

# ISTANBUL'S LAND WALLS – TRANSFORMATION OF AN INTRA-URBAN GAP IN THE BUILT ENVIRONMENT)

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## Abstract

For long periods of history, defensive fortifications of cities were not only absolutely necessary for the protection and prosperity of the community surrounded by the buildings, but due to the comparatively large extent of the fortifications and their persistence, they also remained determining factors of spatial development, morphology and functionality of urban centers for centuries. Only with the change in military paradigms (the emergence of effective, large caliber firearms) did these facilities prove to be outdated and obsolete, whereby several strategies could in principle be adopted for the subsequent use of the vacated areas: Either the building fabric was deliberately preserved and later integrated into the cityscape as cultural heritage (e.g. in Nördlingen, Basel or Lucca) or the walls were demolished and made way for wide boulevards with green spaces and high-quality building plots (e.g. Ringstraße in Vienna). In exceptional cases, such as in Istanbul, the city wall and its (terrestrial) apron remained "left over", so to speak, and was only put to modern use relatively late (about a thousand years after its construction). The spatial focus of the research presented in this paper lays on the urban space at and west of the land wall between the Eyüp district in the northern part of the Golden Horn and Zeytinburnu at the shoreline of the Marmara Sea and attempts to trace the transformation processes in the approximately 11.25 km<sup>2</sup> study area based on selected sources. The objects of consideration are functional as well as land use changes which took place within the last two centuries, whereby this restriction results from the special demands on the data material: In order to allow a quantitative assessment of the development, only qualitative appropriate plans, topographic maps and more modern digital GIS/RS data such as orthophotos and satellite images come into question. These sources are supplemented by material acquired during several field campaigns for data collection and verification in 2009, 2010 and 2011.

**Keywords:** urban analysis, historical geography, cartography, GIS, Remote Sensing.

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## INTRODUCTION, MOTIVATION AND PREREQUISITES

The main reasons for the research preceding this paper were, first of all, the considerable size and presence of a structure that has influenced the appearance and development of the metropolis of Istanbul up to the present day, and the persistence with which the so-called Theodosian Wall has resisted all the pressures of the developing city of millions for centuries. In terms of legal and social history, a city wall can initially be understood as the outer boundary of an economic center (market), an administrative or legal area, or simply as the perimeter of a central location [1]. In addition to these functions, which are associated with a strong symbolism (e. g. depicted on seals), city walls naturally also have a military function, which, however, does not necessarily have to be interpreted as unambiguously as it may seem at first

glance. Despite the importance of city walls as an expression of protection and power, their ambivalence is shown by the fact that they are broken through by access roads and gates, for example, and therefore also represent a kind of interface or link between "inside" and "outside," between the city and its surrounding countryside. This function can be further extended by additional uses of the wall area as a warehouse, dwelling, store, execution site, cemetery, cloister area or cultivation area [2]. Apart from that, it is the military aspect that makes the present case particularly interesting. While in similar cases (e. g. in Central European cities) the ancient or medieval city walls were initially transformed into fortifications with bastions, ravelins, etc. (Vienna, Graz, etc.), in other cases they were directly

demolished, renouncing this development, in order to make room for other uses. In the case of Constantinople, there is also the fact that the conquest of the city in 1453 by Mehmet II. Fatih (1432-1481 AC), was followed by a century-long period of expansion of the Ottoman Empire: This points out two things, on the one hand the

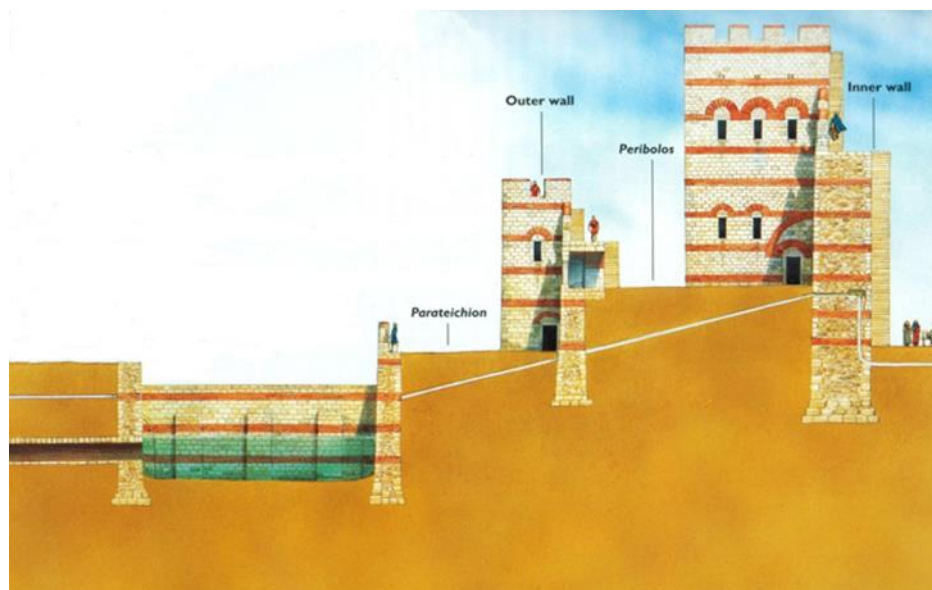
ineffectiveness of the walls in the face of increasingly effective guns, and on the other hand the decrepitude of such a structure in the face of a lack of immediate threats; all this makes the relatively long almost unchanged survival of the walls and their surroundings especially remarkable.

## METHODOLOGICAL FRAMEWORK

### Characteristics of the Study Area

The so-called Theodosian Wall (or “land wall”) is together with the sea wall (about 9 km length) and the wall at the Golden Horn (about 6 km) integral part of the late antique defensive system of the East Roman capital. Even the construction of the earlier fortification of Constantine the Great (270?-337 AC) might have been mainly part of the political program of the emperor as the wall was erected far away from the densely built area. Due to the permanent threat from the foreign forces during the reign of the Emperor Theodosius II (408-450 AC), the rampart was relocated another 2 km westwards. Again, it was not population pressure that was the decisive factor but rather efforts to prepare for possible besieging by ensuring that there was enough cropland to feed the population and to have a sufficient number of cisterns within the wall ring [4]. Later, this fortification was enforced by another two walls in the North; the first wall gave shelter to the district of Blachernae (under the reign of the Emperor Herakleios (575-641 AC) in the 7th century) and the second (under the reign of the Emperor Manuel Komnenos; 1118-1180 AC) attempted to strengthen the existing wall in this section [4]. The overall structure consists of an inner, about 12 m high stone/brick wall with a width

of 4.5-6 m that is strengthened by 96, mostly square towers at the forefront of the wall; on the upside of these constructions, measuring about 10 m x 12 m and a height of 15-20 m, there is a fighting platform for the defendants [5]. At the outside follows the Peribolos which is a continuous terrace with a width of about 15 m that primarily serves for the organization of the defense; behind the exterior wall in front (about 2 m thick at the base, about 8.5-9 m high and equipped with a battlement parapet) military contingents could be moved without the besiegers taking notice of it. This fortification was supplemented with a row of smaller towers, each of them was placed approximately in the middle of the towers of the inner wall; together they represent a very effective bulwark. A 15 m wide so-called Parateichion does not serve for any important military purpose but to keep the besiegers artillery away from the wall as far as possible. In addition to this, a trench - about 20 m wide and about 10 m deep - completes the defensive system; however, as the built-up terrain rises from the coast of the Sea of Marmara to the seventh hill and – interrupted by the valley of Lykos river– descends again from the fifth hill to the Golden Horn, only parts of the moat could be flooded in case of need (Fig.1).



**Figure 1.** Cross section of the Theodosian Wall. Source: Turnbull, 2004

The whole complex is penetrated by ten gates [4], whereby in the given context two aspects are of special meaning; on the one hand the strict functional distinction into five military and five public gates and on the other hand - as a result of that - the different spatial structure of both sides of the wall. Non-military elements like fields, vineyards, villae, cloisters, cemeteries and suchlike could thus only be reached via specific streets. Further information concerning the patterning of the military/non-military landscape can be gathered from the organization of the maintenance of the wall; under the reign of Theodosius II., for instance, every citizen, on whose parcel of land the wall was put up, was assigned to maintain the construction (e.g. after hostile attacks or earthquakes); at the same time, as a compensation they were allowed to draw a profit from the cultivation of the ground in the surroundings of the wall [6]. The so-called *Geoponika*, a text with agricultural and horticultural background and unclear provenance also speaks for the agricultural use of the area around the wall. The latest version of this source is attributed to the reign of the Emperor Konstantinos VII. Porphyrogenetos (mid-10th century), but important parts of the publication are linked to a certain "Scholastikos" Kassianos Bassos (from Bithynia, maybe a

winemaker), who himself apparently used older texts dating from the 4th century AC. *Geoponika* is divided into one Prooimion and 20 books (concerning weather rules, locational hints for houses, search for underground watercourses, construction of cisterns, cultivation of grain, grapes, vine and vinegar production, olive oil, fruits, vegetables and flowers, stock breeding, production of dairy products, honey and other topics). Chapter 12 of the text gives special hints for agriculture and horticulture in the intra-/periurban area. With reference to a law of the Emperor Justinian I. from 538 that regulates conflicts between proprietors and tenants, Koder refers in his study on *Geoponika* to the importance of the vegetable cultivation in the surroundings of the wall for the food supply of the town [7]. Based on this finding and on other sources (Demetrios Kydones, Ibn Battuta, de Clavijo) he postulates that more than 3 km<sup>2</sup> from a total of 6 km<sup>2</sup> of the sparsely populated area inside the land wall (covered with villae, monasteries and palaces) have been reserved for market gardening. Assuming a maximum transport distance of 6 to 7 km to the daily market, one can expect at least another 10 km<sup>2</sup> of cultivated land outside the walls – despite the cloisters, cemeteries and forested land.

### Elements of the Urban Structure

Based on the previous findings, the present work will further investigate the changes in the urban structure of the target area. Following the research of Benevolo [8] and Lichtenberger [9], who point out that city founders would have developed a clear idea of how their cities should look like from the very beginning, structural features typical for Byzantium/Constantinople/Istanbul can also be identified; for example, the agora, the acropolis and the private sphere of the Greek city, or the market function and the urban prominent objects as an expression of the spiritual and secular claim to power. (churches, palaces). Kubat [10] takes up these ideas in her description of the morphological history of Istanbul. Referring to Hillier [11], the author distinguishes between organically grown settlements (instrumental towns) with mainly demand-oriented structuring and symbolic towns with a more extensive, programmatically induced structure. For Istanbul she sees a succession of symbolic (in Byzantine times) and - in Ottoman times - instrumental town [10]. In more detail, the urban structures addressed are composed of a multitude of individual elements of different types and sizes, so that a summary into certain element groups seems absolutely necessary [cf. Streich, 12]. For the present study, for reasons of better overview and greater relevance, we have resorted to a simpler

model [13] that defines 6 structural element groups: Topography (hills, valleys, water bodies, shorelines, ...) not only determines the development of urban structures as a whole but also provides vantage points from which the cityscape is defined in terms of views or panoramas. Lines of movement are the traffic routes that usually have a high frequency of people and also represent meeting zones for passers-by but also interfaces to the adjacent areas (in the sense of shopping streets, etc.). In the urban structure, junctions usually represent connecting elements and multidirectional pivot points between the urban districts. Identity-creating areas are characteristic districts of the city, which are understood as cultural and/or social centers for tourists as well as for locals. Identification markers are buildings that are distinguished by their uniqueness and have high historical or cultural significance. Another characteristic is their high local and international recognition value, which is repeatedly used as a trademark. Green and recreational spaces as the basis for securing the quality of life in the long term complete the systematics applied here.

In the given situation, it can be stated that the topography of the region is relatively easy to describe and therefore has not been explicitly considered in the evaluations: The relief of the wall

environs between the Golden Horn and the Sea of Marmara runs over flat chains of hills separated by the valley of the Lykos River. Major changes (and

thus structural effects) have only resulted from the extensive backfilling, especially in the area beneath the southern end of the wall.

### **Maps and RS-Products as a Source for Urban Structural Analysis**

In attempting to analyze the manifestation of certain effects of urban development on the urban fabric in the study area, topographic cartography has a special place among all available sources for several reasons. From the aspect of the development history of the sources, maps cover an essential period between the high time of the veduta representation, on the one hand, and the advent of (air- and space-based) photography/remote sensing, on the other. Another aspect is the quality of the medium, which gains strongly in expressiveness through the obligatory adherence to certain rules in recording and production (e. g. projection, scale, cartographic model, subject matter, etc.). Finally, the periodicity of these works also makes it possible to classify the development of an urban settlement in a chronological system. The selection of the map series used for this work can therefore be justified by the following necessary characteristics: first, the source must meet the quality requirements of a map, whereby a modern map at a scale of 1:25,000 has been considered sufficient in terms of content and

accuracy and precision. Furthermore, the complete spatial coverage of the study area must be given, and finally, the entire period relevant to urban development (from the last third of the 19th century to the present) should be covered. For this reason, a selection had to be made from the multitude of available cartographic products [14]. To cover the period after 1944, for which no maps of sufficient quality are available to the public, contemporary products of remote sensing were used for the analyses. In accordance with the research question, the spatial focus of the investigation was narrowed down to the area of 500 m around the Land Wall. This also corresponds to a reasonable compromise between the area of interest and the coverage with suitable map material. A 500 m buffer was placed around the immediate wall area (cf. cross-section in Fig. 1) to delimit the closer study area; the area covered by this buffer can be considered sufficient for the research question. Only the burned regions of the city lie outside this boundary.

### **URBAN DEVELOPMENT AS A DRIVING FORCE**

In order to assess the development of the area of the Land Wall and its immediate surroundings, it is of course not enough to consider the building as such, but it is also necessary to take into account the overall urban development of Constantinople/Istanbul over time. Supplementing what has already been said, it can be stated that the first noteworthy changes in the area under study can only be observed with the beginning of the Tanzimat period (from 1839), whose reforms, together with the consequences of the Crimean War (1853-1856), brought with them not only sociopolitical upheavals but also an opening to the West. This changed, among other things, not only the concept of "city" but also the approach to its planning. The map prepared by H. v. Moltke during his mission to Constantinople from 1836 to 1839 (completed in February 1837) fits perfectly into this overall picture, as it represents one of the first western maps of its kind of the historical city and its surroundings. Here, the area surrounding the land walls is still relatively unaffected by the urban development changes of later epochs. In the period before or during the First World War, this development continued, partly interrupted by devastating fires, which left their traces in the

layout of the town. In addition, this era is characterized by a large number of projects, which, however, with a few exceptions (e. g. Gülhane Park, demolition of the artillery barracks at today's Taksim Square) remained stuck in the planning stage. As a result of the national renewal of the Turkish state after the First World War, a re-evaluation of Istanbul can also be noted. In this context, Gül speaks of "the neglected city" and quotes Sir George Clerk, who wrote in *The Times* on August 9th, 1938: "... But Constantinople, now officially Istanbul, was becoming more and more a city of memories, while a bleak village on a bare mountain plateau in the heart of Anatolia was being transformed into a town of immense public buildings and offices ... [15]". In the era of Kemalism (1933-1950), an attempt was made to develop a master plan with the help of foreign experts; under the leadership of Prost (chief planner in Istanbul from 1936 until his dismissal in 1950), a zoning of the city into industrial, commercial, residential and recreational zones was projected. Prost's ideas, with their absolute commitment to automobile traffic, brought profound consequences, especially for the Beyoglu area, but also for the west of the historic peninsula: although the Land Walls



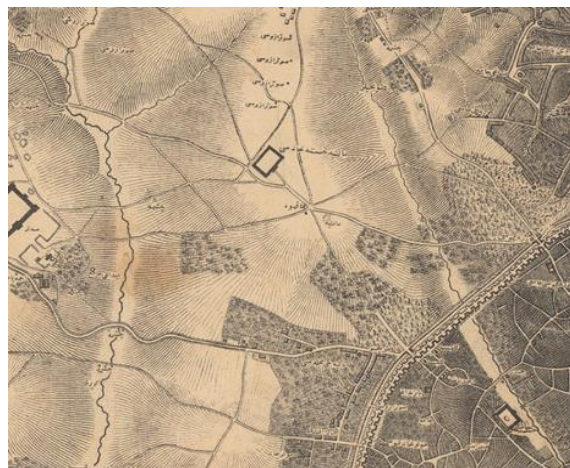
were to be preserved, their apron and also the area of the sea walls were to give way to the construction of spacious streets. With the change of the political system under the Menderes government, the planning was placed in other hands, but Prost's concept was largely retained. Nevertheless, the city's population grew by about 285,000 to a total of 1.2 million by the mid-1950s. Together with the industrial boom after World War II as the result of increased factory settlements, this led to a drastic increase in population density and enormous pressure on the housing market. To the argument of mobilizing the population was added the Menderes government's goal of making the city more attractive to international tourism. For the city layout, this meant not only the construction of the Istanbul-Yesilköy airport in the west of the city, but also the construction of generous traffic routes into the city (Vatan Street, Millet Street, the Yedikule-Yenikapi-Eminönü coastal road, across the Golden Horn to Karaköy and further along the west bank of the Bosphorus, as well as the Aksaray Transversal) and the demolition of the old wooden buildings in the surrounding area in order to better present the most famous mosques to visitors. A wave of

decentralization, the creation of the Ring Road and the construction of the first Bosphorus Bridge had a decisive impact on this era. Former Gecekondut settlements were replaced by apartment house settlements, which led to an increase in population density. Furthermore, to reduce this population pressure on the European side, additional ferry connections were used to shift the settlement centers to the Anatolian side. In order to preserve the historic areas, the development focus on the European side was shifted to the west from 1975 onwards, where new work and residential areas were to be created. In the last epoch of the 20th century, work continued on the construction of ambitious transport concepts. These included the construction of a new Galata Bridge, a second Bosphorus Bridge, and the construction of a second highway ring. Work has also begun on the construction of the subway. After a long period of focusing on traffic concepts, the city began to devote more attention to residential construction in 1999, with the declared goal of providing the population with higher-quality and safer living space.

## THE RESULTS

According to different travel reports dating from that second half of the 19th century, for instance, the land walls are often classified as ruins and to a large extent overgrown by vegetation [15]. The latter astonishes even more as at least until the reign of Sultan Abdülmecid I. (1823-1861) serious efforts to sustain the walls are recorded and just in the reign of his successor the economic reasonableness of these efforts was questioned. In view of the demolition of fortifications no longer needed in many cities all over Europe (e. g. Vienna) there was this odd situation of urban planning in Constantinople that it could not be decided about

the fate of the walls. In 1859, a commission was already installed, that should organize the demolition of all walls to the benefit of the growing together of the historical parts of the city with the newly developed ones, however, in 1885, the work had to be abandoned in order to draft more exact plans of the still existing fortifications. Shortly after installing a new commission, the whole fortification system was declared as a heritage building worthy of preservation via edict in 1913. Moltke's map shows what the Wall and its surroundings looked like during this period (Fig. 2).



**Figure 2.** Detail from the map of H. v. Moltke showing the wall section at Lykos river between Edirnekapi and Topkapi (published 1852). Source: Facsimile in the possession of the author

New stimuli concerning the further composition of the walls came from the traffic engineering branch. In this context it became apparent that the developing capital was hardly suitable for providing space to ensure sufficient transportation of passengers and goods. Especially the improvement of the regional and trans-regional land-based traffic was confronted with obstacles, as the walls hindered the construction of possible means of mass transportation (horse-) tram and railway. Finally, in 1864, two tram lines for the old downtown were projected: one from the ferry port Eminönü via Beyazit to Aksaray and onward to Yedikule or Topkapi, respectively, the other one also from Eminönü to Eyüp. While, however, both

horse-powered (and later electrified) tramlines preliminarily ended at the wall, following this strategy for the connecting to the European railway system was out of question. The relief enforced a routing from Sirkeci by Sarayburnu along the coast of the Sea of Marmara to Edirne and further on to Europe. As a result, the wall at Yedikule had to be penetrated and at least parts of it had to be demolished. Bradshaw's map - although dated 1879 - also shows little change in the study area (Fig. 3); however, the absence of the railroad line between Halkali and Sirkeci (completed in 1872) and the still intact wall in the illustration suggest an earlier date of recording (about 1855?).



**Figure 3.** Detail of the wall's southern end in Bradshaw's map dated 1879. Note the missing railroad track south of the fortress Yedikule. Source: Facsimile in the possession of the author



**Figure 4.** Detail of the wall's southern end in Stolpe's map (version 1882). Note the station of Yedikule (spelled Jedi Kule in the map). Source: Facsimile in the possession of the author

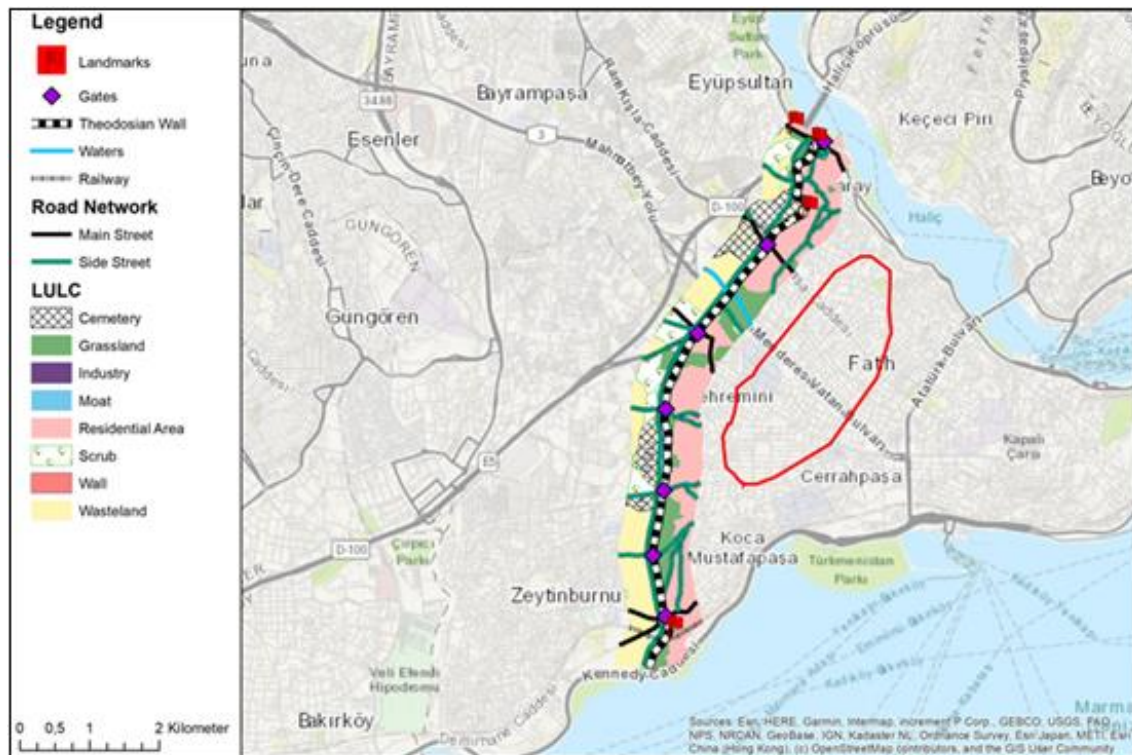
Although, compared to the previous example, the map of Stolpe from 1882 (first surveys 1855 to 1863) already shows much more details (hospitals

and cemeteries of different denominations, fields and scrubland or grassland), there are still no significant structural changes in the study area.



Remarkable are the still undeveloped areas within the land wall in the area of the Lykos valley and north of the Yedikule fortress. From the fact that later versions of the map show in a kind of imprint the course of the rails and even the railroad station Yedikule can be concluded that this object was added later (Fig. 4). The so-called Guedik-Pacha map or “Plan Général De La Ville De Constantinople” (Fig. 5) is considered to be one of the finest maps of the early 20th century Istanbul; compiled under French occupation of the area (1918-1923), the depiction shows only minor changes with regard to the extent and distribution of grassland (cemeteries, parks, meadows); undifferentiated grassland can be seen within the wall, although according to other sources these areas were used as gardens with fruit trees. This also applies to the narrow area in the immediate foreground of the wall, where intensive horticulture was practiced according to the depiction on

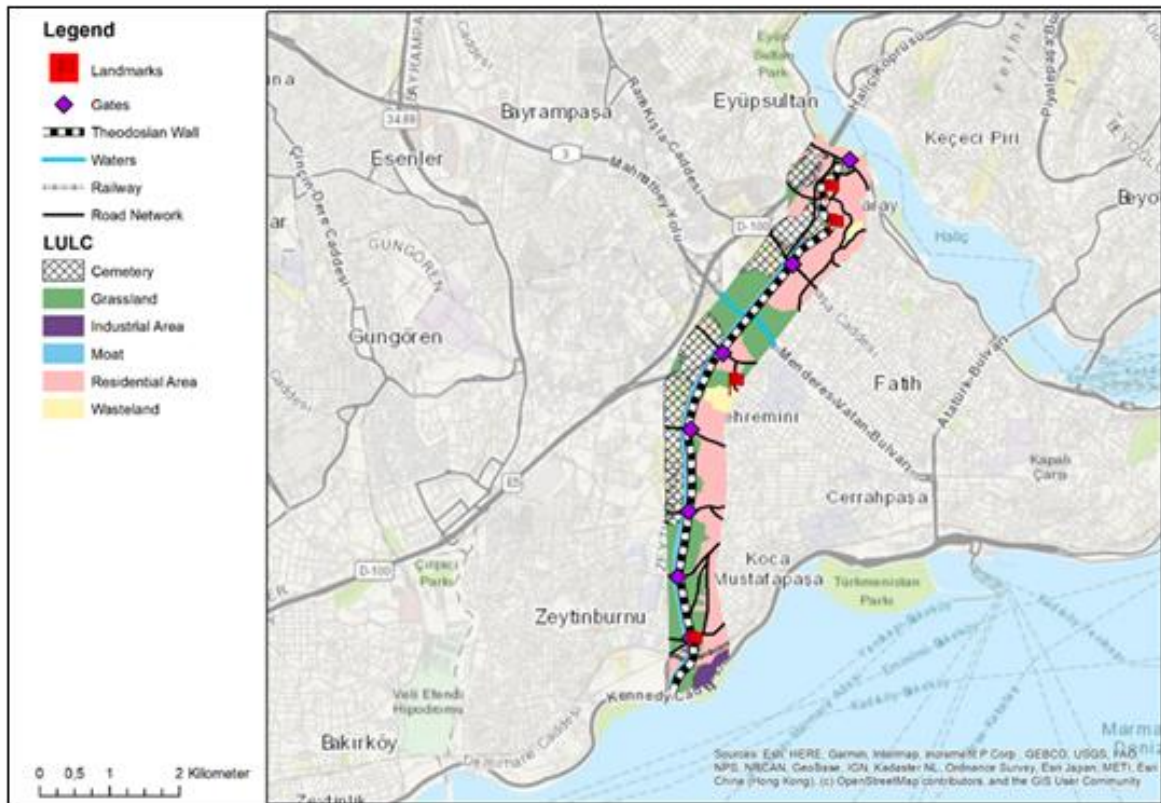
contemporary picture postcards. The residential areas also do not appear to have changed significantly in relation to older maps, although it must be noted that the most drastic changes lie outside the study area: between Davoud-Pacha and the southern banks of the Golden Horn extends a partially re-built burned area of about 8 to 9 km<sup>2</sup>. Most striking is the change in the street network. In the neighborhoods, although still predominantly unstructured and oriental in character, important streets such as the connecting roads to the surrounding countryside or to the city are undergoing a significant upgrade. The main traffic arteries begin to emerge which break breaches into the Land Wall at the places of the former city gates. In the northern part, on the coast of the Golden Horn, between 1893 and 1922 an industrial zone was established, which is bordered to the south by grassland and a residential area, which also has expanded to the south.



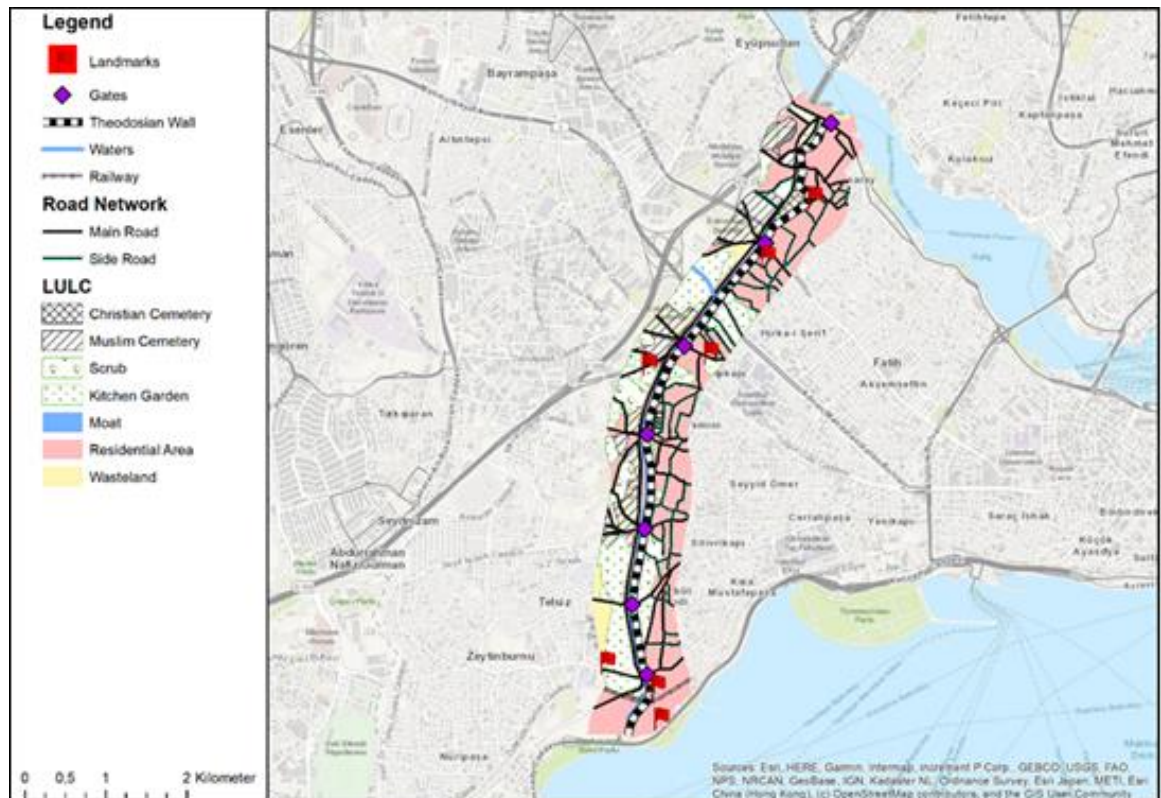
**Figure 5.** Results for the Guedik-Pacha map (published 1922). Note the area delineated in red in the center of the image; it marks the areas of the city burnt down by the fires of 1911, 1918, and 1919, with just over 10,000 wooden houses destroyed

The selected map from 1930 is a representation from the work of E. Mamboury, for many the first travel guide to Istanbul that also attempts to meet scientific standards. In terms of content, the map is comparable to that of Bradshaw (see Fig. 3). The map content is very differentiated and, given the author's biography, also promises high accuracy. Despite the densification of the transportation line

network, the structure of the modern road system is only rudimentary; large parts of the city are still served by cul-de-sacs. Edirnekapi, Topkapi, Gate of St. Thekla, Yedikule and Fatih are presented as landmarks. With regard to the grassland, hardly any changes can be seen around the wall. The settlement area reflects the condition of 1922 with the burned areas.



**Figure 6.** Results for the tourism map from E. Mamboury (1930, German version)



**Figure 7.** Results for the map of the Royal Engineers, Palestinian Field Survey Company, 524th, Sheet 41 (Istanbul), 1944

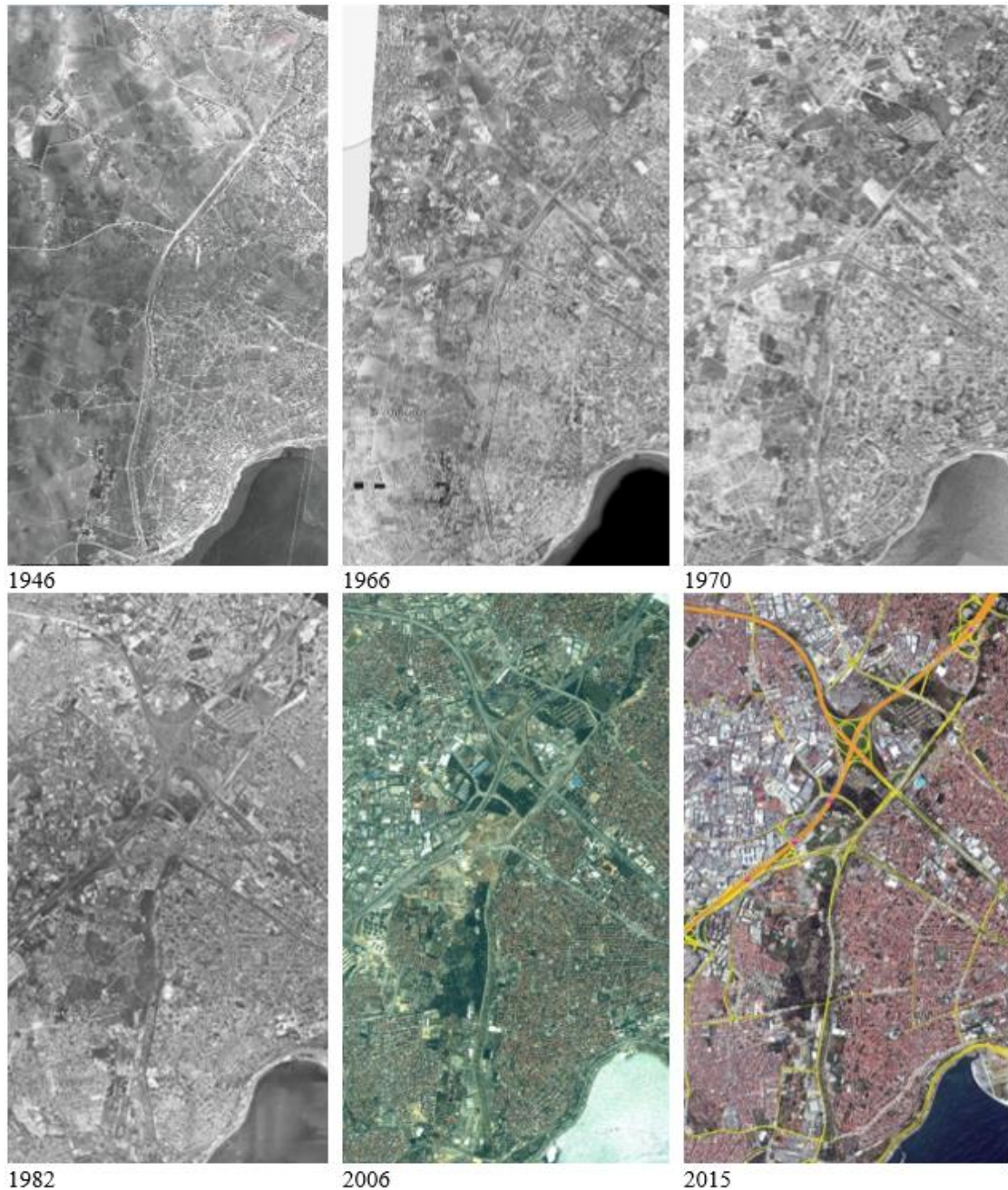
The last map presented here is a 1944 product of the Royal Engineers of the Palestinian Field Survey Company (Fig. 7). Although at a comparatively small scale (1:25,000), the higher degree of generalization is more than made up for by the

improved technical framework. Cemeteries are identified as Muslim or Christian; most of the grassland is classified as kitchen or vegetable gardens; the remaining greenery appears undifferentiated, occasionally interspersed with



scrubland. Factories have been built on the shore of the Sea of Marmara south of the railroad line, and two hospitals are located to the north. The burned areas have been rebuilt in the meantime and are easily recognizable by the checkerboard structure of the area. The street network already shows the basic pattern on which H. Prost's planning will be based a few years later. The application of remote sensing in urban research has progressed rapidly in recent years. The evaluation of urban development processes is a frequently asked task in the field of

urban planning. The focus is increasingly on the development of new methods of urban remote sensing for use in politics and administration. For Istanbul exists an aerial data record, which documents the urban development between the years 1946 and 2015 with several time gradations. Thus, a long time series of 70 years is available for Istanbul. The visualization of these time series offers the opportunity to clearly visualize the contained spatio-temporal changes on both sides of the Theodosian Wall (Fig. 8).



**Figure 8.** Subset of Time Series orthophotographs from 1946 to 2015. Source: <https://sehirharitasi.ibb.gov.tr/>



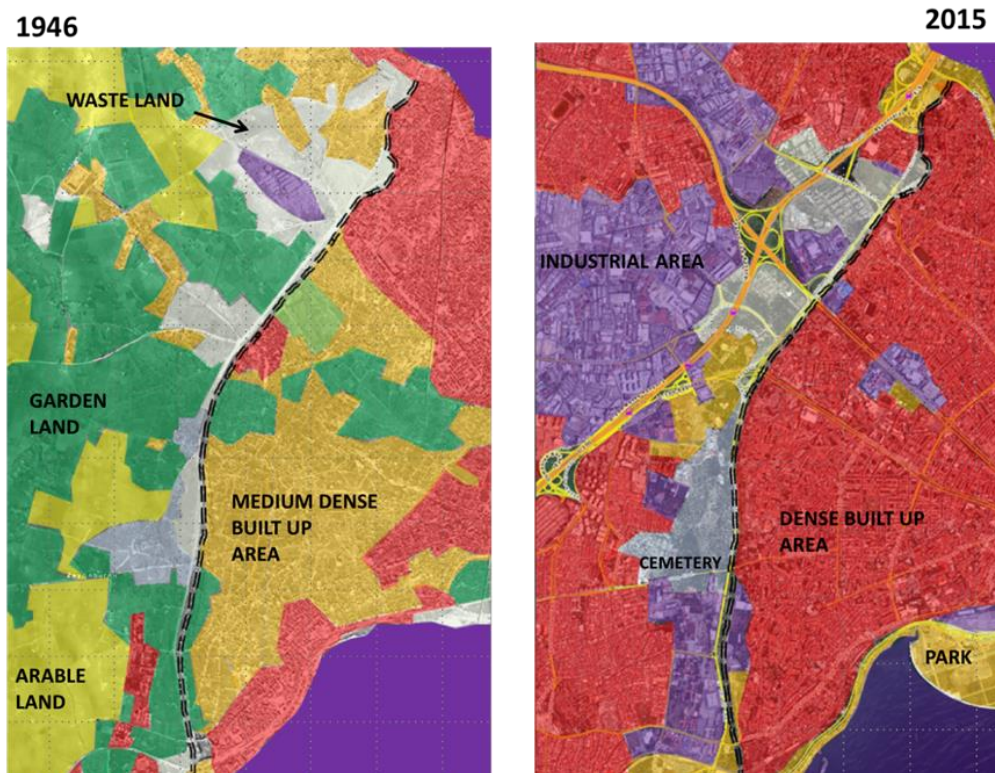


Figure 9. Comparison of land use structures in 1946 and 2015. Source: Sulzer et al., 2021

## Landuse Classification

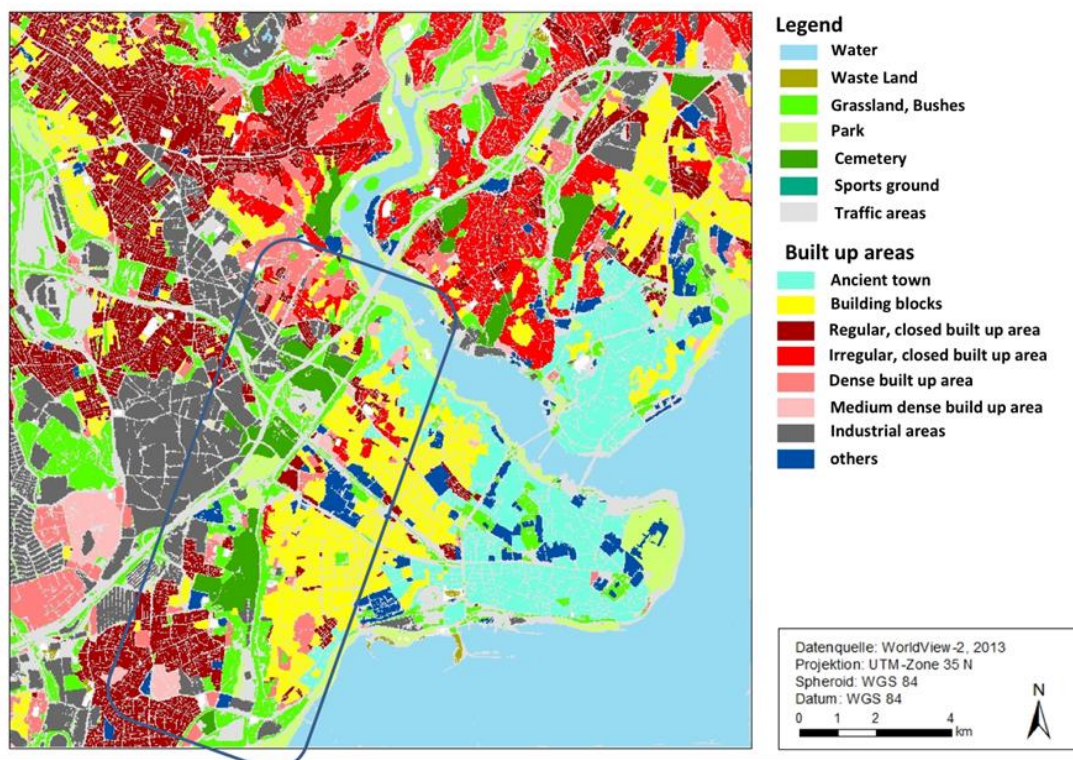


Figure 10. Land use and building structure classification of Istanbul. Source: Sulzer et al., 2021

The land use in 2015 is almost dominated by Denser Built-Up Areas within the city walls and in the northern and southern part outside of the wall. Increased Industrial/Commercial Zone outside the wall can be noticed. There exists no significant

Garden Land any more, except some relicts nearby by the southern part of the wall. Former Arable Land is transferred into Dense Built-Up Areas. Large Traffic Areas with highways were constructed in this former open land. Parks and

Grassland in front and along traffic lines, and shoreline along Marmara Sea and Halic represent new features of town development. Since the availability of modern remote sensing image data with different spectral, radiometric, geometric and temporal resolutions, their application possibilities and the comparisons of the evaluation methods are analyzed in numerous projects. Therefore a digital land use classification was performed with high resolution WorldView 2 satellite images (Fig. 10). The results show that it is possible to differentiate between urban structure types simply based on a land use and land cover classification without additional data like cadastral or height information.

This classification provides more than a simple information about land use. In doing so, different structural types of the WV2 scene are quantified with respect to their land use. Furthermore, the resulting data provide insight into the degree of sealing of the classes by looking at the traffic areas and buildings as one unit. With the availability of aerial imagery since World War II, more detailed insights into the changes in urban structure and land use on both sides of the Wall can be made. High-resolution, multispectral satellite image data such as WordView 1 also enable a largely digital or automatic analysis of the study area.

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