

To Cite This Article: Keleş Özgenç, E. (2026). Multi-criteria evaluation of disaster and emergency assembly areas in urban disaster risk management: The case of Edirne city center *International Journal of Geography and Geography Education (IGGE)*, 59, 88-107. <https://doi.org/10.32003/igge.1953354>

Multi-Criteria Evaluation of Disaster and Emergency Assembly Areas in Urban Disaster Risk Management: The Case of Edirne City Center

Kentsel Afet Risk Yönetiminde Afet ve Acil Durum Toplanma Alanlarının Çok Ölçütlü Değerlendirilmesi: Edirne Kent Merkezi Örneği

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Abstract

This study examines the current status of disaster assembly areas in the city center of Edirne, which are critical to disaster and emergency planning, using a multi-criteria evaluation approach. Within this scope, the assembly areas were evaluated for accessibility, capacity adequacy, and physical infrastructure; the usability of the existing areas in the event of a disaster was determined. The findings indicate that only 15 of the 28 neighborhoods in Edirne's city center have disaster assembly areas. Of these, only 6 had sufficient population capacity. Furthermore, when accessibility and the ability to meet basic needs were evaluated together, only Barış Park was found to be more functional and adequate. In addition, the absence of any disaster assembly areas in 13 neighborhoods, particularly since 12 of these neighborhoods are in the densely built-up urban core, points to a significant planning issue. This situation indicates a serious spatial inadequacy in the very areas where safe open spaces are most needed following a disaster. The research findings reveal that disaster assembly areas in Edirne's city center must be reassessed not only in number but also in capacity, accessibility, facility adequacy, and balanced distribution at the neighborhood level.

Keywords: Assembly areas, urban green spaces, Edirne, disaster, resilient cities

Öz

Bu çalışma, Edirne kent merkezinde afet ve acil durum planlaması açısından kritik öneme sahip afet toplanma alanlarının mevcut durumunu çok ölçütlü bir değerlendirme yaklaşımıyla incelemeyi amaçlamaktadır. Bu kapsamda, toplanma alanları erişilebilirlik, kapasite yeterliliği ve fiziksel altyapı açısından değerlendirilmiş; olası bir afet durumunda mevcut alanların kullanılabilirliği belirlenmiştir. Bulgular, Edirne kent merkezindeki 28 mahalleden yalnızca 15'inde afet toplanma alanları bulunduğunu göstermektedir. Mevcut alanlar arasında ise yalnızca 6'sının yeterli nüfus kapasitesine sahip olduğu belirlenmiştir. Ayrıca, erişilebilirlik durumu ve temel ihtiyaçlara cevap verebilme düzeyi birlikte değerlendirildiğinde yalnızca Barış Parkı'nın daha işlevsel ve yeterli nitelikler taşıdığı tespit edilmiştir. Bunun yanı sıra, 13 mahallede herhangi bir afet toplanma alanının bulunmaması, özellikle bu mahallelerin 12'sinin yoğun yapılaşmanın hâkim olduğu kentsel çekirdek alanlarda yer alması önemli bir planlama sorununa işaret etmektedir. Bu durum, afet sonrasında güvenli açık alanlara en çok ihtiyaç duyulan bölgelerde ciddi bir mekânsal yetersizliğin bulunduğunu göstermektedir. Araştırma bulguları, Edirne kent merkezindeki afet toplanma alanlarının yalnızca sayı açısından değil, aynı zamanda kapasite, erişilebilirlik, tesislerin yeterliliği ve mahalle düzeyinde dengeli dağılım açısından da yeniden değerlendirilmesi gerektiğini ortaya koymaktadır.

Anahtar Kelimeler: Toplanma alanları, kentsel yeşil alanlar, Edirne, afet, dirençli kentler

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INTRODUCTION

More than half of the world's population now lives in cities, meaning disaster risks are felt more intensely and in more complex ways, particularly in urban areas (UNDRR, 2025). The growing urban population not only makes cities more vulnerable to geological, meteorological, and climate-related disasters but also concentrates disaster risks spatially. Therefore, efforts to reduce disaster risks must take a more comprehensive, planning-based approach, particularly in urban areas (Akinsanola et al., 2025; Aman & Aytac, 2022; Gerdan & Sen, 2019; Maleki et al., 2026). In particular, rapid population growth, unplanned development, and inadequate infrastructure further increase cities' vulnerability to disasters (Cetin et al., 2024; Li et al., 2025). According to United Nations projections, by 2050, approximately 68% of the world's population (6.7 billion people) will live in urban areas, indicating that disaster management must now be addressed not merely through a crisis-focused intervention approach but through a risk reduction perspective integrated with urbanization processes (United Nations, 2019). In Türkiye, too, the fact that approximately 93% of the population lives in cities makes this necessity even more evident. In particular, the February 6, 2023 Kahramanmaraş earthquakes, described as the “disaster of the century,” have brought the importance of disaster management and urban preparedness processes back into the spotlight; they have clearly demonstrated that emergency assembly areas must be safe, accessible, and have sufficient capacity, making this a critical requirement for urban planning (Cinar et al., 2018; Turna & Yavuzcehre, 2024).

The United Nations defines disasters as “events that disrupt the normal course of life in a community, result in physical, economic, and social losses, and are difficult to manage with local resources” (UNDRR, 2017). A disaster occurs when a hazardous event interacts with the exposure and vulnerability of people, buildings, infrastructure, and other urban assets. In this framework, hazard refers to a process or event with the potential to cause harm, exposure indicates the presence of people and assets in hazard-prone areas, and vulnerability describes the conditions that increase their susceptibility to damage. Disaster risk is therefore shaped not only by the magnitude of a hazard but also by patterns of exposure, vulnerability, and communities' capacity to cope with its consequences (Boni et al., 2025; Lapietra et al., 2025; UNDRR, 2022). Within this framework, today's cities face risks from a wide range of disasters, including earthquakes, floods, landslides, and storms (Ekin & Sarikaya, 2021; Kadioglu, 2026). In particular, low-income urban populations are more severely affected by disasters because of deficiencies in the built environment, infrastructure shortages, and difficulty accessing safe open spaces. Indeed, the fact that eight of the world's ten most populous cities face moderate or high earthquake risk and that a significant portion of these cities are located in coastal areas, making them vulnerable to hazards such as storms and tsunamis, demonstrates just how critical an issue urban disasters have become on a global scale. Furthermore, not only the frequency of disasters but also their economic impacts are steadily increasing. For example, the 2011 earthquake and tsunami in Japan are recorded in the literature as one of the most costly natural disasters to date, with damages totaling 235 billion U.S. dollars (Dai & Azhar, 2024). Similarly, natural disasters in 2021 caused approximately \$280 billion in economic losses, negatively affected the safety and livelihoods of millions of people, and further exacerbated urban vulnerability (Zhang et al., 2025). This situation demonstrates that disasters do not merely result in human casualties; they also create multifaceted impacts on urban economies, infrastructure systems, and the continuity of urban life.

Disaster risk management seeks to prevent new risks, reduce existing risks, and manage residual risks through a continuous process of mitigation, preparedness, response, and recovery. Mitigation and preparedness include risk-sensitive land-use planning, evacuation arrangements, public awareness, and the provision of safe assembly areas; response covers immediate life-saving actions, while recovery involves the restoration of services and the development of safer and more resilient settlements (Etinay et al., 2018; Graveline & Germain, 2022; Kaya et al., 2026; Sandoval et al., 2023; UNDRR, 2017). Emergency assembly areas therefore directly link pre-disaster preparedness and immediate post-disaster response. In this context, identifying preventive measures to take before a disaster and suitable open spaces to use during one are fundamental requirements for building resilient cities. Within urban planning, it is important to define sufficient open spaces that city residents can quickly access, safely gather in, and use for initial evacuation and guidance processes, where basic needs can be met (Maral et al., 2015; Saricam, 2019). In Türkiye, particularly through earthquake experiences, the need to ensure that emergency assembly and

temporary shelter areas are accessible, safe, and sufficiently sized has been clearly demonstrated. Indeed, numerous studies highlight that emergency gathering and shelter areas in cities are insufficient in number, size, and distribution (Bektas & Sakarya, 2020; Cetin et al., 2024; Gerdan & Sen, 2019; Senik & Uzun, 2021). Ensuring rapid access to safe areas after a disaster plays a decisive role not only in reducing loss of life but also in accelerating post-disaster recovery and rehabilitation (Gunaydin & Sahin, 2023).

The concept of sustainable disaster management encompasses not only reducing disaster risks but also strengthening urban sustainability in its social, economic, and environmental dimensions (Maduz & Roth, 2017). This approach is closely aligned with Sustainable Development Goal 11 (Sustainable Cities and Communities), which seeks to make cities and human settlements inclusive, safe, resilient, and sustainable, as well as with the Sendai Framework for Disaster Risk Reduction, the Paris Agreement, the New Urban Agenda, and Making Cities Resilient 2030 (MCR2030) (Kolte et al., 2023; Raikes et al., 2022; United Nations, 2015; UNDRR, 2015; UNFCCC, 2015; UN-Habitat, 2017). These frameworks emphasize risk-informed urban planning, climate adaptation, institutional preparedness, and accessible, safe public spaces. In Türkiye, these principles are reflected in the Türkiye Disaster Risk Reduction Plan and the Twelfth Development Plan 2024-2028. The Twelfth Development Plan adopts an integrated approach covering risk reduction and preparedness before disasters, effective response during disasters, and recovery and resilient reconstruction after disasters. It particularly emphasizes preparing settlement-level risk maps, integrating disaster risks into spatial planning, developing GIS-based decision-support mechanisms, designating and expanding safe assembly areas, and identifying active-fault avoidance zones. These objectives provide a direct policy basis for evaluating the accessibility, capacity, safety, and spatial distribution of urban emergency assembly areas (AFAD, 2022; Presidency of Strategy and Budget, 2023). The Plan explicitly requires identifying and expanding assembly areas, developing GIS-based decision support, and incorporating disaster risks into spatial planning. Emergency assembly areas constitute an essential component of both disaster risk management and sustainable urban planning by providing locations where affected populations can gather safely, receive initial assistance, and access essential services following a disaster (Aman & Aytac, 2022; Bektas & Sakarya, 2020; Cetin et al., 2024; Gerdan & Sen, 2019; Kara & Yavruoglu, 2025). This process also evaluates open and green spaces not merely as recreational areas but as safe urban spaces during and after disasters. These areas serve as crucial spatial components that not only meet the population's needs for emergency assembly and temporary shelter but also facilitate the resumption of urban life following a disaster (Senik & Uzun, 2021). In this context, determining whether emergency gathering areas in cities are sufficiently equipped to meet post-disaster needs is critical. The spatial distribution of post-disaster gathering areas is based on population distribution within a given area or region and, in this regard, is critical to disaster management and risk assessment.

However, the adequacy of existing open and green spaces in cities for post-disaster use should be assessed not only based on their physical characteristics but also within a multifaceted framework. In the literature, key factors for identifying emergency assembly areas include accessibility, connectivity to road networks, the area's usability and multifunctionality, ownership status, and spatial size (Cinar et al., 2018; JICA, 2002). Many studies in this regard have focused on determining the optimal site for emergency assembly areas. For example, Senik and Uzun (2021) examined emergency assembly and temporary shelter areas in the city of Düzce; Bektas & Sakarya (2020) provided comprehensive evaluations of the adequacy and management of emergency assembly areas in Istanbul. Gerdan and Sen (2019) evaluated the location, characteristics, and adequacy of assembly areas in the İzmit district of Kocaeli province. More recent studies have employed GIS-based service-area analysis and MCDM models to assess the accessibility, capacity, spatial distribution, and hazard safety of existing and proposed assembly areas (Akar et al., 2024; Yildirim & Sisman, 2025). In particular, earthquakes and other disasters in Türkiye in recent years have significantly increased academic interest in the subject. While studies have not limited themselves to addressing disaster assembly areas solely based on their spatial characteristics, research examining these areas through a holistic approach that considers capacity, accessibility, infrastructure capabilities, neighborhood-level spatial distribution, and disaster risk management remains limited. This situation indicates that a significant gap in the literature persists.

Edirne has experienced earthquakes and floods of varying magnitudes throughout history; due to its proximity to Istanbul and the Marmara Region, it is one of the cities of particular concern for disaster risk. In particular, active tectonic structures such as the North Anatolian Fault and the Ganos Fault, which extends to the Saros Gulf, make the city vulnerable to earthquake risks (Karatas & Kaya, 2022). Additionally, increasing population pressure and the decline of open green spaces within the city are heightening the vulnerability of Edirne's city center to disasters. Therefore, it is essential to conduct a detailed assessment not only of the mere existence of emergency assembly areas in Edirne's city center but also of their site selection, capacity adequacy, and distribution at the neighborhood level.

This study aims to assess the current status and adequacy of disaster and emergency assembly areas located in the central district of Edirne in the event of a potential disaster. Within this scope, the study examined the disaster and emergency assembly areas designated by the Disaster and Emergency Management Presidency (AFAD) for size, area per person, accessibility, and spatial distribution; it also assessed the post-disaster usability of urban open and green spaces. The study is structured around two main research questions:

- i. Are the disaster and emergency assembly areas in the central district of Edirne sufficient in terms of current status, spatial size, and area per person?
- ii. Is the site selection of these areas appropriate in terms of neighborhood population and accessibility?

In this regard, the study offers a proactive assessment that centers on pre-disaster preparedness, risk reduction, and urban resilience, rather than a post-disaster response-focused approach. Furthermore, it is expected to yield concrete findings that will guide decision-makers in sustainable urban planning and disaster management, thereby contributing to the planning of more resilient cities.

MATERIAL AND METHOD

Study Area

This study focuses on disaster and emergency assembly areas within the neighborhoods of the central district of Edirne Province (Figure 1). Edirne is situated in the northwest of Türkiye, in the Thrace subregion of the Marmara Region, and lies approximately between 41°40' north latitude and 26°30' east longitude. As the second-largest urban center in the Thrace Region after Istanbul, the city is a significant settlement area at the regional level due to its geographical location, historical development, and population density. The total area of the Edirne central district is approximately 9,359.81 km², and its population is 200,753. The urban core defined by the Edirne Municipality covers 171.92 km², and the study area encompasses the neighborhoods within this boundary. Edirne city center has 28 neighborhoods, and 25 disaster assembly areas defined by AFAD are located in 15 of these neighborhoods (Table 1). The total area of the disaster and emergency assembly areas is 86.26 ha.

Edirne is located in one of Türkiye's major earthquake-prone regions and is situated in a seismically sensitive area due to the influence of the North Anatolian Fault Zone, particularly its proximity to the Ganos Fault. The districts of Enez, Keşan, and İpsala, within the provincial borders, have a high potential for impact because of their proximity to the North Anatolian Fault Zone and are likely to be directly affected by major earthquakes that could occur between the Marmara Sea and the Saros Gulf. The Ganos Fault, the westernmost segment of the northern branch of the North Anatolian Fault, runs from south of Edirne to the Saros Gulf, placing the eastern, southeastern, and western parts of the Thrace Region within a seismically active belt (Karatas & Kaya, 2022). Historical events such as the 1912 Mürefte earthquake (magnitude 7.3) and the 1953 earthquakes (M_w 5.1) demonstrate that Edirne and its surroundings must be considered in terms of disaster risk. Therefore, evaluating the adequacy and accessibility of the city's existing disaster assembly areas is important not only for planning but also for risk reduction and urban resilience.

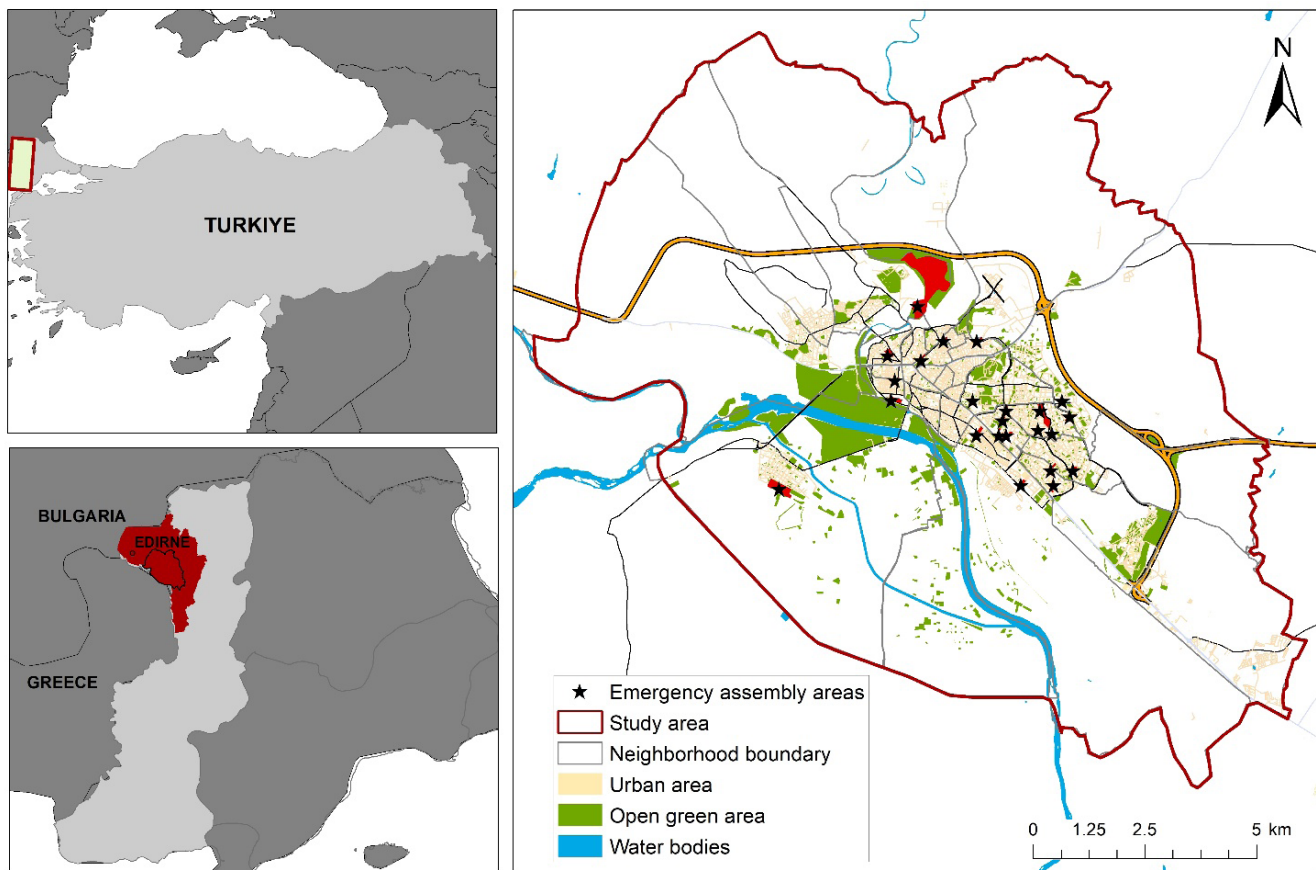


Figure 1: Geographical location of the study area

The data on the size and geographic coordinates of the disaster and emergency assembly areas analyzed in this study were provided by the Provincial Directorate of Disaster and Emergency Management of the Edirne Governor's Office. Data on neighborhood populations were obtained from the relevant municipalities and neighborhood offices, while OpenStreetMap data were used to create the road network and spatial base maps. Additionally, Google Earth imagery and field observations were used to assess the current land uses and environmental characteristics of the areas. All data were organized, spatially analyzed, and visualized using ArcGIS 10.8.2 software.

The disaster assembly areas evaluated in this study have various existing land uses within neighborhoods, such as parks, sports fields, schoolyards, public institution grounds, areas surrounding mosques, parking lots, and marketplaces. This indicates that disaster assembly areas are largely selected from existing open and semi-open public spaces. However, the current land uses of these areas necessitate an evaluation of their post-disaster functionality not only by area size but also by accessibility, multifunctionality, and infrastructure adequacy. In this context, the study examines not only the quantitative presence of disaster assembly areas but also their relationship with the neighborhood population, accessibility levels, and quality of use.

Table 1: Disaster and Emergency Assembly Areas in the Central District of Edirne

No	Neighborhood	Assembly Area	Current use	Neighborhood Population	X coordinate	Y coordinate
1	Atatürk Neighborhood	Barankaya Sports Facilities	Sports facility	17450	26.572554	41.670032
2	Babademirtaş Neighborhood	Selimiye Mosque Parking Area	Parking lot	3017	26.558464	41.678915
3	Barutluk Neighborhood	Thursday Marketplace	Marketplace	5469	26.573622	41.682520
4	Cumhuriyet Neighborhood	Kaptan Sports Facilities	Sports facility	12028	26.596556	41.670102
5	Çavuşbey Neighborhood	Technical and Industrial Vocational High School	School	4025	26.549308	41.679713
6	Dilaverbey Neighborhood	Monday Marketplace	Marketplace	3564	26.550791	41.670186
7	Fatih Neighborhood	Esentepe Sports Facilities	Sports facility	20661	26.599641	41.656471
8		Mega Park	Park		26.593614	41.656688
9	İstasyon Neighborhood	Show Sports Facilities	Sports facility	4405	26.585819	41.653831
10		DSI Sports Facilities	Sports facility		26.573788	41.663954
11	Karaağaç Neighborhood	Trakya University Faculty of Fine Arts	University	2980	26.520761	41.652106
12	Kocasinan Neighborhood	EFOD Association	Private	12734	26.353637	41.391146
13		Chamber of Pharmacists	Public		26.353674	41.390815
14	Menzilahir Neighborhood	Muradiye Mosque and Its Surrounding Area	Mosque	2613	26.564704	41.682329
15	Mithatpaşa Neighborhood	Polis Park	Park	2768	26.551864	41.674398
16	1. Murat Neighborhood	Zübeyde Hanım Park	Park	6113	26.580025	41.666860
17		Avclar Club	Private		26.344856	41.395121
18		Binevler Indoor Marketplace	Marketplace		26.581792	41.663542
19		1. Murat Park	Park		26.345827	41.394856
20	Şükrüpaşa Neighborhood	Artificial Pond Area	Park	16.999	26.590407	41.668493
21		Türkan Saylan Park	Park		26.354986	41.401553
22		Şehitler Park	Park		26.581044	41.668285
23		Physicians' Club	Public		26.352225	41.395180
24		75th Year Primary School	School		26.353464	41.394816
25	Yeniimaret Neighborhood	Kırkpınar Stadium (Sarayıçi Wrestling Arena)	Recreation/ Park	5595	26.557774	41.689576

Method

This study adopted a GIS-supported, criterion-referenced assessment framework to determine the current condition and functional adequacy of the disaster and emergency assembly areas officially designated by the AFAD in the city center of Edirne. The analysis evaluated the performance of the existing assembly-area system rather than identifying or ranking alternative sites. Accordingly, the designated areas were examined independently against spatial, functional, and operational criteria derived from institutional guidance and previous studies. No criterion weighting, pairwise comparison, compensatory aggregation, or alternative-ranking procedure was applied. This non-compensatory structure was considered appropriate because satisfactory performance for one criterion cannot offset a critical deficiency in another; for example, a large assembly area may remain functionally inadequate if it cannot be reached safely or lacks the infrastructure required for emergency use.

The methodological framework was developed through a targeted review of national and international studies addressing the planning and assessment of disaster assembly areas, with particular reference to JICA (2002), Kalkan (2022), Erdin et al. (2023), and Ozcidem Sumen et al. (2025). Institutional principles established by AFAD were also considered. A criterion was included if it was directly relevant to assessing an existing assembly area, could be measured using available spatial or field data, was repeatedly emphasized in the relevant literature or institutional guidance, and could be interpreted using a documented threshold or an explicit operational rule. Based on these conditions, the assessment incorporated accessibility,

road connectivity, usability and multifunctionality, ownership and public availability, spatial size, population capacity, and infrastructure adequacy. The selected criteria and their definitions are presented in Table 2.

The spatial database comprised the boundaries and locations of AFAD-designated assembly areas, neighborhood boundaries, neighborhood populations, the urban road network, current land uses, ownership information, and infrastructure characteristics. All spatial datasets were converted to a common projected coordinate system suitable for distance and area calculations. Where more than one assembly area was located within the same neighborhood, the areas and estimated capacities of these sites were aggregated to determine the total level of service available to the neighborhood population.

Table 2: Criterion-referenced framework for evaluating existing disaster assembly areas

Criterion	Indicator and assessment procedure	Adequacy classification	Reference
Accessibility	Distance between residential areas and the nearest designated assembly area; 500 m GIS buffer analysis	Adequate: within 500 m; Inadequate: beyond 500 m	(Atmaca et al., 2023; Erdin et al., 2023; Gunaydin & Sahin, 2023; JICA, 2002)
Road connectivity	Direct connection to the urban road network, continuity of pedestrian access, access for emergency vehicles, and observable physical barriers	Adequate: direct and continuous road/pedestrian access; inadequate: discontinuous access or major barriers	(Akar et al., 2024; JICA, 2002; Kalkan, 2022)
Usability and multifunctionality	Current land use, compatibility with emergency functions, continuity of public access, and presence of fixed obstacles	Suitable: continuously accessible and compatible with emergency use; unsuitable: inaccessible or incompatible use	(Atmaca et al., 2023; JICA, 2002; Kalkan, 2022; Ozcidem Sumen et al., 2025)
Ownership and public availability	Public, institutional, mixed, or private ownership and continuity of access during emergencies	Adequate: public ownership and unrestricted access; inadequate: private ownership without guaranteed emergency access	(JICA, 2002)
Minimum spatial size	Surface area of each designated assembly area	Adequate: $\geq 500 \text{ m}^2$; inadequate: $< 500 \text{ m}^2$	(JICA, 2002)
Capacity adequacy	Assembly area per resident and estimated number of people that can be accommodated	Adequate: $\geq 2.5 \text{ m}^2/\text{person}$	(Atmaca et al., 2023; Erdin et al., 2023; Gunaydin & Sahin, 2023; JICA, 2002; Saygili & Akpinar, 2022; Tarabanis & Tsionis, 1999)
Infrastructure adequacy	Availability of electricity, water, sanitation or sewer connections, toilets, and assembly-area information or directional signs	Adequate: more than three components; inadequate: two or fewer components	(Atmaca et al., 2023; Gerdan & Sen, 2019; Kalkan, 2022; Kara & Yavruoglu, 2025; Kose & Yazici, 2025)

The seven key criteria were identified based on the relevant literature:

- **Accessibility:** The accessibility of disaster assembly areas has been evaluated based on the ability of individuals to reach these areas quickly and safely from the building blocks where they are located. The maximum walking distance recommended by JICA (2002) is accepted as 500 m/15 minutes; in some studies, this distance is discussed as 200 m/15 minutes or within a walking distance range of 0-1,200 m (Erdin et al., 2023; Gunaydin & Sahin, 2023). In this study, the 500 m/15-minute criterion was adopted because of its widespread use in the literature and its practicality for urban pedestrian accessibility (Browning et al., 2022; JICA, 2002; Sahin Kormeci, 2025; Zhang et al., 2023). Accordingly, buffer zones were established for all disaster assembly areas, and the potential for pedestrian access from neighborhoods to these areas was evaluated. Areas within this distance were classified as accessible, while those beyond 500 m were assessed as underserved areas.
- **Road connections:** To ensure that rescue teams, emergency response vehicles, and essential supplies can reach assembly areas following a disaster, these areas must be connected to major thoroughfares. For this reason, existing areas have been evaluated for access to major roads, pedestrian access, and accessibility for people with disabilities to the greatest extent possible (JICA, 2002).

- **Usability and multifunctionality:** When assessing the usability of disaster assembly areas, the current uses of these areas and their potential for multifunctionality were taken into account. The literature indicates that active green spaces, children's play areas, sports fields, neighborhood parks, turf fields, schoolyards, areas surrounding mosques, vacant lots, and open parking lots can be used as disaster assembly areas (JICA, 2002; Ozcidem Sumen et al., 2025; Senik & Uzun, 2021). In this context, because disaster assembly areas within the study area serve various functions, such as parks, sports facilities, schools, public institutions, marketplaces, or parking lots, it is necessary to examine how these areas can be adapted and utilized during a disaster. Furthermore, the literature emphasizes that such areas must be large enough to be functional; specifically, JICA (2002) states that areas smaller than 500 m² may be less suitable for such use.
- **Ownership status:** It is generally accepted that public areas should be given priority when selecting disaster assembly areas. Accordingly, the areas covered by this study consist largely of publicly owned parks, schools, sports facilities, marketplaces, and public institution sites (JICA, 2002).
- **Area size and capacity adequacy:** One of the principal indicators of the adequacy of disaster assembly areas is the amount of space available per person. JICA (2002) recommends a minimum of 1.5 m²/person, whereas Tarabanis and Tsionis (1999) propose 2.0 m²/person. More recent studies conducted in Türkiye have adopted a standard of 2.5 m²/person for disaster assembly areas (Erdin et al., 2023; Gunaydin & Sahin, 2023; Ocak, 2025; Saygili & Akpınar, 2022). Accordingly, this study used 2.5 m²/person as the principal capacity-adequacy threshold. This value was preferred because it provides a more conservative estimate of population capacity than the minimum values proposed by JICA (2002) and Tarabanis and Tsionis (1999), thereby reducing the likelihood of overestimating the number of people that an assembly area can safely accommodate. For each neighborhood, the total area of the designated assembly sites was divided by the resident population to calculate the available assembly area per person. Neighborhoods with values of 2.5 m²/person or above were classified as adequate, whereas those below this threshold were classified as insufficient.
- **Infrastructure adequacy:** The functionality of disaster assembly areas is not limited solely to their size and accessibility. To meet basic needs following a disaster, these areas must be equipped with infrastructure elements such as electricity, water, and sewer connections, restroom facilities, and directional information signs (Gerdan & Sen, 2019; Kara & Yavruoglu, 2025). Therefore, as part of this study, all areas were also evaluated with respect to these infrastructure capabilities. This allowed us to determine whether an area deemed suitable in terms of capacity and accessibility might prove inadequate in practice due to infrastructure deficiencies.

RESULTS

Assessment of the Adequacy of Disaster and Emergency Assembly Areas

Within the scope of disaster management, the adequacy of disaster assembly areas within Edirne's central district was evaluated based on current status and capacity criteria outlined in the literature. Disaster assembly areas are a fundamental component of urban disaster management, as they enable the safe guidance of the population during a disaster, ensure orderly initial assembly, and facilitate rapid, effective response organization. Therefore, not only the existence of these areas but also their size, their relationship to the population, their spatial accessibility, and their distribution at the neighborhood level must be considered together. Edirne city center has 28 neighborhoods, including newly established ones. However, only 25 disaster assembly areas have been designated across just 15 of these neighborhoods. This indicates that, while disaster assembly areas exist across the city, their spatial distribution is uneven throughout the city center. Disaster assembly areas have been selected from public open spaces with different characteristics, such as parks, sports fields, schoolyards, mosque courtyards, public institution grounds, and market areas, based on their current functional use.

Based on the standard of 2.5 m² per person, the total area of disaster assembly areas in the Edirne city center is approximately 862,628 m², with a total capacity of 345,052 people. At first glance, this indicates that disaster assembly areas across the city have significant quantitative capacity. While the total population of the Edirne central district is 200,753, the assembly areas'

capacity is considered sufficient. However, the total capacity may appear high, but this potential is not distributed equally or sufficiently at the area and neighborhood scales. Indeed, when evaluated individually, some assembly areas can accommodate the population of their respective neighborhoods, while others are clearly insufficient (Figure 2; Table 3). The Faculty of Fine Arts at Trakya University, the Sarayıçi Wrestling Arena (known as the Kırkpınar Stadium), the Artificial Pond Area (Barış Park), the Technical and Industrial Vocational High School, and the Friday-Monday Marketplace are the primary areas that stand out for their large capacity. In contrast, many small and medium-sized areas (Şehitler Park, 1. Murat Park, Police Park, EFOD Association, etc.) cannot provide sufficient capacity for the populations they serve. This shows that, even with a large total area of disaster assembly areas, their adequacy varies greatly.

When examining disaster assembly areas at the neighborhood level, spatial inequalities within the city become even more evident. When the assembly areas within the same neighborhood are considered together, it was determined that the total capacity in the neighborhoods of Karaağaç, Yeniimaret, İstasyon, Şükrüpaşa, 1. Murat, Çavuşbey, and Dilaverbey is sufficient to accommodate the neighborhood population. In contrast, the existing capacity in the neighborhoods of Fatih, Atatürk, Cumhuriyet, Barutluk, Menzilahır, Babademirtaş, Kocasinan, and Mithatpaşa is insufficient to accommodate their populations. In particular, the neighborhoods of Atatürk, Fatih, Cumhuriyet, and Kocasinan stand out as the primary areas identified as deficient, despite their high population densities and low capacity levels. These neighborhoods are particularly significant because they house a large share of the city center's population. However, the fundamental issue is that existing capacity is not distributed among neighborhoods in a manner consistent with population size and spatial requirements. Conversely, the significant excess capacity observed in the Yeniimaret and Karaağaç neighborhoods indicates that, although the city's total capacity appears theoretically sufficient, it is not evenly distributed among the neighborhoods. Consequently, while the disaster assembly area system in Edirne's city center offers strong quantitative potential, it does not translate into an equitable and functional structure at the neighborhood level.

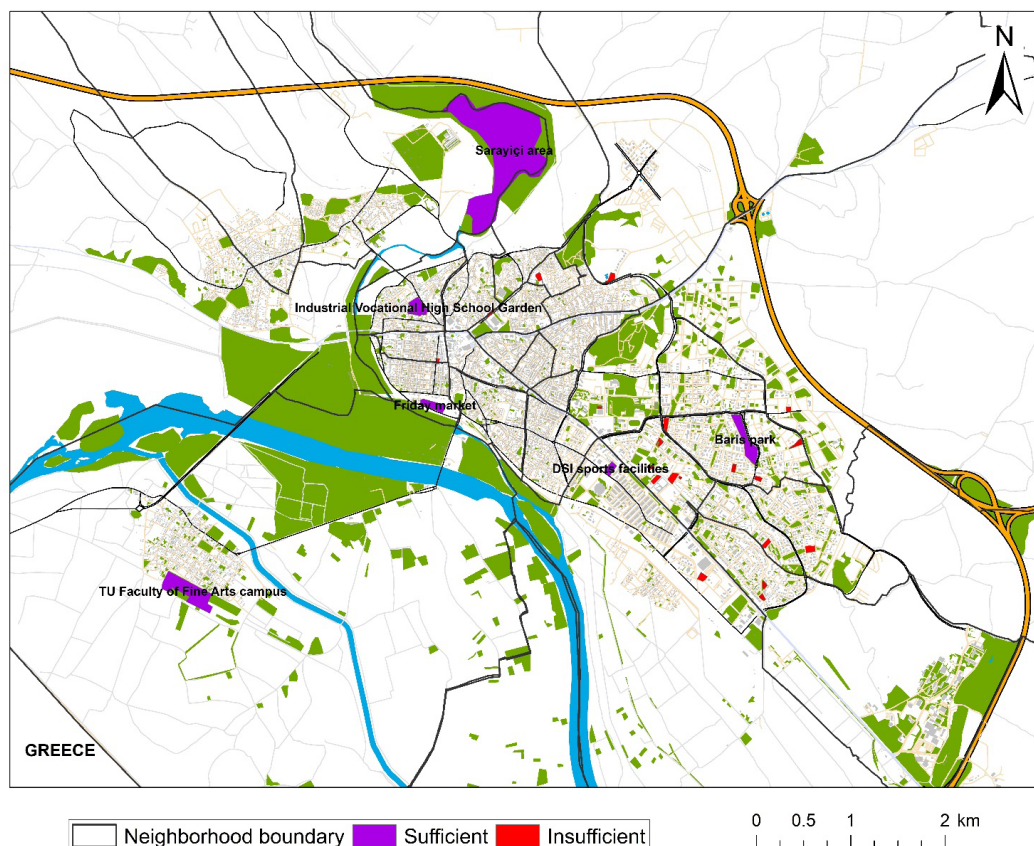


Figure 2: Adequacy of disaster assembly areas

As shown in Table 3, while some areas of the city have significant excess capacity, other neighborhoods face serious capacity shortages; in some neighborhoods, there are no assembly areas at all. Only 15 of the 28 neighborhoods in the Edirne city center have disaster assembly areas, while none have been designated in the remaining 13, creating a significant vulnerability in urban disaster management. In particular, in the neighborhoods of Medrese Alibey, Talatpaşa, Abdurrahman, Meydan, Kurtuluş, Yanıkçı Şahin, Yıldırım Hacı Sarraf, Yıldırım Beyazıt, Umurbey, Sabuni, Sarıcapaşa, and Nişancı Paşa, located in the urban core, the absence of any disaster assembly areas indicates that these neighborhoods may face a shortage of open and safe spaces in the event of a disaster. In addition, the 100. Yıl Neighborhood, located on the urban periphery, has a lower-rise, less-dense building fabric, which may result in lower vulnerability during a disaster compared to central neighborhoods. In contrast, the lack of open spaces in the core urban fabric presents a serious planning issue that could hinder rapid and safe evacuation during a disaster.

Table 3: Current Adequacy of Capacity at Disaster Assembly Areas

No	Neighborhood	Assembly Area	Area size (m ²)	Total Neighborhood Population	Person Capacity	Total Neighborhood Person Capacity	Status
1	Atatürk Neighborhood	Barankaya Sports Facilities	2.316	17450	926	926	Insufficient
2	Babademirtaş Neighborhood	Selimiye Mosque Parking Area	3.338	3017	1335	1335	Insufficient
3	Barutluk Neighborhood	Thursday Marketplace	8.824	5469	3530	3530	Insufficient
4	Cumhuriyet Neighborhood	Kaptan Sports Facilities	1.574	12028	630	630	Insufficient
5	Çavuşbey Neighborhood	Technical and Industrial Vocational High School	24.939	4025	9976	9976	Sufficient
6	Dilaverbey Neighborhood	Friday-Monday Marketplace	17.000	3564	6800	6800	Sufficient
7	Fatih Neighborhood	Esentepe Sports Facilities	7.000	20661	2800	4623	Insufficient
8		Mega Park	4.558		1823		Insufficient
9	İstasyon Neighborhood	Show Sports Facilities	4.125	4405	1650	7098	Insufficient
10		DSI Sports Facilities	13.620		5448		Sufficient
11	Karaağaç Neighborhood	Trakya University Faculty of Fine Arts	96.241	2980	38496	38496	Sufficient
12	Kocasinan Neighborhood	EFOD Association	3.104	12734	1242	2411	Insufficient
13		Chamber of Pharmacists	2.922		1169		Insufficient
14	Menzilahir Neighborhood	Muradiye Mosque and Its Surrounding Area	4.957	2613	1983	1983	Insufficient
15	Mithatpaşa Neighborhood	Polis Park	1.636	2768	654	654	Insufficient
16	1. Murat Neighborhood	Zübeyde Hanım Park	2.756	6113	1102	5193	Insufficient
17		Binevler Indoor Marketplace	7.672		3069		Insufficient
18		Avclar Club	1.654		662		Insufficient
19		1. Murat Park	899		360		Insufficient
20	Şükrüpaşa Neighborhood	Artificial Pond Area	50.000	16999	20000	27725	Sufficient
21		Şehitler Park	6.952		2781		Insufficient
22		Türkan Saylan Park	5.359		2144		Insufficient
23		Physicians' Club	3.575		1430		Insufficient
24		75th Year Primary School	3.426		1370		Insufficient
25	Yeniimaret Neighborhood	Kırkpınar Stadium (Sarayıçi Wrestling Arena)	584.181	5595	233672	233672	Sufficient

In this context, Table 3 shows that the disaster assembly areas in Edirne's city center offer significant potential for total capacity. Still, this potential is marred by serious inequalities in adequacy and distribution at the neighborhood level. While total

capacity exceeds the current population in the neighborhoods of Karaağaç, Yeniimaret, İstasyon, Şükrüpaşa, Çavuşbey, and Dilaverbey, a significant capacity shortfall was identified in the neighborhoods of Fatih, Atatürk, Cumhuriyet, and 1. Murat, Barutluk, Menzilahır, Babademirtaş, and Mithatpaşa. This situation indicates a clear disparity in the adequacy and service provision across neighborhoods for the safe evacuation of the population during disasters and emergencies. Consequently, the fundamental issue regarding disaster assembly areas in the Edirne city center is not merely the scarcity of such areas; rather, it is the failure of existing areas to form a system that is compatible with population density, accessible, and spatially balanced.

Assessment of the Accessibility of Disaster and Emergency Assembly Areas

In disasters and emergencies, the ability to quickly and easily direct the affected population to safe areas is one of the most fundamental elements of disaster management (Erdem et al., 2017). For this reason, disaster assembly areas must be sufficiently large, easily accessible, safe, and able to meet basic needs. Considering the panic, uncertainty, and disorientation that arise after a disaster, individuals' ability to reach assembly areas where they can remain safely for a certain period depends on these areas being integrated with the transportation system, supported by basic infrastructure, and appropriately located within the urban fabric (Akar et al., 2024). In this context, accessibility emerges as a critical evaluation criterion for identifying disaster assembly areas, on par with capacity.

The literature recommends that disaster assembly areas be connected to at least two evacuation routes, each at least 7 m wide, and that these routes be designed to account for risks such as building collapse and road closures (Akar et al., 2024; Chu & Su, 2012). An examination of the current distribution in the Edirne city center reveals that all defined disaster assembly areas are connected to main roads and connecting axes. This situation presents a relatively positive picture regarding access to assembly areas in scenarios where the transportation system is not completely disabled following a potential disaster. However, a main road connection alone is not sufficient. A neighborhood-level assessment shows that while many areas are within walking distance, this accessibility is uneven across the city. In particular, while some neighborhoods have accessible gathering areas within a 500-meter radius, these areas lack sufficient capacity, highlighting the need to consider accessibility alongside functional adequacy. In this context, the neighborhoods of Sarıcapaşa and Sabuni provide notable examples. Both neighborhoods are approximately 500 meters from nearby areas such as the Selimiye Parking Lot and Police Park, and thus do not appear completely inaccessible. However, the fact that these areas do not provide sufficient capacity even for their own neighborhoods indicates they do not constitute a genuine safeguard for neighboring neighborhoods. Similarly, in the neighborhoods of Medrese Alibey, Nişancı Paşa, Yanıkçı Şahin, Talatpaşa, and Abdurrahman, there are no disaster assembly areas, nor are there any alternative assembly areas within a 500-meter radius. These neighborhoods, characterized by densely packed building blocks, are more vulnerable in potential disaster scenarios due to a lack of open space and limited access. Additionally, it has been determined that the existing areas in the Cumhuriyet and Kurtuluş neighborhoods cannot provide access to the entire neighborhood within a 500-meter radius. Particularly in the Cumhuriyet Neighborhood, which has seen a recent increase in population density and is home to new residential areas, the existing assembly area system has been found insufficient at the neighborhood scale. Therefore, it is necessary to plan new assembly areas in these neighborhoods so that the population can access them safely and quickly.

When the spatial structure of neighborhoods is evaluated alongside their capacity, it becomes apparent that while some large areas theoretically offer high capacity, they are not sufficiently functional within the 500-meter/15-minute access threshold during a disaster (Figure 3). In particular, while Sarayıçi Wrestling Arena and the Friday-Monday Market Place appear advantageous in terms of area size, their locations within the city allow only a limited segment of the population to reach them quickly. In contrast, the Artificial Pond Area, the Trakya University Faculty of Fine Arts campus, and the Technical and Industrial Vocational High School area stand out as more accessible and functionally suitable at the neighborhood level in Şükrüpaşa, Karaağaç, and Çavuşbey, respectively. This demonstrates that, in selecting disaster assembly areas, not only the area's size but also its spatial accessibility to serve the entire neighborhood should be a fundamental criterion.

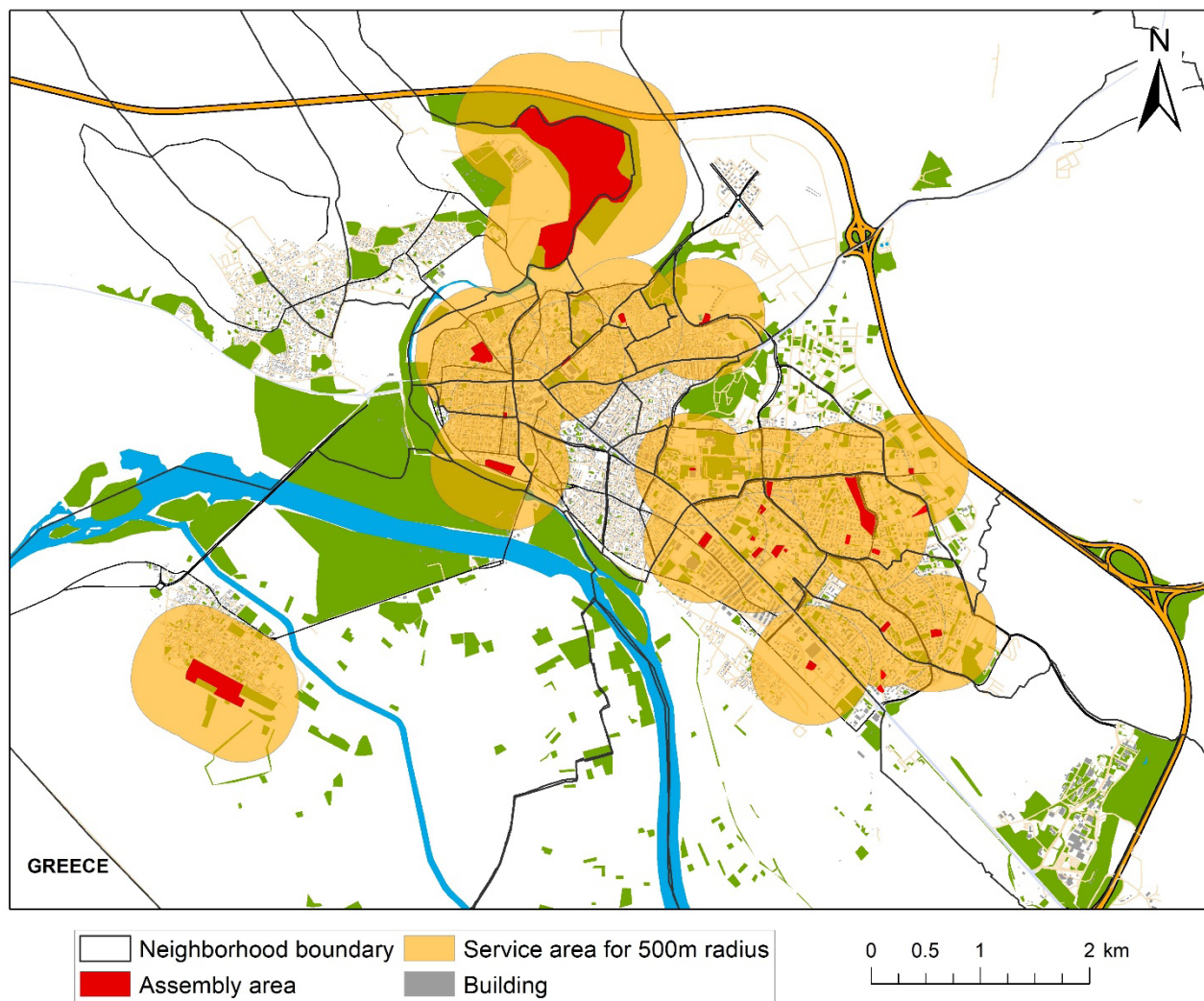


Figure 3: Accessibility to disaster assembly areas within a 500-meter radius across the neighborhood

The ability of disaster victims to use assembly areas safely, quickly, and conveniently after a disaster depends on ensuring pedestrian access, on the one hand, and establishing connections to major transportation routes to allow rescue teams and essential supplies to reach the area, on the other (Erđin et al., 2023; Kalkan, 2022). An assessment across the Edirne city center revealed that all existing assembly areas have an advantage in access to main roads and pedestrian paths. However, the fact that access to the areas' surroundings is generally available does not imply that the conditions for internal use are equally sufficient. Indeed, many assembly areas have shortcomings in internal layout, wayfinding, and user comfort. Furthermore, the fact that nearly all assembly areas (except the Artificial Pond Area) are not accessible to people with disabilities highlights another aspect of the accessibility issue that must not be overlooked. This situation indicates significant shortcomings in the current system regarding the principle of inclusivity in disaster management.

Another crucial factor to consider when evaluating assembly areas is their sufficient distance from high-rise buildings. Given the potential for building collapse, facade failure, or secondary risks during a disaster, the distance of assembly areas from high-rise structures should be assessed as a fundamental safety criterion. The areas examined in this study generally meet favorable conditions regarding distance from buildings of five stories or higher (Table 4). However, the buildings surrounding

the Türkan Saylan Park and Kaptan Sports Facilities assembly areas are densely populated with five-story buildings within a 50-meter buffer zone. This situation is particularly significant for reducing the physical risks that assembly areas may face during a disaster. Therefore, ensuring that these areas are located in a safe position, not only in terms of capacity and accessibility but also with respect to environmental risks, should be considered a fundamental principle of disaster assembly area planning.

The quality of disaster assembly areas is not limited to accessibility and capacity; it is also important that these areas have the infrastructure to meet the basic needs of disaster victims. Amenities such as electricity, water, restrooms, and information boards directly affect the functionality of assembly areas during the first hours and days after a disaster (Erdirin et al., 2023). Additionally, they are expected to offer a flexible physical layout that can be utilized for shelter purposes when necessary. While some infrastructure improvements have been made in the examined gathering areas in recent years, these facilities remain insufficient in most areas.

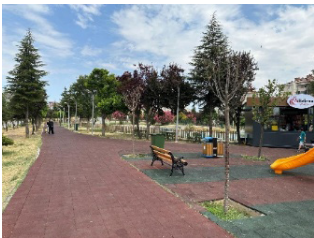
Table 4: Current Characteristics and Suitability of Assembly Areas

No	Assembly area	Area size (m ²)	Neigh. Population	Total Area	Area per Person > 2.5 m ²	Status	Transport			Infrastructure			General Suitability
							Main Road	Pedestrian Access (500 m)	Distance from High-Rise Buildings (>5 floors)	Electricity	Water	WC	
1	Barankaya Sports Facilities	2.316	17450	2316	0.13	Insufficient	+	+	+	-	-	-	Not suitable
2	Selimiye Mosque Parking Area	3.338	3017	3.338	1.11	Insufficient	+	+	+	+	+	+	Not suitable
3	Thursday Marketplace	8.824	5469	8.824	1.61	Insufficient	+	+	+	-	-	-	Not suitable
4	Kaptan Sports Facilities	1.574	12028	1574	0.13	Insufficient	+	+	-	-	-	-	Not suitable
5	Technical and Industrial Vocational High School	24.939	4025	24.939	6.20	Sufficient	+	+	+	+	+	+	Suitable
6	Friday-Monday Marketplace	17.000	3564	17.000	4.77	Sufficient	+	+	+	+	+	+	Suitable
7	Esenetepe Sports Facilities	7.000	20661	11.558	0.56	Insufficient	+	+	+	-	-	-	Not suitable
8	Mega Park	4.558					+	+	+	+	+	+	
9	Show Sports Facilities	4.125	4405	17745	4.03	Sufficient	+	+	+	-	-	-	Suitable
10	DSI Sports Facilities	13.620					+	+	+	+	+	+	
11	Trakya University Faculty of Fine Arts	96.241	2950	96.241	32.62	Sufficient	+	+	+	+	+	+	Suitable
12	EFOD Association	3104	12734	6026	0.47	Insufficient	+	+	+	+	+	+	Not suitable
13	Chamber of Pharmacists	2922					+	+	+	-	-	-	
14	Muradiye Mosque and Its Surrounding Area	4.957	2613	4.957	1.90	Insufficient	+	+	+	+	+	+	Not suitable
15	Polis Park	1.636	2768	1.636	0.59	Insufficient	+	+	+	+	+	-	Not suitable

16	Zübeyde Hanım Park	2.756	6113	12981	2.12	Insufficient	+	+	+	+	+	+	Not suitable
17	Binevler Indoor Marketplace	7.672					+	+	+	+	+	+	
18	Avcılar Club	1654					+	+	+	+	+	+	
19	I. Murat Park	899					+	+	+	+	+	+	
20	Artificial Pond Area	50.000	16999	69312	4.07	Sufficient	+	+	+	+	+	+	Suitable
21	Şehitler Park	6.952					+	+	+	+	+	+	
22	Türkan Saylan Park	5.359					+	+	-	+	+	+	
23	Physicians' Club	3575					-	+	+	+	+	+	
24	75th Year Primary School	3426					+	+	+	+	+	+	
25	Kırkpınar Stadium (Sarayıçi Wrestling Arena)	584.181	5595	584.181	104.41	Sufficient	+	+	+	+	+	+	Suitable

After evaluating all criteria together, it was determined that the most suitable site in terms of capacity, accessibility, infrastructure, and transportation is Barış Park, also known as Artificial Pond Area. The key features that distinguish Barış Park include its location within the Şükrüpaşa Neighborhood, its connectivity to major transportation routes, its suitability for pedestrian access, and its potential for more comprehensive use compared to other areas (Table 5). Similarly, the Trakya University Faculty of Fine Arts campus and the Technical and Industrial Vocational High School site are among the prominent gathering areas due to their large land areas and relative accessibility advantages within their respective neighborhoods. In contrast, while Sarayıçi Wrestling Arena and the Friday-Monday Marketplace offer significant capacity, they appear to be more limited in their ability to provide equitable and balanced services at the neighborhood scale, given their spatial characteristics within the urban context. This situation demonstrates that while some areas may be quantitatively strong, they are not equally effective in terms of spatial accessibility and service coverage.

Table 5: Spatial and functional characteristics of the artificial pond area (Barış Park), which was deemed “appropriate” based on the established evaluation criteria

Photograph	General information	Evaluation based on criteria
 Overview WC	Barış park Neighborhood name: Şükrüpaşa Neighborhood Population: 16,999 Area: 50,000 m ² ; Capacity: 20,000 Area per person: 3.35 m ² /person Land use: Park, recreation	Connection to the main transportation corridor ✓ Pedestrian access ✓ Accessibility for people with disabilities ✓ Open and safe environment ✓ Distance from high-rise buildings ✓ Sufficient capacity ✓ Infrastructure facilities ✓

On the other hand, when the neighborhood population, infrastructure capabilities, and accessibility conditions are considered together, it becomes apparent that some smaller-scale areas serve a more limited function. In particular, areas such as Şehitler Park, Polis Park, Kaptan Sports Facilities, Barankaya Sports Facilities, and the Muradiye Mosque and its surrounding area may be insufficient to handle intense user pressure following a disaster because of their limited size and low capacity relative to the neighborhood population. Similarly, areas such as Zübeyde Hanım Park, Avcılar Community Center, and I. Murat Park appear insufficient to meet neighborhood-scale needs when considered individually. In particular, while Şehitler Park is adequate in terms of existing infrastructure, it is too small to accommodate the neighborhood's population (Table 6).

Table 6: Characteristics of Şehitler Park, which was found to be “inappropriate” based on the evaluation criteria

Photograph	General information	Evaluation based on criteria
 Overview WC	Şehitler park Neighborhood name: Şükrüpaşa Neighborhood Population: 16,999 Area: 6,952 m² Capacity: 2,781 Space per person: 0.41 m²/person Current use: Park, recreation	Connection to the main transportation corridor ✓ Pedestrian access ✓ Accessibility for people with disabilities – Open and safe environment ✓ Distance from high-rise buildings ✓ Sufficient capacity – Infrastructure facilities ✓

In this context, rather than relying solely on site size when designating disaster assembly areas, a comprehensive planning approach is needed that considers criteria such as neighborhood-level accessibility, adequate capacity, infrastructure, and service coverage area. In particular, areas that, despite having high capacity, remain more limited within neighborhoods' daily access patterns, and areas with low capacity but in critical locations for intra-neighborhood use, must be addressed with different planning strategies. Therefore, it is crucial to enhance the disaster assembly area system in Edirne's city center by reassessing the qualities of existing areas and reinforcing them accordingly.

DISCUSSION

The findings reveal a clear distinction between the aggregate availability of disaster assembly space and its functional adequacy at the neighborhood scale. Although the total theoretical capacity of the designated assembly areas in Edirne exceeds the population of the central district, this apparent city-wide sufficiency conceals substantial spatial disparities. Some neighborhoods have considerable excess capacity, whereas others have insufficient capacity or no designated assembly area. Thus, the principal problem is not simply a quantitative shortage of assembly space, but a spatial mismatch between population demand and the location, capacity, accessibility, and functional characteristics of available sites.

This pattern is consistent with previous studies reporting deficiencies in the capacity, spatial distribution, accessibility, and functional suitability of emergency assembly areas in other cities (Gerdan & Sen, 2019; Bektas & Sakarya, 2020; Senik & Uzun, 2021; Gunaydin & Sahin, 2023; Cetin et al., 2024). The present study extends this evidence by demonstrating that aggregate capacity may mask considerable neighborhood-level deficiencies. In particular, the surplus capacity observed in Yeniimaret and Karaağaç cannot compensate for deficits in densely populated neighborhoods such as Atatürk, Fatih, Cumhuriyet, and Kocasinan, especially under post-disaster conditions in which mobility may be restricted. Recent GIS-based studies similarly emphasize that the adequacy of emergency assembly areas depends on the combined consideration of population demand, accessibility, transportation networks, spatial configuration, and hazard conditions rather than on site area alone (Akar et al., 2024; Yildirim & Sisman, 2025).

The absence of designated assembly areas in 13 of the 28 neighborhoods is another weakness of the existing system, particularly because most of these underserved neighborhoods are located within the densely built-up urban core. Compact urban morphology, limited vacant land, and the scarcity of sizeable open spaces constrain opportunities to provide new assembly areas retrospectively. This finding highlights the importance of integrating disaster preparedness into land-use and open-space planning before development reaches densities at which suitable emergency spaces become increasingly difficult to provide. It also reinforces the role of urban open and green spaces as multifunctional infrastructure that can support both everyday urban activities and emergency functions (Cinar et al., 2018; Senik & Uzun, 2021). From a spatial-equity perspective, the concentration of deficiencies in particular neighborhoods is also important, because residents without nearby safe open spaces may face disproportionately greater difficulties during the immediate post-disaster period.

The accessibility analysis further shows that geographical proximity alone does not necessarily correspond to effective service provision. Sarıcapaşa and Sabuni, for example, are located within approximately 500 m of neighboring assembly areas; however, these sites lack sufficient capacity even for their own neighborhood populations. Conversely, large sites such as the Sarayıçi Wrestling Arena provide substantial theoretical capacity but cannot offer equally effective immediate access to populations located farther away. Capacity and accessibility should therefore be considered as interdependent dimensions of functional adequacy. This interpretation aligns with studies that emphasize walking distance, transportation connectivity, and evacuation routes as central components of emergency assembly planning (JICA, 2002; Erdin et al., 2023; Akar et al., 2024). Although all designated assembly areas in Edirne are connected to the urban road system, road connectivity alone cannot ensure effective neighborhood-scale access, particularly when considering potential post-disaster blockage, debris, congestion, and structural damage. The 500 m Euclidean buffer applied in this study should therefore be interpreted as a practical proxy for reasonable walking-distance accessibility rather than an exact representation of actual pedestrian movement. Euclidean distance does not fully account for street configuration, intersections, physical barriers, entrance locations, or potential route disruption following a disaster. Future studies should incorporate full Network Analysis to more realistically account for micro-scale urban street morphology, actual pedestrian routes, connectivity, and possible post-disaster obstructions.

Accessibility must also be considered together with environmental safety and inclusiveness. The proximity of Türkan Saylan Park and Kaptan Sports Facilities to concentrations of five-story buildings indicates that a geographically accessible site may still be exposed to secondary hazards such as building collapse, façade failure, falling structural elements, or road obstruction. Accordingly, environmental safety should be evaluated jointly with capacity and accessibility (Chu & Su, 2012; Akar et al., 2024). Similarly, although most sites provide general pedestrian access, provisions for people with disabilities remain limited. This finding suggests that distance-based accessibility assessments may underestimate the barriers vulnerable user groups experience and emphasizes the importance of incorporating universal accessibility principles into disaster assembly planning.

Infrastructure provision constitutes another essential dimension of operational functionality. Adequate site size or favorable location does not necessarily ensure preparedness when basic infrastructure is absent, while infrastructure provision alone cannot compensate for severe capacity deficiencies. Şehitler Park illustrates this relationship: despite relatively favorable infrastructure and access conditions, its capacity remains substantially below the population it is expected to serve. This supports the criterion-referenced, non-compensatory approach adopted in the study, whereby satisfactory performance on one criterion cannot offset a critical deficiency in another. Previous research has similarly identified electricity, water, sanitation, toilets, information systems, and transportation access as important components of operational readiness (Gerdan & Sen, 2019; Atmaca et al., 2023; Erdin et al., 2023; Kara & Yavruoglu, 2025). Within this framework, Barış Park represents the clearest example of balanced multi-criteria performance. Its relative suitability derives not from size alone but from the combined presence of sufficient capacity, pedestrian accessibility, transportation connectivity, environmental safety, infrastructure, and accessible-use conditions. More broadly, the current use of designated sites as parks, sports facilities, marketplaces, school grounds, mosque surroundings, and institutional spaces demonstrates the potential of everyday urban spaces to serve as emergency infrastructure. However, such multifunctionality is effective only when emergency requirements are explicitly incorporated into their design, management, accessibility, and infrastructure.

Taken together, these findings indicate that disaster assembly planning in Edirne should move beyond an inventory-based approach focused primarily on the number and size of designated sites. A more resilient system requires the spatial coordination of population demand, accessibility, capacity, safety, infrastructure, and inclusive use. In densely developed neighborhoods where large new open spaces are difficult to provide, smaller and strategically distributed sites may complement larger city-scale areas, while high-capacity sites may function as higher-order components within a hierarchical emergency-space system. The Edirne case therefore demonstrates that city-wide quantitative sufficiency does not necessarily translate into neighborhood-level resilience and that the effectiveness of assembly areas should be evaluated as an interconnected spatial service system.

CONCLUSION AND RECOMMENDATIONS

This study evaluated disaster assembly areas in the city center of Edirne in terms of capacity adequacy, accessibility, infrastructure capabilities, and spatial distribution at the neighborhood level. The results indicate that disaster assembly areas across the city possess significant potential in terms of total size and capacity per person. However, this capacity is not distributed evenly among neighborhoods. In contrast, some neighborhoods have excess capacity, others exhibit significant capacity deficits, and in some neighborhoods, no assembly area has been designated at all. This situation highlights the need to evaluate the adequacy of disaster assembly areas not only by total area, but also by neighborhood population, area per person, and spatial distribution. Another important finding is that while some assembly areas with large total areas appear sufficient in terms of capacity, they cannot provide equal and effective service and access at the neighborhood level because of their locations within the city. In contrast, some areas, despite being smaller in scale, can play a more functional role due to their location within the neighborhood. This situation demonstrates that size alone is insufficient for selecting disaster assembly areas; criteria such as accessibility, walking distance, service area, and location within the neighborhood must also be incorporated into the planning process. In this context, it is necessary to identify new assembly areas, particularly in neighborhoods that cannot provide adequate services within a 500-meter walking distance, and to reassess existing large areas to establish stronger access links with the neighborhoods. These findings are consistent with previous studies reporting deficiencies in the capacity, accessibility, and spatial distribution of assembly areas in Turkish cities (Gerdan & Sen, 2019; Bektas & Sakarya, 2020). Recent GIS-based research has similarly demonstrated that adequate service coverage depends on the combined consideration of population demand, transportation networks, spatial distribution, and hazard safety rather than on site size alone (Akar et al., 2024; Yildirim & Sisman, 2025).

The study's results indicate that 12 neighborhoods in Edirne's city center have a more vulnerable structure and lack disaster assembly areas. The fact that only 15 of 28 neighborhoods have disaster assembly areas suggests that the lack of open, safe spaces in the remaining neighborhoods could hinder rapid, safe evacuation during a disaster. Therefore, neighborhoods with no assembly areas must be prioritized for intervention, followed by planning new areas in neighborhoods with capacity gaps, taking into account population density and urban development trends. In particular, incorporating small-scale but accessible new open spaces in central neighborhoods could help reduce neighborhood-level inequalities. From the perspective of environmental and spatial justice, the unequal distribution of safe and accessible assembly areas may expose residents of underserved neighborhoods to disproportionately higher disaster risk. Accordingly, municipalities should prioritize underserved neighborhoods by incorporating spatial equity, population vulnerability, and accessibility criteria into the designation and improvement of emergency assembly areas.

The study also found that a significant portion of existing gathering areas lacks adequate infrastructure and on-site facilities, and that accessibility for people with disabilities is notably deficient. For this reason, it is insufficient to define disaster assembly areas solely as open spaces. They must be supported by basic amenities such as electricity, water, restrooms, information boards, and accessible usage arrangements. Furthermore, regularly updating the inventory of existing areas, verifying it through field observations, and periodically reassessing it in response to changes in neighborhood populations are crucial for establishing a more functional and reliable disaster management system. Future research should develop integrated assessment frameworks that account for population dynamics, urban resilience indicators, and interacting hazard scenarios; apply GIS-based multi-criteria decision analysis to identify and prioritize suitable locations for new emergency assembly areas; and validate the resulting alternatives through participatory evaluation processes that incorporate local needs, capacity requirements, institutional priorities, and community-based knowledge. In conclusion, the Edirne example demonstrates that approaches to disaster assembly area planning based solely on total area are insufficient; it highlights the need for a comprehensive planning approach that considers population size, access options, infrastructure levels, and spatial distribution to create safer, more inclusive, and equitable cities.

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