Chapter 4

# Alterations within the Coastal Urban Environments: Case of the Coastal Squares of Istanbul Megacity

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Additional information is available at the end of the chapter

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**Abstract**

Two-thirds of the megacities of the world are standing on the coastal areas. Today, coastal megacities are under the impact of varying factors like human-induced changes such as urbanization and mega projects and the natural ones as global climate change and natural disasters. Many European coastal cities are examining the impacts of the sea level change due to the global climate change. Regarding its long history, interplay with the sea and the drastic population, Istanbul captures a significant place both in Turkey and in the world. It is standing as a city, which is phase by phase losing its interaction with the sea due to the mega projects generated within the last decades. Although their limited number; public squares and parks attached with the promenades are the only openings to the sea and they contribute maintaining the continuity and sustainability of coastal identity. This chapter handles five significant historical squares and interrogates their interplay with the natural and physical challenges of the twenty-first century. Regarding this aim, case areas are evaluated by parameters of morphological attributes, formation of squares, qualification of the surfaces and coastal-based natural disaster impacts such as sea level rise and tsunami through literature-based studies and spatio-temporal diagrammatic maps.

**Keywords:** coastal megacities, coastal squares, spatial alterations, Istanbul

## 1. Introduction

Megacities are the world's most populated areas that are subjected to a sustained growth both in terms of physical and in terms of demographic parameters. According to the world population ranking of megacities, 6 out of 10 most populated ones are "coastal," and they are altering under the impact of many dynamics. The main criteria for being a "coastal" megacity

are simply related with the connection and integration with coastlines both with positive and negative aspects, while coastal areas provide access to rich and diversified usages. On the other hand, even a slight increase in sea level would have significant physical impacts within the city boundaries [1]. Megacities are defined with at least 10 million population, but coastal megacities need further physical parameters like 100 km distance from the coastline and 100 m elevation from the sea level in all city limits [2].

Coastal megacities are mainly compositions of concrete buildings, skyscrapers, complex traffic roads and so forth standing next to the coast, but they also have significant influences on the formation of the coastline, ecological balance, air pollution, sea habitat and weather systems. Thus, a dynamic and integrated bond can be found between the city and the coast regarding human factors and environmental issues. As a result, the current coastal megacities are facing several facts like "urbanization and pertinent mega-projects," "global climate change and the pertinent sea level rise," "earthquake and the secondary hazards" and "environmental pollution."

Regarding their location-based factors, European cities have no risks on hurricane storms, and they do not face with tropical cyclones; however, tidal and nontropical storm floods are still effective such that some cities were built under sea level height and sheltered by walls/overflow sets [3].

Squares are the most important public spaces of a city and usually compensate different functions [4]. Within the context of urban space organization, public squares are either formed spontaneously or designed through several determinative factors (physical or sociocultural). The most important physical determinants/reasons for the formation of squares are the intersection of main roads, gateway for urban coastal areas and association with coastal components like bridges, ports and harbors and a scene for monumental buildings/landmarks [5]. In the historical development of public squares, the basic definitions are classified referring to their locations, main functions and surrounding buildings such as ceremonial squares, market squares, church squares, political squares and so forth. Today, this classification is diversified with new concepts like historical squares, transfer squares, urban interior squares and port/coastal squares. Coastal squares are semi-enclosed and usually amorphous urban gaps that constitute an entrance for people who use sea transportation and also respond to their actions like meeting, waiting, welcoming or watching seascape [6]. They also provide significant contributions to the identity of the city and the perception of coastal landscape. In most of the existing coastal cities, there are many privileged coastal squares which generate an interface between the city and water, become a focal point and enrich the urban identity like Piazza San Marco in Venice.

In the case of Istanbul, we are dealing with an ever-expanding city with an area of 5313 square kilometres and a population of 14.8 million [7]. Standing as a historical city, Istanbul has a long interplay with its surrounding seas, which reaches back to the seventh century BC. Its location in between Europe and Asia generates its unique natural and cultural coastal formations. As a capital of two empires, the coastal location brings about both advantages and disadvantages. The north-eastern hill of the historical peninsula was the first nucleus of the

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city, and it had a strategic location as being on the intersection point of the Sea of Marmara, Bosphorus and Golden Horn to maintain control in terms of defence and maritime trade [8].

Istanbul is a unique city that connects two continents with a total coastline of 647 km. [9]. Within the development of the city, not only the historical and cultural values but also the internationally important coasts have been influential. In the pre-republic period, coastal areas of the city had served as trade and port. Together with the establishment of the republic, the capital function of the city came to an end. Hence, the seaside mansions emerged along the coastal edges along the strait of Bosphorus. Following the 1930s, Istanbul has gained its importance back by its unique historical sites and the attractive public places. However, the coastal areas have examined the most significant alterations again in the coastal areas due to the rapid urbanization and industrialization starting in the 1950s [10, 11].

Coastal landfill areas had been constructed till the end of the 1990s with the aim of establishing transportation lines and nodes besides the coastal recreation areas [12]. Deindustrialization decisions in the 1980s brought about the initial steps of the coastal urban transformation projects. Starting in the first half of the 2000s, the coastal urban environments of Istanbul have started to examine drastic spatial changes by welcoming mega projects. "Urban Transformation Projects," which are a series of mega projects regarding many planning and implementation studies, became more popular after the mid-2000s and attract many star architects and planners to propose various contemporary and sometimes contradictory design projects for coastal areas such as Kartal-Pendik Regeneration Master Plan, Galataport and Haydarpaşa [11]. They were also controversial in terms of ignoring the historical pattern, destructing physical and social traces, leading to social dissociation by responding to high-income groups' requests and limiting public access.

Coastal areas of the Istanbul megacity are open to several disasters like earthquake, tsunami and sea level rise. Turer Baskaya revealed the city as one of the most hazard-prone coastal megacities in the world due to the existence of the active North Anatolian Fault laying under the Sea of Marmara [13].

As the citizens are gradually losing their contact with the sea, due to the dynamics effective on the coastal areas, historical coastal squares appear to be more important. Historical coastal squares of the Istanbul megacity which is experiencing drastic coastal alterations have always been the "gates to the sea" and should be regarded as the unique cultural elements of urban memory. As a city representing a synthesis of western and eastern cultures, coastal squares stand significantly even expressing limited social similarities with the Mediterranean countries examining cultural diversity. This chapter highlights the importance of assuring the sustainability of the coastal cultural spaces as in the case of squares even with their associated meanings.

In this context, this chapter aims to interrogate the dynamics, physical and spatial alterations/transformations pertinent with the square and identifies five historically specific coastal squares for the studies. Regarding this aim, the case areas are evaluated by the parameters of morphological attributes, the formation of squares, qualification of the surfaces and coastal-based natural disaster impacts such as sea level rise and tsunami through literature-based studies and spatio-temporal diagrammatic mappings.

## 2. Materials and methods

Two basic methods have been used in the research to evaluate the temporal and spatial changes of selected squares in the city of Istanbul over the changes on the coast: (1) literature-based studies to understand and explain the historical evolution and changing spatial dynamics of the selected squares and (2) diagrammatic mapping with the data obtained from maps, satellite images and other visualized analyses.

Literature-based studies are mainly focused on coastal megacities, transformation of coastal areas and historical development of Istanbul. Throughout the mapping study, historical maps (Jacques Pervititch's insurance maps, drafted over 25 years between 1921 and 1946) and satellite images (Istanbul Metropolitan Municipality City Maps) are used to evaluate morphological transformation process in each of the five squares [14]. Pervititch's historical maps showed the first formations of squares, coastline and coastal areas and their relationship with other functional subdistricts and satellite maps (1970) and (2016) to emphasize the rapid change with coastal plan applications. In this context, physical transformation processes (especially alteration of coastlines) of selected areas are integrated to final maps [15].

Spatio-temporal diagrammatic maps have been produced on the 1/1000 scale current maps from Istanbul Metropolitan Municipality (IMM) [14]. Main parameters and components of these diagrams can be classified into two subcategories: morphological attributes (including physical environment features such as buildings, street networks and other open spaces, location and formation of coastal squares and permeability of surfaces) and coastal-based natural disaster impacts (sea level rise and tsunami). Firstly, current maps, satellite images, on-site analyses and historical-actual photographs are used to decode the morphological key elements and all superposed on the diagrams. Secondly, coastal-based disaster impacts are illustrated as layers where related information is obtained from literature-based studies or visualized data analyses: sea level rise data are received from Flood Map: Water Level Elevation Map (Beta) application and tsunami run-up height data are received from a geological-geotechnical study report (2007), which is prepared for Istanbul Metropolitan Municipality by OYO International Corporation [16, 17]. Finally, all the morphological and disaster-related parameters are comparatively evaluated to understand the dynamics and alteration processes of coastal squares. In this context, causality relations between spatio-temporal changes of coastal structure and coastal-based disasters are revealed within a multidisciplinary investigation.

## 3. Spatial development of Istanbul and its effects on coastal squares

The old city plan of Istanbul is like an irregular network in which there are nodes in various dimensions. While small nodes express fountains and small-scale mosques, large nodes express Islamic-social complexes where mosques, tombs, fountains and madrasah [18]. Although the urban texture has been continuously changed by the emergence of new building complexes, in other words, functional nodes, it has preserved its general fabric. Unlike other cultures, the formation of public space and the emergence of the square have arisen with

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the use of architectural structures and monumental objects in Islamic culture. Thus, the large mosques were responsible for the gathering people, while fountains and other architectural structures were created as a square. According to Kuban, those singular elements also emphasize permanency in the urban texture [18].

In the historical period, from 1680, expansion of city borders of Istanbul was started through Bosphorus seashore, from inside the historical walls. New settlements extended from Bosphorus to Beykoz (Black Sea) to the whole Golden Horn shores and to Kadikoy districts (Marmara Sea). There has been a horizontal development along the coastal axis since the trade was prioritized in these settlements; the coastal side has been developed due to the importance of water transportation [19]. The disconnected coastal settlements were usually built towards the foothills or into the valleys. In the meantime, the hillsides were covered by plantation. These features of Istanbul lasted until the twentieth century [18]. When unpretending coastal settlements significantly developed in direct proportion to population growth, Istanbul began to lose its landscape characteristics. Therefore, rapid planned/unplanned developments had led to the disappearance of natural values. On the contrary, the expansion of the physical environment through the city walls was regarded as the beginning of the westernization process in the context of urban form and scale [18]. The inner city of Istanbul, restricted by the walls, had given place to the coastal city, which concentrated on the coastal line. Further, coastal settlements have continued to develop rapidly with the ignorance of the topography; in the meantime, the functional division of the city and its historical continuity has been ensured by port trade.

Especially in design perspective of squares, in the late nineteenth century with the construction of the Galata Bridge and The New Mosque (Yeni Camii), Eminonu Square was designed as a transportation hub inside the city walls and by the coastal area of Golden Horn. Even though The New Mosque and Spice Bazaar were significant architectural structures which increased common use of the square, the square was, and still is, a connection point in the city. However, it has been observed that tourism has developed along with the existence of historical monuments in Eminonu, which is a central area throughout history [20]. Because of safety and security reasons, city borders were limited to the city walls until the Ottoman period. Therefore, the square within the city walls has the characteristics of being separated from the other coastal squares by its historical infrastructure. Observing the historical background, the square was defined as a square which serves the entire city of Istanbul, while other coastal squares, outside the city walls, occurred with the establishment of new neighborhoods in the Golden Horn, Bosphorus and Uskudar in the fifteenth century without defining as a square [18]. Uskudar, on the other hand, was developed to transfer the commercial axis from Anatolia to Europe due to the significance of water transportation system [19]. With the construction of the first bridge and its connection vehicle roads, Uskudar's development has started to move towards higher hills/areas beside the coast. In the 1930s, urban planning strategies had changed according to vehicle traffic and road system in the city. In consequences of those changes, Uskudar square became a nodal point of Anatolian side [21]. Population growth and urbanization cause air pollution and reinforcement, and the rapid increase in density also led to unfavorable developments of topographical features of the area. It was observed that the forests in the district were replaced with agricultural land and then with housing areas in time [22]. The effects/pressure

of construction can also be seen in Ortakoy, which has a strategic location because of having connection roads. Combining the two sides of Istanbul and being a transit zone along the coastal route, settlements/residential areas are located on valley slopes and alluvial plain by the sea. Ortakoy Mosque, where the stream reaches the sea with reclamation, was constructed in 1854–1855 by Sultan Abdulmecit, and Fountain of Damat Ibrahim Pasa was constructed in 1973. Both architectural monuments were used to form the Ortakoy square. With the construction of Bosphorus Bridge in 1970, Ortakoy stream was completely covered and the route of stream planned as the main street. It shows the intervention to streams because of the consequences of land use decisions related to changing transportation models after the 1950s. Similarly, Stream of Bulbul in Uskudar was affected by rapid urbanization and transportation policies. The unbalanced development between nature and human communities has also an impact on local climates.

There has been an acceleration of filling of coastal areas after the 1980s due to population increase and inadequacy of the infrastructure. It shows that coastal squares were affected by contrasts between the development of transportation networks and the change of function in coastal areas. With demolishing residential areas, Uskudar square was enlarged the same way as other parts of Istanbul [23]. Meanwhile, the filling areas in Kadikoy were designed for both vehicle traffic and recreational areas. Today, however, Kadikoy square is still a transportation hub and transfer centre. One of the most important reasons for that is the division of the square by roads, and due to the structures with different functions and the loss of boundaries, the square is perceived as an amorphous layout.

Besides, the first settlement in Buyukada, which has a different development process, was established as a fishing village where the garden of Aya Nikola Monastery is located. The fire in 1850 had destroyed the architecture of the island, and the settlement on the coastal area, located to the north of the island, began to develop hereafter [24]. The area, which was composed of summer houses scattered in the eighteenth century, is today the centre of the sea transportation. On the other hand, the inner square where the clock tower is located is today the centre of commerce. It is used for recreational purposes along with the pier and its surroundings. Even though the district is the densest part of the island, the height above the water level of the dock allows only visual contact with the sea. The most significant feature that distinguishes the square from other squares is the lack of vehicle traffic, the fact that it is a pedestrian-oriented district. But the situation did not prevent the island geography from being influenced by the rapid urbanization. The increase in population and prioritization of tourism in the preliminary plan caused sprawl and diffusion on the physical pattern.

Under the pressure of urbanization on Istanbul's coastal line, the ecological balance has been ruined by the settlement areas of the valleys and the destruction of the forests and the decrease of the green areas. This situation has created the basis for the change of the climatic conditions of Istanbul. At the same time, the physical characteristics of the topographical structure of the coastal settlements began to disappear. The reason to examine these five squares is related to their location and their historical background while the city is facing those problems. Methodologically, five key squares are chosen by underlining changes in physical environment and on natural values (**Figure 1**).

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**Figure 1.** Location of the squares and classification of Istanbul coastline due to natural and cultural characteristics (developed from [25], the sources of the images, respectively [26–30]).

### 3.1. Morphological and climatic alterations within coastal squares

By the historical development process of Istanbul, all the selected coastal squares have become important focal points within their urban environment. Except for Buyukada, each square has historical roots that preceded the Republican Period and a dominant influence in the formation of the physical environment. Buyukada Square was acquired by filling the coastal area after the 1970s, and the impact of the inner bazaar square was extended to the coastal zone both to be associated with the pier. In terms of size, Eminonu, Kadikoy, Ortakoy and Buyukada Squares are classified as medium sized (5000–15,000 $m^2$), except Uskudar Square, which was previously considered as medium sized but later included in the very

large (25,000 $m^2$ and above) classification because of new transportation policies and urban design-regulation interventions developed from the beginning of the 2000s. In addition, each coastal square has richness and considerable similarities in terms of functional qualities and morphological characteristics (**Table 1**).

Morphologically, Eminonu, Uskudar, Ortakoy and Buyukada have "organic pattern" attributes with the incorporation of various urban fabric formations throughout the historical development process. On the other hand, Kadikoy has a typical "grid pattern" formation since it was founded as a Greek colonial settlement in ancient times and its properties (urban blocks, street networks, etc.) have survived so far on a large scale. These morphological attributes also affect the formation of the squares along with other transportation issues directly: Eminonu, Uskudar and Ortakoy Squares have amorphous forms (Uskudar later "amorphous-linear" with further extensions), while Kadikoy Square has a linear formation. Although located within an organic pattern, Buyukada Square has an exceptional situation with its linear form due to the regular construction of coastal filling. Street networks are also irregular and formed with different cross-sections in organic patterns in contrast with the organized and hierarchical system in grid-shaped Kadikoy. Considering that the squares as "portals/entrance gates" on the coastal belt, it can be argued that they also constitute "joints " or "intersection hubs" of land and sea transportation networks (both in terms of vehicle and in terms of pedestrian usage).

Undoubtedly, one of the most influential factors on the morphological properties of coastal squares is the transformation/alteration process of coastlines. While coastal areas have been formed in more organic forms with beaches, rocky cliffs, small-sized piers and waterside residential areas in history, the coastline has been reshaped by landfills, beaches have lost their qualities and more linear and impermeable areas have begun to emerge due to the mega-urbanization process of Istanbul in the second half of the twentieth century. In this context, one of the most striking examples for the new formation of coastal squares after the radical change of coastline is the Buyukada Square: the coastal area, which defined with waterfront mansions and beach areas until the 1970s, was filled up to the level of the port resulting in a brand new

| | PERIOD | | | | | SIZE | | | | FUNCTION | | | | | | MORPHOLOGICAL QUALITIES | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1923 (Before Republican) | 1923 - 1950 | 1950 - 1980 | 1980 - 2000 | After 2000 | SMALL (5000 m2 and below | MEDIUM (5000-15000 m2) | LARGE (15000-25000 m2) | EXTRA LARGE (25000 m2 and above) | COMMERCIAL | RELIGIOUS | CIRCULATION | LANDMARK | RECREATION | CULTURE & TOURISM | ENTREE | FORECOURT | BOARD-TYPE | HUB | JOINT | INTERFACE | INTERIOR | FIELD | DECORATIVE | GARDEN | VIEW PLATFORM |
| **EMINONU** | • | | | | | | **14700** | | | • | • | • | • | | • | • | | • | • | • | • | | • | • | | |
| **USKUDAR** | • | | | | | | | | **27500** | | • | • | • | • | • | • | | • | • | • | • | | • | • | | • |
| **KADIKOY** | • | | | | | | **12700** | | | • | | • | • | • | • | • | | • | • | • | | | • | • | • | • |
| **ORTAKOY** | • | | | | | | **5100** | | | • | • | • | • | • | • | • | | • | | • | | | • | • | | • |
| **BUYUKADA** | | | • | | | | **10150** | | | • | | • | | • | • | • | | | | • | • | | • | | • | • |

**Table 1.** Morphological comparison of selected coastal squares.

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public space. Similarly, the coastal area in Uskudar that which gained its local identity with its small-sized piers and beaches and an important interaction surface between sea and land has undergone a major change in form with landfills associated with new "transfer point" identity and further transportation policies. The situation is much different in Kadikoy coastal area; due to the port and square were placed within a sheltered bay, large landfills were constructed on the west coast that oriented to the Marmara Sea. In comparison, it is possible to see the least coastal change in Ortakoy, which has a more rigid and compact structure in terms of morphology. Although the Bosphorus Bridge (as an essential transportation project) was built right next to the district, coastal form and local identity have been highly conserved (**Table 2**).

Interventions such as filling-splitting on coastal areas and the alteration of coastline not only lead to striking differences in the identity-perception qualities of coastal areas but also bring important macro- and microclimatic changes both in terms of sea and in terms of land ecology. Therewithal, these interventions considerably increase the risk level in terms of natural disasters such as earthquakes, floods and tsunami. In this context, locational and coastal characteristics of selected squares also bring different risk factors: as a result of sea level rise (1 m), floods or submersions cover lands in different proportions. In a similar way, tsunami run-up heights and impact areas also vary for each coastal area: 0–1 m for Ortakoy, 1–2 m for Eminonu and Uskudar and 2–3 m for Kadikoy and Buyukada [17].

Eminonu Square, as one of the oldest squares of Istanbul, has links to the coastal area in close proximity through historical periods but later detached from the coast due to the altered land use and transportation policies, and currently, the connection is provided with underground pedestrian crossings. The interventions on the coastal line also affected functional areas, and the coastal belt became a complex transfer hub. Thus, the square itself remained in the inner part and is acting as the entrance to the bazaar area. While the former square was located in front of Yeni Camii (Mosque) with an elliptical form, it is now about three times larger and has been converted into an amorphous-shaped sectional/jointed layout (**Figure 2**).

Due to the destruction of the historical structures on the coastline and the construction of wide transportation axes in different elevations (some below sea level), the coastal belt and the eastern part of the square are under risk for disasters such as floods and tsunami. After a possible 1 m rise at sea level, approximately 70% of the square and the entrance of the bazaar

| Coastal square | Transfer hub | Contact with coastline | | |
|---|---|---|---|---|
| • Former<br>+ Current | | Detached by vehicle road | Detached by pedestrian road | Adjacent |
| **Eminonu** | • + | + | • | |
| **Uskudar** | • + | + | | • |
| **Kadikoy** | + | • | | + |
| **Ortakoy** | | | | • + |
| **Buyukada** | | | + | |

**Table 2.** (Former and current) Relevance of the squares to the coastline.

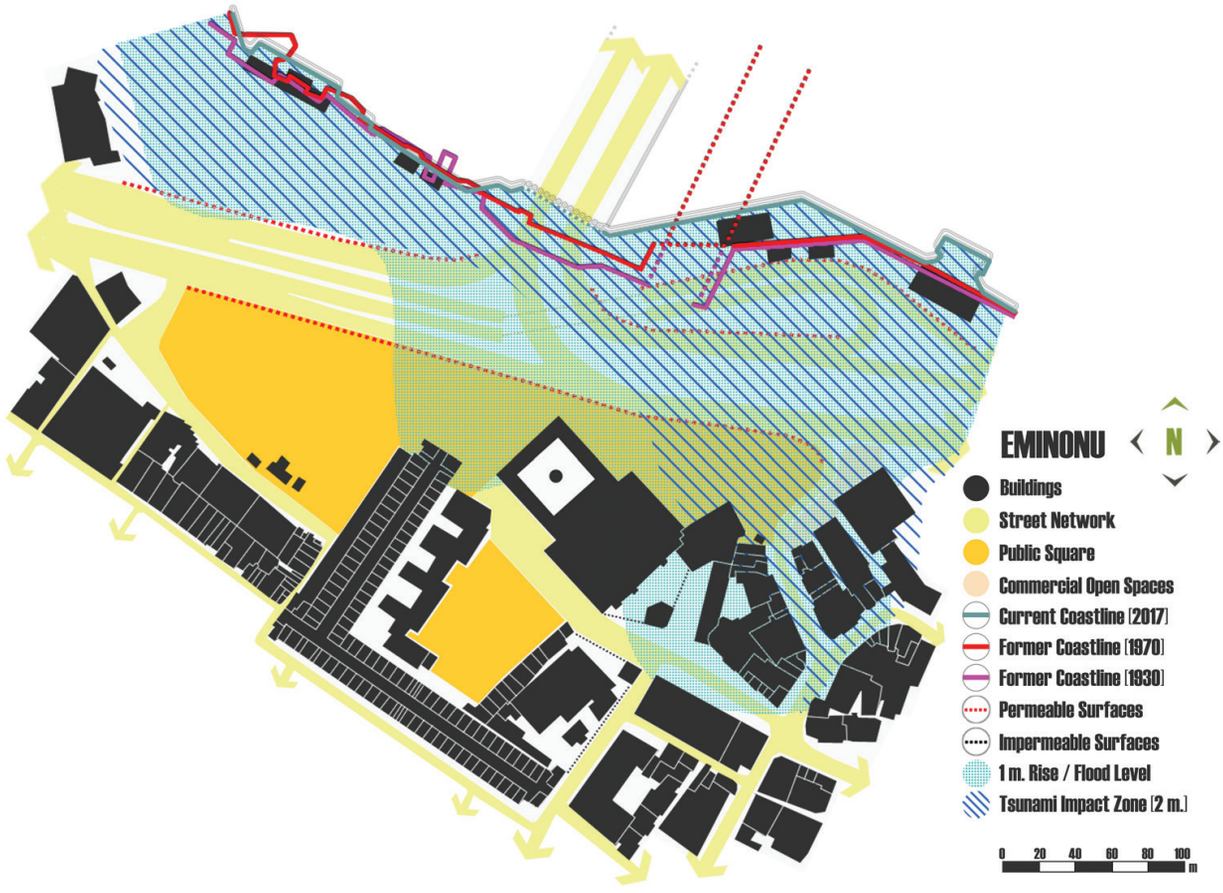


**Figure 2.** Morphological structure of Eminönü; location of the public square, alteration process of the coastline and sea level rise/tsunami impact areas.

area will be flooded. Likewise, a potential tsunami will also affect especially the eastern part up to about 2 m and probably spread towards the inner parts (**Figure 2**). It can be argued that the location factors (intersection point of Bosphorus, Golden Horn and Sea of Marmara) below sea level transportation regulations and the lack of impermeable surfaces (undefined open spaces) should be the main reasons for expected intensive disaster effect.

Uskudar Square, which is another historical place that became an important transportation hub on the urban scale, has a similar process like Eminonu as a result of altered land use decisions and detached from the coastal area by vehicle roads. The first formation of the square was quadrangular-shaped, small-sized public space (Bosphorus village port square) defined by the coastline and the surrounding buildings but later grew with the identity of transportation hub over time and transformed into a large-scale amorphous-linear layout as a result of the most recent interventions. The square still maintains the characteristics of being the entrance of the bazaar and interregional transfer point, but it has lost its identical attributes (**Figure 3**).

The former coastline, which defined by historical buildings, small-scale ports and restricted beaches-rocky areas, is transformed into a sharp and linear formation, and all the mentioned functional areas have demolished. The new shape of the coastline also affected the square directly, such that last extensions were conducted parallel to the coastline towards the western part of the area (**Figure 3**).

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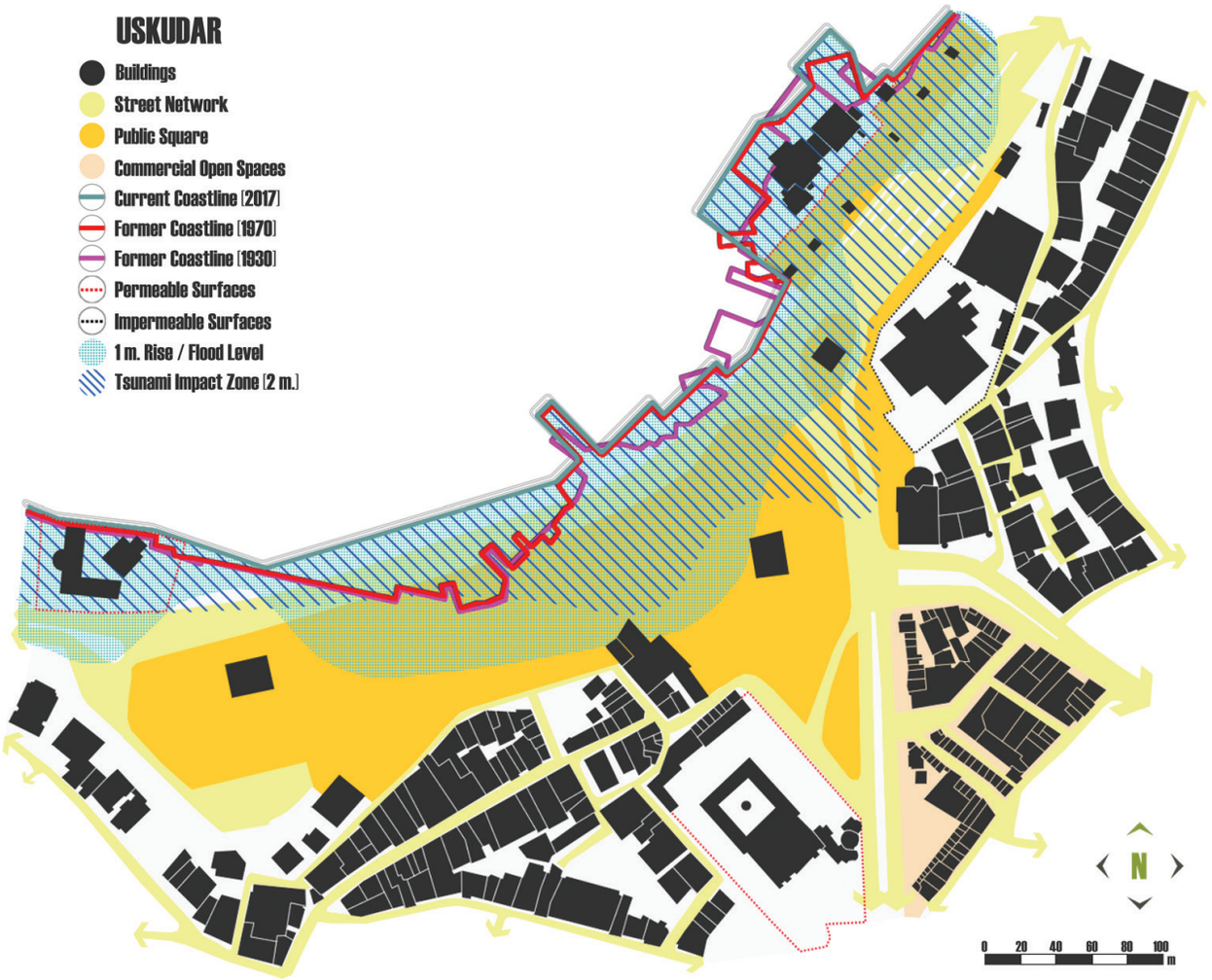


**Figure 3.** Morphological structure of Uskudar; location of the public square, alteration process of the coastline and sea level rise/tsunami impact areas.

Like Eminonu Square, it is critically located at the intersection point of Bosphorus and the Sea of Marmara, so disaster-based risks still have a certain level of influence: In case of a 1 m rise in sea level, landfills, port area and about 50% of the extended part of the square are facing the threat of submersion or flood. Or in case of a tsunami, historical parts of the square (on the eastern side) are under the first degree of flood risk; for the rest, the flood may spread towards the other parts of the square and inner parts of the bazaar (**Figure 3**). Besides, the coastal area already faces floods, especially during heavy rain falls. In this context, it is strikingly seen in Uskudar that the radical changes on the coastline increase the risks of floods due to sea level rise or tsunami as well as rainfalls. It should also be underlined that there is a risk of collapse during a severe earthquake.

The coastal area in Kadikoy was rather characterized by open green spaces and separated from the coastline by vehicle road at the beginning of the Republican Period, but later, the north-western part was transformed into a linear square as intended to include ports and the cultural centre. Currently, it is one of the significant coastal squares, which has a direct contact with the sea with its adjacent spatial organization as well as an impressive vista platform on looking Haydarpasa Train Station (a monumental landmark) and the historical peninsula. Interaction

with the residential area is disjointed as in the original formation; the gap is again used as public green space and the connections with the bazaar are provided by radial pedestrian arteries.

The coastline on the side of the square is largely protected; however, large-scale landfills were constructed in the south-western and north-eastern parts of the coast. By historical chronology, it can be observed that the coastal formation of the north-eastern port has undergone at least three radical changes (**Figure 4**); likewise, about 120,000 $m^2$ landfills were added to the south-western part between 1985 and 1993 resulting in a prominent alteration of coastal identity and usages.

Coastal-based disaster risk levels of the square and landfill areas are quite high due to the area formed as a jetty/an extension towards the Sea of Marmara westwards. In case of a 1 m rise in sea level, approximately 80% of the coastal square and most of the gaps between the bazaars will be flooded or submerged. However, the expected disaster level of a possible tsunami will have much more impact than sea level rise: the water will run-up to 3 m height and completely cover the entire coastal area up to the entrance of the bazaar (**Figure 4**). Secondly,

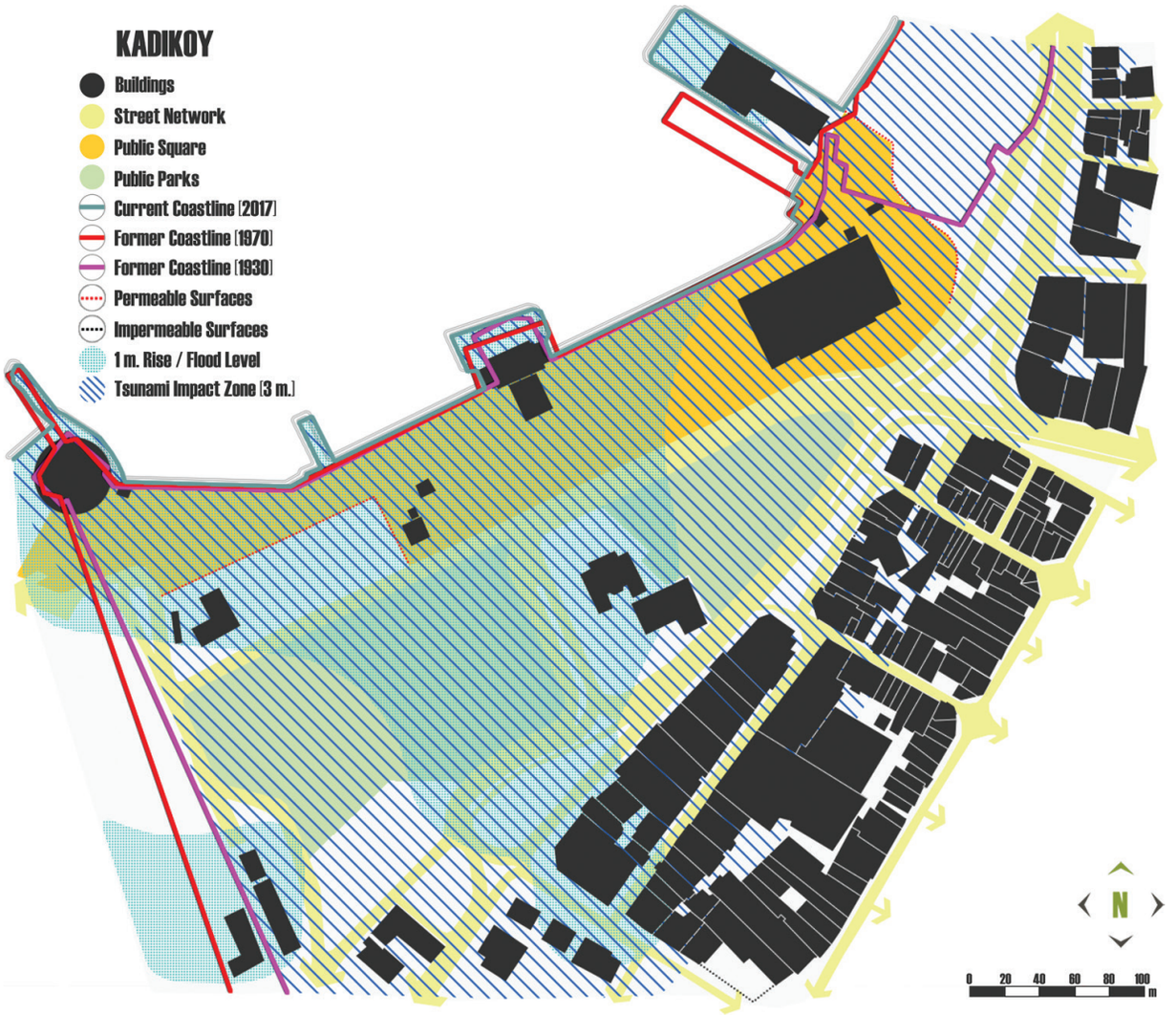


**Figure 4.** Morphological structure of Kadikoy; location of the public square, alteration process of the coastline and sea level rise/tsunami impact areas.

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the landfill areas in the south-west and the inner parts of the bazaar will also be affected. Therefore, it can be argued that the location- and orientation-based risk factors are prior and higher in Kadikoy coastal area, and the alterations in the coastline are also influential as interventions were large scale and in radical formations.

As a typical Bosphorus Village settlement, Ortakoy has substantially succeeded in protecting its morphological attributes and functional relations from the past. On the other hand, Ortakoy Square was one of the essential interfaces between the land and sea and also a landmark since the time it was first built. Although the square has an amorphous and jointed structure, it is highly defined by other urban components (coastal line, ports, mosque, fountains, commercial buildings and other historical structures), both terms of boundaries and subregions and also entirely in human scale (**Figure 5**). Unlike Eminonu, Uskudar and Kadikoy, the coastal area is completely dissociated from vehicular traffic that also diversifies its identity.

Ortakoy is the area that has faced the least coastal alterations compared to the other squares. Although most of the port squares in many Bosphorus Village settlements have several transformation processes, Ortakoy Square retained its morphological structure due to its identity and characteristic features. Only some small-scale landfills were constructed during the renovation of ports; nevertheless, the most prominent change is observed in the south-eastern part of the square.

In accordance with the location and coastal formation attributes, the least impacts from coastal-based disasters are also seen in Ortakoy Square and its vicinity: a possible 1 m rise in sea level will not affect the entire district. Also in case of a tsunami, only a very limited part of the coastline (up to 1 m) may face a possible flood (**Figure 5**). The sheltered and limited structure of Bosphorus does not permit the construction of large-scale landfills, and the dynamic movement of the water reduces the risk of coastal-based disasters. When considered with the minor alteration process due to its local identity, Ortakoy Square is the most advantageous one as compared to other selected coastal squares.

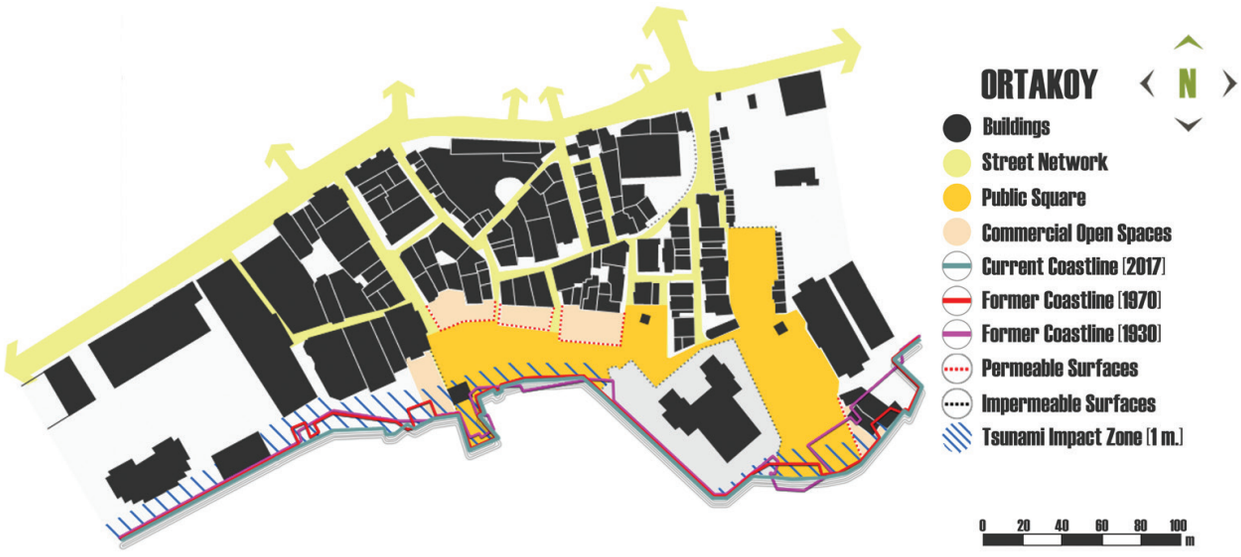


**Figure 5.** Morphological structure of Ortakoy; location of the public square, alteration process of the coastline and tsunami impact areas.

Buyukada, as a typical island settlement, is one of the most critical areas regarding the earthquake risk due to its proximity to fault lines. The settlement has emerged as a fisher village in the historical period and later gained a special identity with the gathering of different ethnic groups. The physical formation of the area constituted a unique mosaic, which has conserved since today. There is no physical connection with the land, and the entire island is completely closed to vehicular traffic, thus providing positive qualities both for scale perception and for spatial order as in Ortakoy. The coast is privileged as the only access is made by sea transportation, and the coastline, ports and functional areas are significant components (**Figure 6**).

Buyukada Square is different from the other examples since the overall square was obtained by landfills after the 1970s due to lack of capacity—the limited spatial organization of port and its vicinity. The buildings formerly located near the coastline now constitute the southern border of the square. Other small piers, recreational areas and commercial open spaces are also linked with the linearly shaped square.

Although the physical attributes are mostly conserved except this landfill square, locational factors (open to Sea of Marmara, first-degree earthquake zone, etc.) expose many major threats for coastal-based disasters: 90% of the coastal area, buildings on the south-western border and the port area will be flooded after a 1 m rise in sea level. Similarly, the entire coastal band will be affected after a possible tsunami, and the run-up will reach inner parts (**Figure 6**).

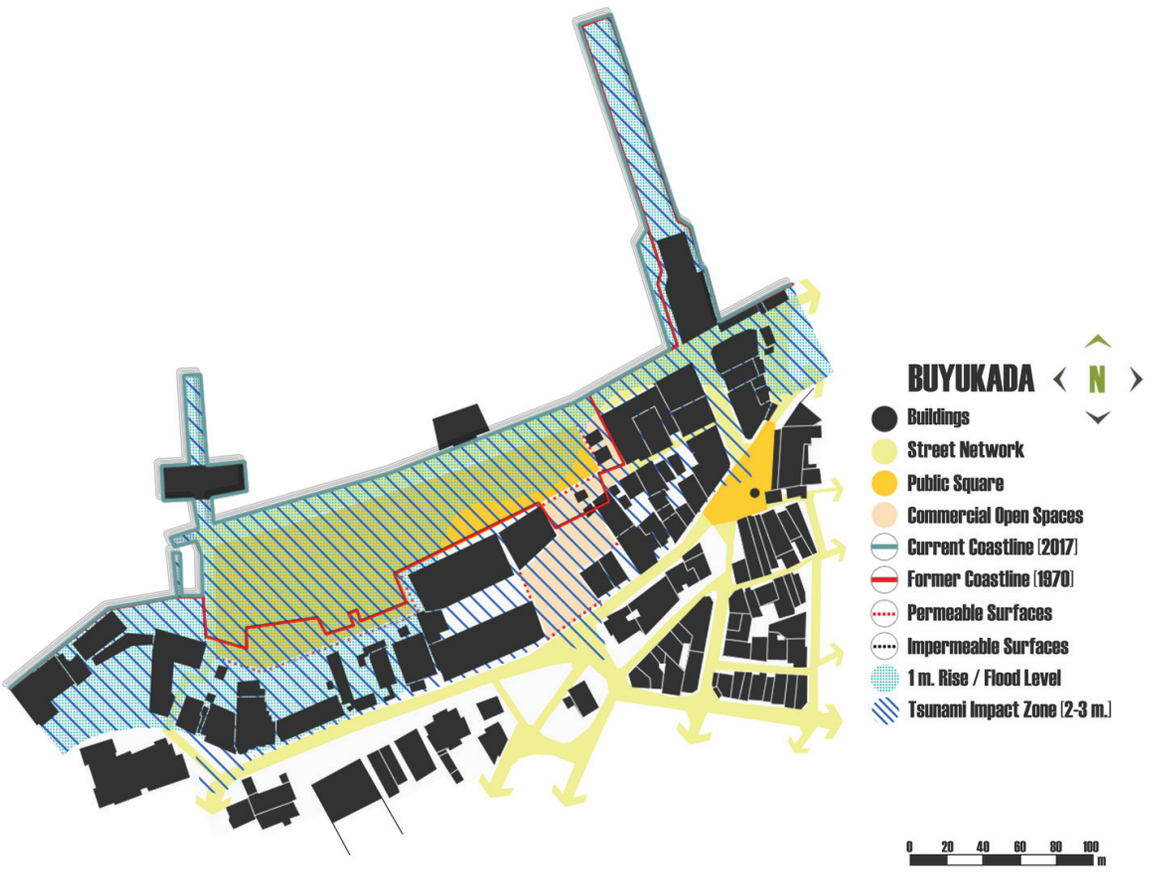


**Figure 6.** Morphological structure of Buyukada; location of the public square, alteration process of the coastline and sea level rise/tsunami impact areas.

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| | Change in morphological structure | Change in coastal line | Location-based risks | Sea level rise impact | Tsunami impact |
|---|---|---|---|---|---|
| **Eminonu** | ●●●●○ | ●●●●○ | ●●●○○ | ●●●●● | ●●●●○ |
| **Uskudar** | ●●●●○ | ●●●●● | ●●●○○ | ●●●●○ | ●●●○○ |
| **Kadikoy** | ●●●○○ | ●●●●○ | ●●●●○ | ●●●●● | ●●●●● |
| **Ortakoy** | ●○○○○ | ●○○○○ | ●○○○○ | ○○○○○ | ●○○○○ |
| **Buyukada** | ●●○○○ | ●●●○○ | ●●●●● | ●●●●○ | ●●●●○ |

• **Change/impact level** (1-very low, 2-low, 3-medium, 4- high, 5-very high); ○ **No change/impact.**

**Table 3.** Comparison of coastal squares in terms of physical- and disaster-based issues.

In this context, it can be argued that the alterations on the coastline constitute specific threads regarding sea level rise, but locational factors and geological structure compose of higher priority risks related to the tsunami.

Comparison of the squares according to the alterations within morphological features, coastal land uses and durability to disaster-based risks reveals the Ortakoy square standing on the Bosphorus as the best one (**Table 3**). Squares standing on the coasts of the Marmara Sea and at the intersection area in between the Marmara Sea, Golden Horn and Bosphorus have been spatially and sub-functionally altered much due to the coastal landfills. Besides, they have got weak strength towards the disasters like sea level rise and tsunami due to their locations. The most extreme morphological alterations occur at the transportation-oriented squares such as Eminonu, Uskudar and Kadikoy. These three squares and the one in Buyukada stand as the highest vulnerable one to coastal hazards.

In this context, it has been examined, comparatively on different squares, how the transportation and land use-based decisions of mega-urbanization affected the coastal usage and how the man-made alterations towards the coastal line and the locational characteristics triggered the disaster risk.

## 4. Conclusion

By handling the rapid changing coastal megacity of Istanbul and focusing on its historical coastal squares, this chapter aims to figure out the dynamics effective on these cultural open spaces as it is the initial stage of developing sustainable development strategies. Thus, this chapter handles five significant historical squares and interrogates their interplay with the natural and physical challenges of the twenty-first century. They are evaluated by five major parameters such as morphological attributes, the formation of squares, qualification of the surfaces and coastal-based natural disaster impacts such as sea level rise and tsunami.

Coastal squares, which became important focal points due to their morphological and socio-cultural values in the historical process, have a fragile relationship with the global phenomenon of "sustainability" through first-degree dependent, constant or variant parameters. The

most important constant parameter is the location factor: coastal areas that already have sustainable qualities/formations are gradually losing their endurance due to the changing climate conditions on a global scale. In this context, it is possible to say that another variant parameter (climate) directly influences the core attributes of coastal squares. On the other hand, variant essential parameters of coastal squares such as morphological alterations through physical interventions and transformation of square forms/usages through the changes in coastlines increase the risk factor even at higher levels in terms of coastal-based disasters.

As seen in the results through evaluation of five selected coastal squares in Istanbul, Ortakoy Square stands out as a less risky one against coastal-based natural hazards due to its sheltered structure regarding location-based characteristics and the limited morphological change on both coastline and square layout. Morphological transformations in other selected squares and the increasing location-based risks either with climate change or geological metamorphoses reduce the level of durability of coastal squares and make them more vulnerable. Currently, coastal squares of Eminonu, Uskudar and Kadikoy are adversely affected by excessive rains and floods: the structural enclosure of transportation axes, high amount of impermeable surfaces and the lack of water evacuation areas can be identified as critical factors which also constitute a hazardous foundation for future risks.

Today, it is required to provide urban coastal conservation strategies capable of diminishing the emerging natural and physical challenges of the twenty-first century. Reducing the influence of urbanization pressure on the squares should be the right approach especially for conservation and sustainability of coastal squares. In addition to historical values and spatial significances of coastal squares, their presence in the coastal skyline/silhouette should also be maintained. Strategies should also consider that coastal squares are key components that provide critical benefits such as functional continuity on the coastal areas, interface connections of the interior parts with coastline and urgent public usages to save the city/citizens against natural disasters.

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