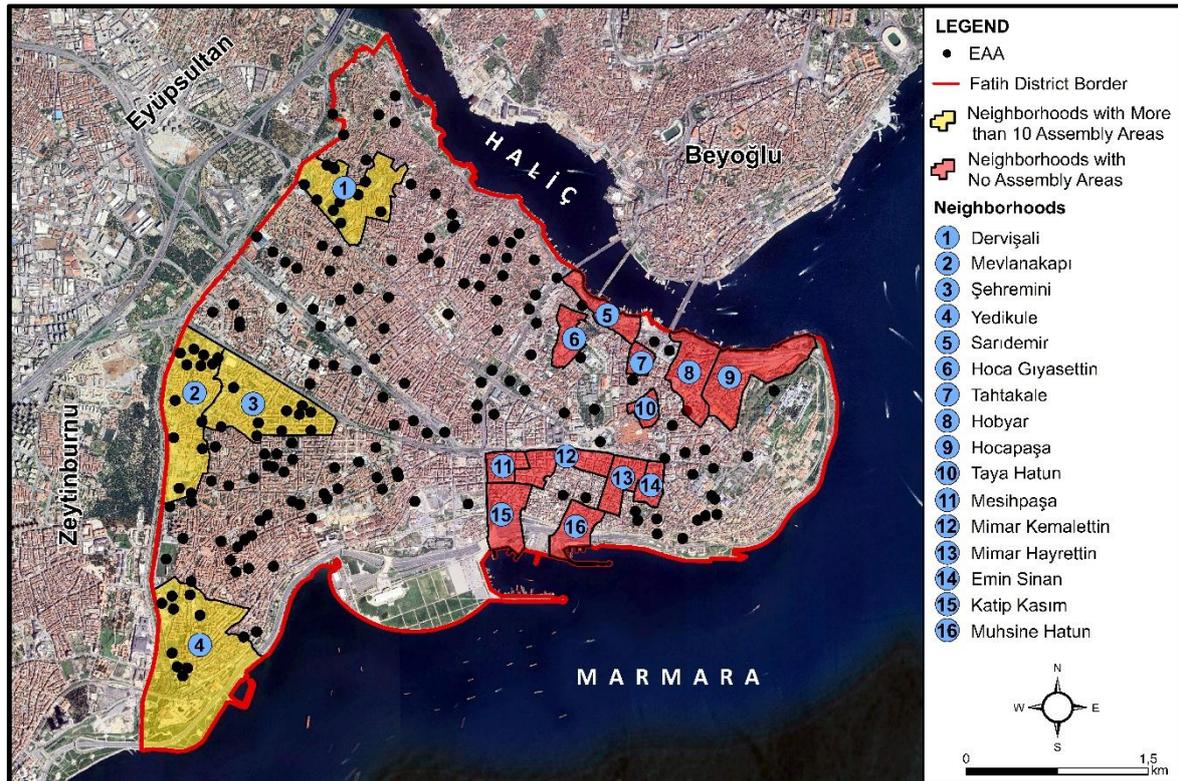


Figure 3. Neighborhoods in terms of the number of assembly areas.

Assembly areas in Fatih are distributed across locations of varying characteristics (Table 4). Parks of various sizes and facilities account for 34% of the assembly areas, followed by school gardens and mosque courtyards. Additionally, 4.86% are located in parking lots and commercial zones. The intensive use of these latter areas complicates their suitability as effective assembly areas.

Table 4. Distribution of Disaster and Emergency Assembly Areas by Characteristics.

Attribute	Unit	Rate (%)	Attribute	Unit	Rate (%)
Park	64	34,59	Parking	8	4,32
Schoolyard	52	28,10	Sports Facility	8	4,32
Mosque Courtyard	28	15,13	Commercial Area	1	0,54
Square	12	6,48	University Campus	1	0,54
Wasteland	11	5,94			

Fatih, which forms the historic core of Istanbul, one of the oldest and largest settlements in the world, boasts unique historical and touristic sites included in the UNESCO World Cultural Heritage (Ayasofya-i Kebir and Küçük Ayasofya mosques) and World Heritage lists (Nur-u Osmaniye Complex, Historical Walls, Süleymaniye and Molla Zeyrek mosques, Sultanahmet Historical Sites)

(URL 9). Several assembly areas in Fatih (2, 96, 127, 130, 158, 164) are situated close to or even within these tourist attractions (Figure 4).

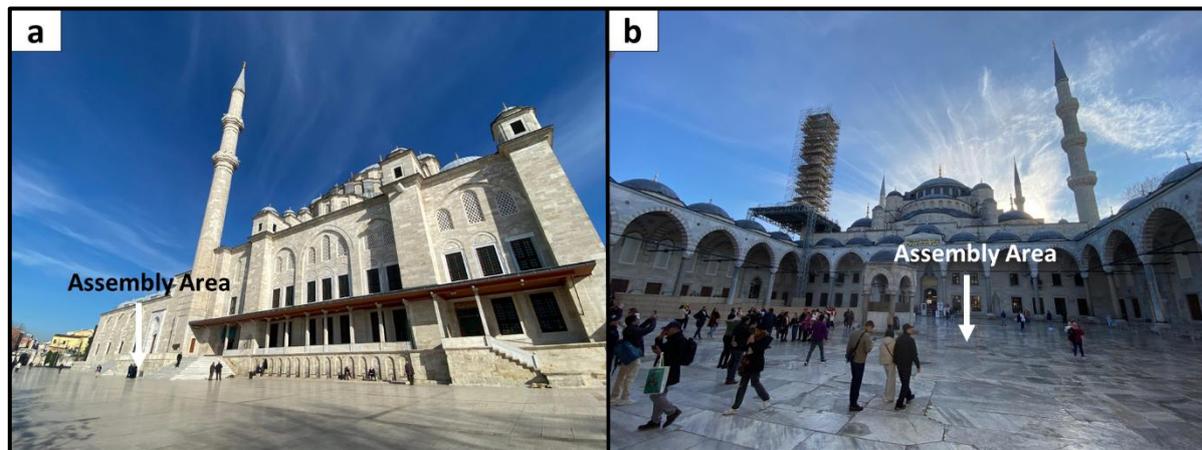


Figure 4. a) Assembly areas around Fatih Mosque (2); b) Sultanahmet Mosque (96).

In the event of a disaster, the crowds, tents, containers, and aid trucks gathering in these areas could significantly damage the aesthetic appearance of the historical monuments. The use of these sites as assembly areas may cause damage to their historical significance and a temporary or permanent decline in their touristic value. Considering Fatih's contribution to Türkiye's tourism through its artifacts, this issue should be carefully addressed within disaster management plans.

### 3.2. Evaluation of Assembly Areas in Fatih in Terms of Secondary Hazards

Events that may cause loss of life or property following a disaster, triggered by the initial event, are called secondary disasters (URL 10). Earthquakes, which come to mind first when it comes to disasters in Istanbul, are also the most frequent causes of secondary disasters (Gaferoğlu et al., 2024). This study identified the secondary hazards that assembly areas in Fatih might face because of their locations. These hazards were grouped into three categories: hazardous structures, hazardous items, and soil liquefaction. The assembly areas were then classified according to these risks (Table 5).

Table 5. Distribution of Assembly Areas in Fatih by Hazard Type

Type of Hazard	Hazardous Structures	High-rise Building	18, 30, 40, 49, 58, 78, 104, 131, 134, 140, 149, 166, 185.
		Wrecked Building	166, 170.
	Minaret	1, 2, 6, 11, 20, 21, 31, 37, 39, 48, 64, 70, 83, 84, 89, 90, 93, 94, 96, 110, 111, 121, 123, 125, 127, 135, 139, 145, 148, 152, 158, 159, 167, 179, 183.	
	Hazardous Items	Transformer and Natural Gas Network	3, 7, 31, 45, 46, 50, 52, 69, 92, 102, 107, 149, 153, 167.
		Metro and Gas Station	34, 48, 57, 114, 124, 137.
	Soil Liquefaction		7, 12, 26, 34, 46, 61, 62, 65, 70, 86, 88, 89, 94, 97, 103, 107, 109, 110, 111, 112, 113, 114, 132, 150, 151, 152, 155, 160, 162, 164, 165, 170.

The findings indicate that 85 out of 185 assembly areas in Fatih may be exposed to various secondary hazards. In addition, the classification based on distance to hazardous structures and elements revealed that 66 assembly areas are located within 0–50 m, 11 within 51–100 m, 21 within 101–150 m, and 87 are situated at least 150 m away from such hazard sources (Table 6; Figure 5).

Table 6. Distances of Assembly Areas in Fatih to Hazardous Structures and Items.

0- 50 m (66 units)														
1	2	3	6	7	11	18	20	21	30	31	34	37	39	40
45	46	48	49	50	52	58	64	69	70	78	79	83	84	89
90	92	93	94	96	100	102	104	107	108	110	111	114	121	123
124	125	127	131	134	135	139	140	145	148	149	152	153	158	159
166	167	170	179	183	185									
51-100 m (11 units)														
57	61	71	87	113	118	130	137	144	155	163				
101-150 m (21 units)														
15	22	25	26	44	55	62	65	72	73	76	85	122	133	138
146	154	156	165	178	181									
151> m (87 units)														
4	5	8	9	10	12	13	14	16	17	19	23	24	27	28
29	32	33	35	36	38	41	42	43	47	51	53	54	56	59
60	63	66	67	68	74	75	77	80	81	82	86	88	91	95
97	98	99	101	103	105	106	109	112	115	116	117	119	120	126
128	129	132	136	141	142	143	147	150	151	157	160	161	162	164
168	169	171	172	173	174	175	176	177	180	182	184			

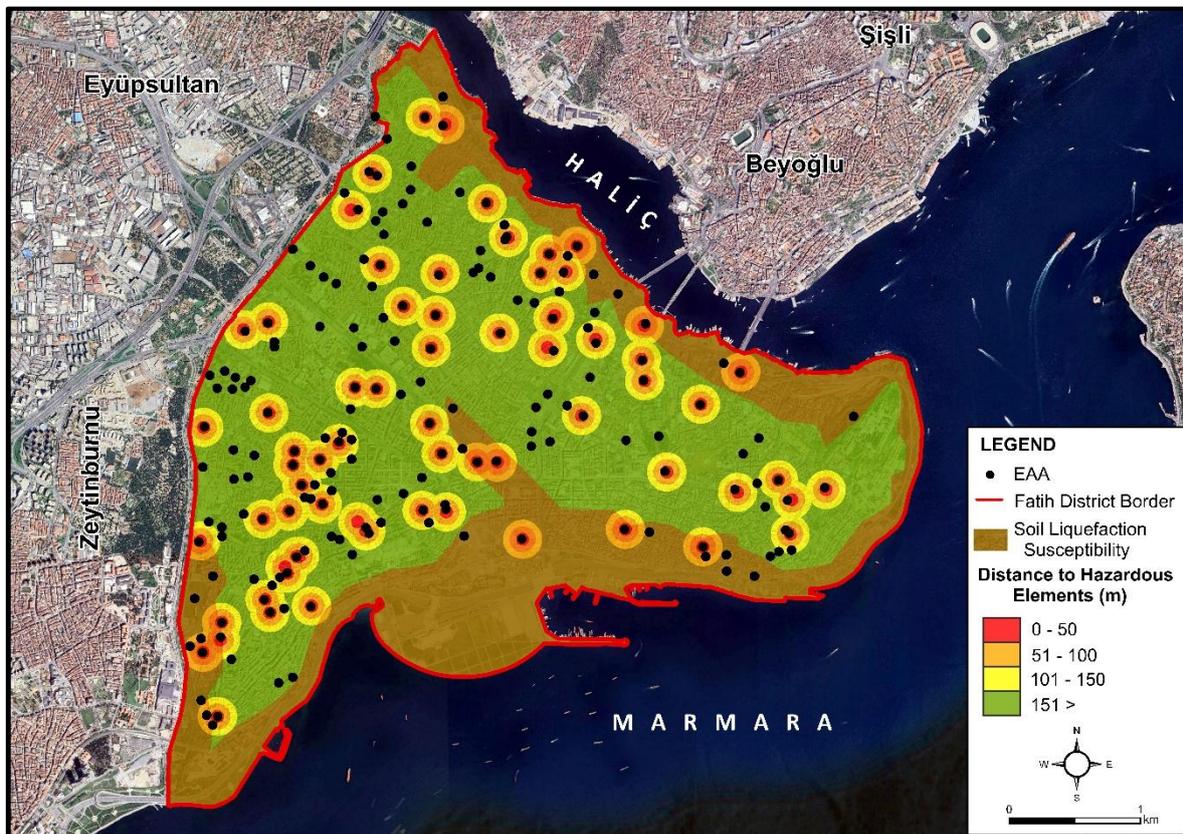


Figure 5. Fatih District distance map to hazardous structures and items.

### 3.2.1. Hazardous Structures

Generally, multi-storey buildings are more vulnerable to earthquake damage than low-rise structures. Although these buildings may survive the main earthquake, they may collapse during aftershocks or have various parts break off. Using the areas surrounding these buildings, which could be affected in the event of a collapse, as assembly points poses a significant risk to the safety of disaster victims. Furthermore, it should be noted that these buildings may block narrow streets, hindering access to assembly areas (Şenol Balaban, 2011). In Fatih, 13 assembly areas were identified as being at risk due to these hazards (Figure 6).



Figure 6. Google Earth and ground images of the assembly area 30.

In Fatih, assembly areas 166 and 170 are located near abandoned buildings. These deteriorating structures may pose secondary hazards to the assembly areas (Figure 7).



Figure 7. Google Earth and ground images of the assembly area 170.

Mosque minarets are structurally vulnerable and can be easily damaged during earthquakes and storms. The collapse of these tall structures or the falling of fragments can pose significant risks to the areas surrounding the minarets. In Fatih, which is home to a large number of historic mosques, 35 assembly areas were identified as potentially affected by minarets that may collapse during earthquakes or storms (Figure 8).

### 3.2.2. Hazardous Items

Urban infrastructure components like transformers, high-voltage power lines, natural gas distribution networks, subway stations, and gas stations can create secondary risks such as explosions and fires when damaged during disasters. In Fatih, 14 assembly areas are located near transformers or natural gas networks (Figure 9).

Fuel stations located in residential areas carry inherent risks even under normal conditions and can become significant sources of secondary hazards in the event of disasters such as fires, earthquakes, or floods. The crowds that will gather at these locations during disasters will further elevate the associated risks. Indeed, in 2012, an explosion occurred at a fuel station in Muş-Bulanık

following an earthquake (URL 5). In Fatih, four assembly areas (48, 57, 124, 137) are located near fuel stations (Figure 10).



Figure 8. Google Earth and ground images of the assembly area 83.

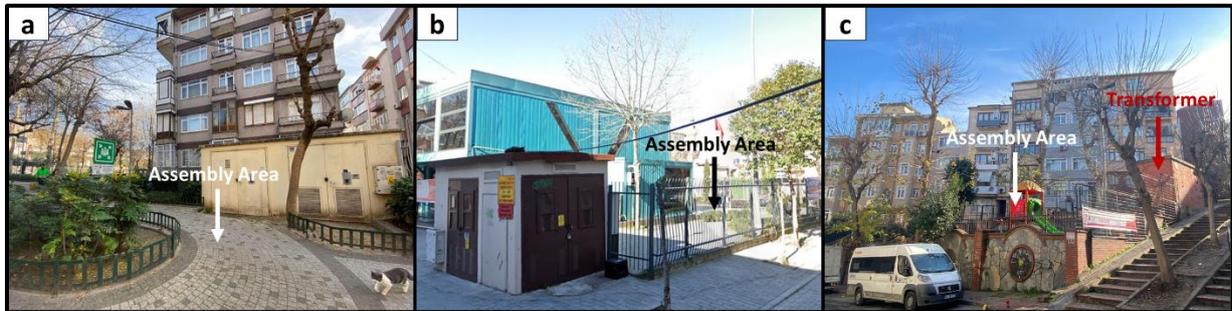


Figure 9. Images from a) 50 b) 102 c) 149 assembly areas.



Figure 10. Google Earth and ground images of the assembly area 124.

Metro stations are vulnerable to risks such as structural collapse, explosion and flooding during disasters. Using these stations or their surroundings as assembly areas can create additional secondary hazards. In Fatih, two assembly areas are located directly on metro stations (Figure 11).



Figure 11. Google Earth and ground images of the assembly area 114.

### 3.2.3. Soil Liquefaction

In poorly consolidated, loosely structured soils, such as embankments, delta plains, and dune areas, earthquake-induced ground shaking can cause groundwater to rise toward the surface, leading to soil liquefaction or burial of structures (Ishihara and Koga, 1981). As a result of soil liquefaction, swamp-like conditions may develop in the affected area. In the event of an earthquake, areas prone to soil liquefaction are more severely affected by tremors, often resulting in ground collapse. According to data from the General Directorate of Mineral Research And Exploration (MTA), a coastal area of 5.22 km<sup>2</sup> in Fatih District is prone to soil liquefaction (Üstün et al., 2022). In the event of a potential earthquake, the exposure of 32 assembly areas within this zone to soil liquefaction would significantly hinder their functionality and safety for use as emergency assembly areas (Figure 12).



Figure 12. Google Earth images of soil liquefaction-prone aggregation areas (a 12, b 62, c 109).

### 3.3. Additional Challenges in the Assembly Areas in Fatih District

In addition to the previously discussed issues, such as hazardous structures and items and soil liquefaction, field studies identified several other problems affecting the assembly areas in Fatih. These include use as parking lots, insufficient space, lack of equipment, occupation, and limited accessibility (Table 7).

In densely populated yet space-constrained districts like Fatih, the utilization of parking lots as assembly areas becomes a necessity. However, vehicle parking in these areas must follow specific regulations, with the primary function of these spaces as assembly areas always kept in mind. Our study revealed that 14 assembly areas are currently used as parking lots and do not qualify as assembly areas in their current state (Figure 13).

Table 7. Problematic Assembly Areas in Fatih.

<b>Problem</b>	<b>Parking</b>	34, 35, 54, 59, 69, 97, 103, 107, 118, 123, 129, 133, 147, 160.
	<b>Lack of Space</b>	1, 3, 8, 18, 22, 23, 27, 28, 30, 31, 39, 51, 57, 61, 70, 73, 78, 81, 94, 104, 120, 122, 136, 143, 145, 149, 168, 170, 171, 183.
	<b>Lack of Equipment</b>	1, 65, 71, 91, 107, 112, 132, 143, 155, 157, 162, 167, 183.
	<b>Occupation</b>	75, 94, 154.
	<b>Limited Accessibility</b>	30, 113, 123, 124, 129, 132.



Figure 13. Google Earth and ground images of the assembly area 129.

Fatih District's high density and limited space are also evident in its assembly areas. Thirty assembly areas in the district are smaller than 1 km<sup>2</sup> (Figure 14; Table 7). Additionally, some assembly areas are located on median strips at busy intersections with heavy vehicle traffic. To serve their intended purpose effectively, assembly areas should be equipped with basic facilities such as toilets, electricity, and water to meet the needs of people during disaster processes. However, deficiencies in 13 assembly areas in Fatih (Figure 15) can lead to significant difficulties in disaster response efforts.

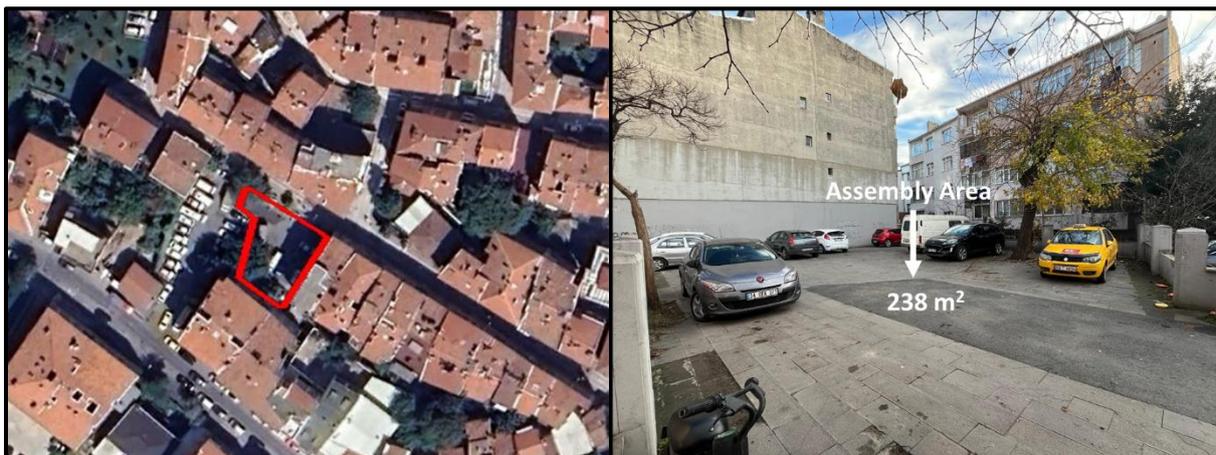


Figure 14. Google Earth and ground images of assembly area 104.



Figure 15. Google Earth and ground images of assembly area 162.

As in many urban areas across Türkiye, property issues affect several assembly areas in Fatih. Some sites are privately owned and have been partially or completely converted into residential or commercial areas. In three such assembly areas, this could hinder effective disaster response (Figure 16).

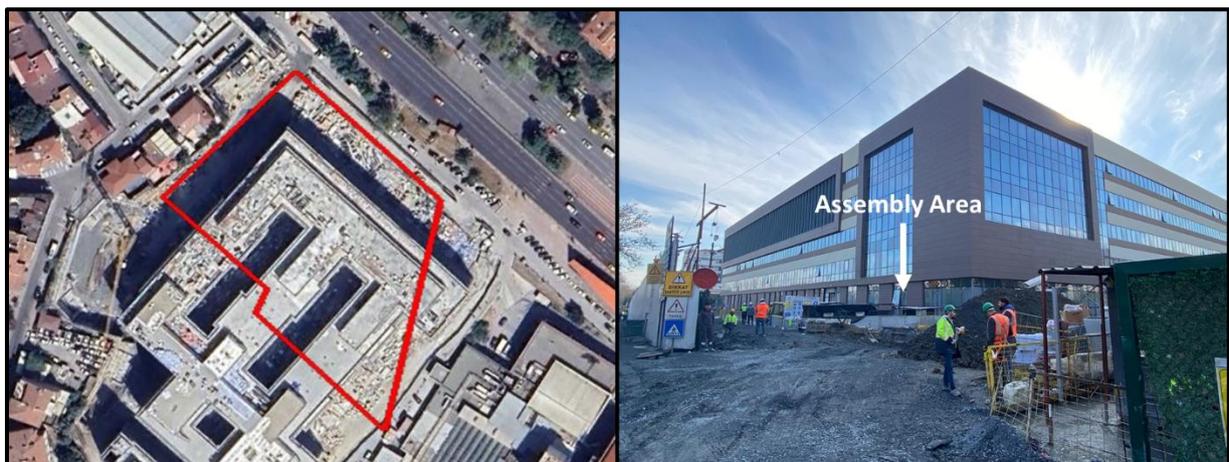


Figure 16. Google Earth and ground images of assembly area 75.

Six of the assembly areas were fenced off with railings and wires for various purposes. In their current state, these places are unlikely to be usable during disaster situations (Figure 17).



Figure 17. Google Earth and ground images of the assembly area 113.

#### 4. CONCLUSIONS AND RECOMMENDATIONS

It is important to identify and eliminate existing deficiencies to ensure proper disaster management in crowded areas with intensive land use, such as Fatih District. In this way, it will be possible to reduce the damages of possible disasters. In this context, the findings and recommendations reached through this research are as follows:

- The distribution of the 185 assembly areas across Fatih District is unbalanced, with 12 neighborhoods lacking any designated assembly areas. It is essential to urgently identify suitable locations in these neighborhoods and equip them with the necessary infrastructure and superstructure.
- The findings indicate that 85 out of 185 assembly areas in Fatih have the potential to be exposed to various secondary hazards. Moreover, the classification based on proximity to hazardous structures and elements revealed that 66 assembly areas are located within 0–50 m, 11 within 51–100 m, 21 within 101–150 m, and 87 are situated at least 151 m away from these hazard sources (Figure 5; Table 6). In particular, the 66 assembly areas located within 50 m of hazard sources pose considerable risks and should not be overlooked in disaster management planning.
- The coasts of Fatih District include filling areas and alluvial lands, which, according to MTA reports (Üstün et al., 2022), are prone to soil liquefaction. Thirty-two assembly areas are located on these zones (Figure 5; Table 5). It is impossible to use these areas, especially after earthquakes. They should either be relocated to safer locations or have their soil mechanics improved.
- On-site inspections of 33 assembly areas in Fatih revealed that some locations (1, 65, 107, 112, 132, 143, 143, 155, 157, 162, 167) lacked essential infrastructure items such as promotional signboards, electricity, water, and toilets, while others (71, 91, 183) exhibited various deficiencies. These deficiencies must be addressed to enhance the functionality of assembly areas during disaster response efforts.
- Several assembly areas (39, 104, 136, 149) are too small to meet the needs. Relocating them to larger nearby areas or clearing and expanding their perimeter could help resolve this problem. Additionally, several assembly areas (3, 75, 94, 154) have ownership-related issues. These issues should be resolved through expropriation.
- Fatih embodies the millennia-long history of Istanbul, one of the world's most significant centres of cultural heritage. Several assembly areas in the district (2, 96, 127, 130, 155, 158, 164) are located in or near rare historical monuments. The use of these sites as assembly areas poses a threat to the preservation of the historical fabric. Therefore, disaster plans should include strategies to protect these artifacts from disasters and risks in disaster processes.

- The use of disaster and emergency assembly areas as recreation areas, parking lots, etc., can contribute to their recognition and maintenance. Indeed, such examples exist in Fatih (34, 35, 54, 59, 69, 97, 103, 107, 118, 123, 123, 129, 133, 147, 160). However, it is essential to remember that these are designated assembly areas, and arrangements made for daily needs must not compromise their primary function or diminish their effectiveness in disaster situations.
- Field studies revealed that some assembly areas (30, 113, 123, 124, 129, 132) were not open to the public and were instead used as parking lots, restaurants, cafes, and schoolyards, with access restricted by commercial establishments. The status of these areas should be clearly defined, and appropriate measures should be taken to ensure they meet the requirements for use as assembly areas.
- Some assembly areas are located near abandoned buildings (166, 170), which may pose secondary hazards during disaster processes. These structures should be examined by experts, and if found to have historical or touristic value, they should be restored and reinforced; otherwise, they should be demolished.
- The high density of buildings in Fatih poses challenges for establishing adequately sized and well-equipped assembly areas. Instead of designating every available open space in the district as an assembly area, it would be more effective to reduce the number of assembly areas if necessary and focus on establishing safe and functional ones.
- Some assembly areas (112-113; 128-173; 143-144-166-167) share the same or similar names. To prevent confusion during disaster management, these areas should be identified by numbers rather than names.

In recent years, disaster awareness in Türkiye has increased, primarily due to the efforts of public institutions and non-governmental organizations, particularly AFAD, as well as the extensive media coverage of disasters that have occasionally resulted in loss of life and property. In Fatih District, which constitutes the focus of this study, local administrations have also carried out joint initiatives with AFAD. Notably, 2020 was declared the “Year of Preparedness for Disasters” by AFAD, and in line with the designated themes, several drills and meetings were organized in the district. Furthermore, the Provincial Disaster Risk Reduction Plan (İRAP), prepared in 2021 under the coordination of AFAD and local administrations, represents an important nationwide initiative (URL 11). Within the framework of these reports, integrated disaster risk and damage reduction studies were conducted for Istanbul, and planning efforts that included Fatih District were undertaken. During these processes, task distributions and action plans were defined for disaster management. These efforts, when considered together with the findings of the present study, underline the necessity of developing sustainable and locally adapted strategies to strengthen Fatih’s disaster preparedness and resilience.

Türkiye faces various disaster risks, and Istanbul due to its population, investments, historical significance, and touristic importance is considered a priority area for disaster management. Therefore, the number of disaster-focused academic studies on Istanbul should be increased, and greater support should be provided for projects addressing this subject. This study evaluated the disaster and emergency assembly areas in Fatih District in terms of functionality and secondary hazards. Further research could build on this work by analyzing the selection of optimal locations for assembly areas. The research is expected to increase disaster awareness in Fatih and contribute to the district's disaster management strategies.

#### **Author Note**

Some findings of this study were presented as an oral presentation at the VI International Congress on Geography Education (UCEK-6) held between 19-22 September 2024.

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