
UNDERSTANDING THE VULNERABILITY OF HISTORIC URBAN SITES

Nuran Zeren Gulersoy¹ | A. Balin Koyunoglu²

1 Istanbul Technical University

2 FMV Isik University

Turkey is a country which is vulnerable to great disasters. In particular, Istanbul as its former capital and the largest metropolitan city has suffered significant losses that have been well-reported. In the last 500-years, numerous earthquakes, fires, and other devastating disasters have damaged the city and caused a huge amount of losses for its inhabitants. Not only its monumental buildings but also its densely built housing areas have repeatedly been destroyed and rebuilt. In order to protect the multi-layered cultural and natural heritage of Istanbul, original methodologies were developed. These have included insurance maps, the implementation of innovative buildings techniques and evacuation strategies. This study includes an analysis of several major disasters in the history of Istanbul and post-disaster assessments based on historical site plans made between the 16th and 19th centuries. The outcome of this study is twofold: (1) the representation of significant disasters together with historical maps of Istanbul (2) the assessment of innovative site renovations and renewal methodologies to minimize destructive impact of the disasters. The impacts of the disasters were not only physical, economic and social but also caused a disruption in the authenticity of the continuous city form.

Keywords

Istanbul earthquake, quake, fire, cultural heritage, conservation

How to Cite

Zeren Gulersoy, Nuran; Ozcan Koyunoglu, Balin. "Understanding the Vulnerability of Historic Urban Sites". In Carola Hein (ed.) *International Planning History Society Proceedings, 17th IPHS Conference, History-Urbanism-Resilience, TU Delft 17-21 July 2016, V.03 p.353, TU Delft Open, 2016.*

DOI: <http://dx.doi.org/10.7480/iphs.2016.3.1351>

INTRODUCTION

Cultural Heritage is vulnerable to various risks which change from country to country. In Japan, traditional buildings constructed with combustible materials are prone to the risk of fire; in Nepal, the monumental and historical structures built with un-reinforced masonry as the main structural system are more vulnerable to the ground motion from earthquakes. In Turkey, as well as their being vulnerable to earthquakes and fires, natural, archaeological and historic urban sites are also under pressure from rapid urbanization, and the listed buildings in the urban fabric are prone to deterioration change and disappearance.

Risk mitigation in historical sites was discussed in detail during the 1980s, but the first platform on the protection of cultural heritage under risk began in 1992 with a series of seminars and meetings organized by ICOMOS, ICOM, and UNESCO. The Inter-Agency Task Force (IATF), was established in October 1992 for the protection of cultural heritage against many kinds of risk. The IATF works on five different issues: the creation of financial sources, emergency response, documentation, education and the preparation of regulations, and takes as its main legal base the Venice Charter of 1964. The group has worked on different cultural heritage protection field studies at various scales.¹ This pioneering step was followed by several other meetings and collaborations resulting in risk reduction projects for heritage sites.

Turkey is located on an active part of the Alpine-Himalayan belt. Consequently, it is a vulnerable country that faces a major earthquake on average every year and a half.² Turkey suffered two major earthquakes in the Marmara Region in 1999. The first one registered 7.4 on the Richter scale in August 1999 and before any real recovery could be made, a second hit the same region in November 1999 with a magnitude of 7.2. According to the official numbers, a total of 15,000 lives were lost. As this implies, Turkey has a history of large earthquakes that can be both progressive and adjacent.

During the last 500 years, Istanbul suffered several devastating earthquakes (Table 1). The earthquakes of August 1509, July 1690, May 1766 and July 1894 were recorded to have produced massive amounts of physical destruction as well as great social and economic losses. In addition to the significant number of casualties from each earthquake, monumental buildings and examples of civil architecture, now listed as world cultural heritage sites: the City Walls, Topkapi Palace, the Hagia Sophia, Fatih Mosque and the Grand Bazaar, as well as thousands of residences and inns, were damaged and needed to be reconstructed.

Addition to these major earthquakes, Istanbul also suffered a number of great fires. In 1729, a fire destroyed an eighth of the city, from the gate of Fener to Ayvansaray. The Beyoglu, Galata, and Karakoy districts have been fully burned in the Great Beyoglu Fire of 1870, and between 1782 and 1784, there was a further series of major fires. The destruction triggered new development decisions and preventive measures. After each disaster, more innovative techniques were used, and more durable materials were employed in the reconstruction processes. Also, the urban pattern was altered according to the needs of the recovery phase, for instance: the establishment of evacuation routes and temporary accommodation for disaster survivors.

Cultural and natural heritage sites are not only vulnerable to disasters such as earthquakes and fires, but are also under pressure from rapid urbanization and are prone to deterioration, change and disappearance. Significant efforts have been made to prevent physical damage and minimize the number of possible deaths, especially in the historic urban sites in Turkey, and principles to redefine goals, strategies and implement better risk mitigation have been developed.

DATE	LATITUDE	LONGITUDE	INTENSITY	MAGNITUDE	DAMAGE OF THE HISTORICAL MONUMENTS AND NEIGHBORHOODS
10.09.1509	40.90	28.70	vii	8	(1) Hagia Sophia, (2) Aqueduct of Valens, (3) Sea Walls, (4) Gates, (5) Topkapi Palace, (6) New Palace, (7) Sultan Beyazid II Mosque, (8) Sultan Mehmet II Mosque and its Complex, (9) Yedikule, Fener, (10) Davupasa, (11) Galata Walls, (12) Galata Tower, (13) Dikilitas, (14) Pera, (15) Prince Islands, (16) Maiden Tower, (17) Rumeli Fortress
11.07.1690	Epicentre offshore Istanbul		—	—	(1) Walls of Topkapi Palace, (2) Surrounding Residence, (3) Minarette of Fatih Mosque
22.02.1766	40.80	29.00	VII	9	(1) Sea Walls, (2) Tower in Yedikule, (3) Grand Bazaar, (4) Kitchen Complex and its Chimney, (5) Kariye Mosque, (6) Faith Mosque, (7) Eyup Sultan Mosque
10.07.1894	40.60	28.70	X	7,3	(1) Sirkeci Train Station, (2) Faith, (3) Besiktas, (4) Aksaray, (5) Edirnekapi, (6) Topkapi Palace, (7) Balat, (8) Bakirkoy, (9) Silivrikapi, (10) Princes Islands, (11) Ruhban Mektebi

TABLE 1 Chronological List of Istanbul Earthquakes and their Recorded Damage to Historical Monuments and Neighborhoods.

This paper focuses on great disasters that threatened the urban fabric of Istanbul, and those types which still threaten its urban conservation sites. It is aimed at producing a discussion on how to continue conservation studies to risk preparedness and preventive care for Turkey’s cultural heritage. In this study, the post-disaster assessment literature for urban conservation sites is investigated to better comprehend the recovery phases of the major disasters of the last 500 years, and to highlight the vulnerability of the urban conditions. Risk prevention and mitigation principles, consisting of structural peculiarities, open space networks, and routes for evacuations will be discussed based on the old site plans of Istanbul from the 1500s and the 1900s. Lastly, alternative interventions for the conservation of historic urban sites under the disaster risk will be discussed with case studies in urban planning, conservation and architectural design tools.

MAJOR HISTORICAL DISASTERS

Throughout history, the accessibility of water has been one of the most important factors in determining settlement locations. Therefore, historic settlements were often nestled in coastal areas. This location preference left them prone to disasters. Istanbul is a city that has suffered numerous earthquakes, fires, and other disasters. The disasters affected Istanbul socially, culturally and economically. During the Ottoman period, the first earthquake to cause significant damage occurred on January 16, 1489.³

The second major disaster was the 1509 earthquake, which was as known as the “Little Doomsday” (Figure 1). This disaster was one of the strongest earthquakes of the last five centuries in the Eastern Mediterranean region. It occurred in the Marmara Sea on September 10, 1509.⁴ The earthquake destroyed the urban center of Istanbul. In the early 16th century, Istanbul had an approximate population of 160 thousand, and the Galata neighborhood had 35 thousand households. The earthquake destroyed over a thousand residences, killed around 4 thousand people and injured a further 10 thousand. Almost all buildings in the Historic Peninsula and Pera were damaged. The land and sea walls of Istanbul were demolished, as were the gates of Edirnekapi and Yedikule. Additionally, the earthquake destroyed the remains of the Constantine walls, the walls of Galata and the Galata Tower. The Hagia Sophia was largely unscathed, except for damage to its added minaret and mosaics. However, the Blue (Fatih Sultan Mehmet) Mosque suffered damage to its four central columns, its main dome, and its minarets. Topkapi Palace was partially destroyed. The aqueduct of Valens and the Dikilitas (the Obelisk of Theodosius) in the At Meydani (Hippodrome) were also demolished.⁵

There was more damage to the neighborhoods of the Historic Peninsula as well as to the Princes Islands in addition to numerous other monumental structures such as the Rumeli fortress and the Maiden's Tower. In March 1510, reconstruction started with 3000 master builders and 11,000 assistants.⁶ Extra taxes were applied to pay the reconstruction expenses. The city was rebuilt.

The epicenter of the 1766 earthquake was the Historic Peninsula. The sea walls were severely damaged. The observation towers in Yedikule collapsed. The Grand Bazaar and several surrounding inns were destroyed. The kitchen complex and its chimneys of Topkapi Palace were wrecked, and the palace itself was damaged. Sultan Murat III (1717-1774) and his family moved to another city.⁸ The monumental Kariye and Eyup Sultan Mosques were demolished, and the Fatih Mosque was damaged.⁹

After the 1766 earthquake, executives ordered that brick and stone would be used as restoration materials, due to their durability in fires. However, timber continued to be used in individual reconstruction projects because it was believed that timber houses were safer in an earthquake.¹⁰ The government also implemented permanent housing units with identical or similar plans to the demolished buildings.¹¹ Additionally, the significance of cultural and historical heritage protection was stated, and cultural and historical heritage was prioritized in the reconstruction process.¹²

On July 10, 1894, another destructive earthquake occurred in Istanbul. A significant amount of civil architecture was damaged (Figure 2).¹³ The Grand Bazaar was destroyed. Most of the Sirkeci railway terminal along with the Fatih, Besiktas, Aksaray, Edirnekapi, Topkapi, Balat, Bakirkoy and Silivrikapi neighborhoods were demolished. Over 2 thousand buildings were wrecked. After this earthquake, Sultan Abdulhamid II (1842-1918) appointed Demetrios Eginitis (1862-1934), the head of the Athens Observatory, to carry out post-disaster assessments.¹⁴ This investigation included a scientific report into the magnitude of the earthquake and the affected regions. The report also indicated that the Princes Islands were affected by the quake. In particular, the Ruhban Mektebi on Heybeli Island was demolished.¹⁵

The earthquake of 1690 was also devastating for Istanbul. This earthquake caused many deaths and the destruction of many neighborhoods. It damaged the walls of Topkapi Palace, and the surrounding residences were severely damaged or destroyed. The earthquake that occurred on the morning of May 22, 1766, was the second most severe earthquake to occur after that of 1509.⁷ It caused a tsunami that swept through the Istanbul Bosphorus and several Bosphorus villages from Besiktas to Istinye were affected.

Victims of the disaster were sheltered in open urban areas. Local municipalities controlled daily diary supplies to prevent any epidemics.¹⁶ Immediately after the earthquake, a volunteer help commission was established.¹⁷ The commission assisted authorities in rehabilitation work and collected money to support reconstruction efforts. The rebuilding and rehabilitation work was completed in ten years.¹⁸



FIGURE 2 The earthquake of 1894. Damaged Historic Neighborhoods and Monumental Structures

The impacts of these major earthquakes were recorded in a broad range of documents including scientific reports, travelers' journals and the archives of foreign diplomats. The effect was so severe that most of the Byzantine remains and many Ottoman monuments were damaged. However, after each devastating earthquake, the reconstruction efforts were aimed at rebuilding the previous architectural pattern identically without any consideration of precaution or prevention evident in the planning process. Timber structures were common and continued to be used due to their perceived resistance to earthquakes even though those structures remained vulnerable to fires – the other significant danger to the city.

Fires were an inevitable risk in Istanbul. Each time the city was ruined, it was revived in its vernacular form. In addition to disaster-related city transformation, the increasing population of the downtown area also changed the building pattern. Connected buildings started to be constructed. The street network was shaped much more narrowly, and dead-end streets occurred due to a lack of planning. Thus, the urban fabric changed rapidly and with different dynamics. This changing urban fabric increased the likely impact of a fire or any other natural disaster.

On August 22, 1782, a fire started in a house in a neighborhood near the Gul Mosque (Hagia Theodosia) in the Cibali district.¹⁹ It took sixty-five hours to extinguish. Over 20,000 houses and workplaces were destroyed, and people drowned in the Golden Horn and the Marmara Sea while attempting to escape from the flames. Previously, there had been a fire in Samatya on July 10, which damaged 1000 houses, and on August 21, 1782, a fire in the Balat district had spread to the Fener, Fatih, Edirnekapi and Yenibahce districts and burned approximately 7 thousand buildings to the ground. Spanish cartographer Thomas Lopes (1730-1802) indicated the losses from these three fires²⁰. Almost half of the city was destroyed (Figure 3).

Together with the instances of fire and earthquakes, storms and lightning are also worth mentioning. One of the oldest illustrations of Istanbul shows a significant storm of 1489.²¹ One of the earliest cartographers, Hartmann Schedel (1440-1514) published a representation of a storm and the lightning strike that blew up a gunpowder storehouse in the At Meydani (Hippodrome) and destroyed the Gungormez Mosque (Temple of Zeus Hippios, later the Soter Khristos Tes Khalkes Church) (Figure 3). It is therefore quite possible to state that the city of Istanbul has witnessed a broad range of natural disasters throughout its history, and each time it was resurrected from the ruins.



FIGURE 3 (a) Thomas Lopez's Map – Ruined Districts in the Historic Peninsula of Istanbul indicated in Yellow (b) an Illustration by Deroy-Kohl after the fires of the 1780's, (c) Hartmann Schedel's Illustration, the Damaged Gungormez Mosque.

POST-DISASTER ASSESSMENTS

A French writer, Bertrand Bareilles came to Istanbul in 1880 and saw the remaining aftermath of the great Beyoglu fire of 1870. He indicated that the Pera district was still partly vacant, construction was continuing, and new buildings were being made of timber in a similar fashion to the remaining old part of the settlement.²² Although the city had lost a significant amount of structures, the post-disaster assessments still lacked mitigation measures regarding urban planning, architectural design tools, and conservation. These evaluations are the only documented surveys of the city, and only a few of them include recommendations to reduce casualties in the aftermath of a disaster.

Helmuth Karl Bernhard Graf von Moltke (1800-1891) was commissioned to establish a street network for Istanbul by Sultan Mahmud II (1785-1839), and he completed the maps around 1839 under the reign of Sultan Abdulmecid (1823-1861).²³ Moltke's aim was to allow access from all popular neighborhoods and gates. The importance of eliminating dead-end streets and developing neighborhood squares to decrease the impact of fire were stated in the plan report (Figure 4). Even though Moltke's plan was not implemented, his proposed street pattern is still available.

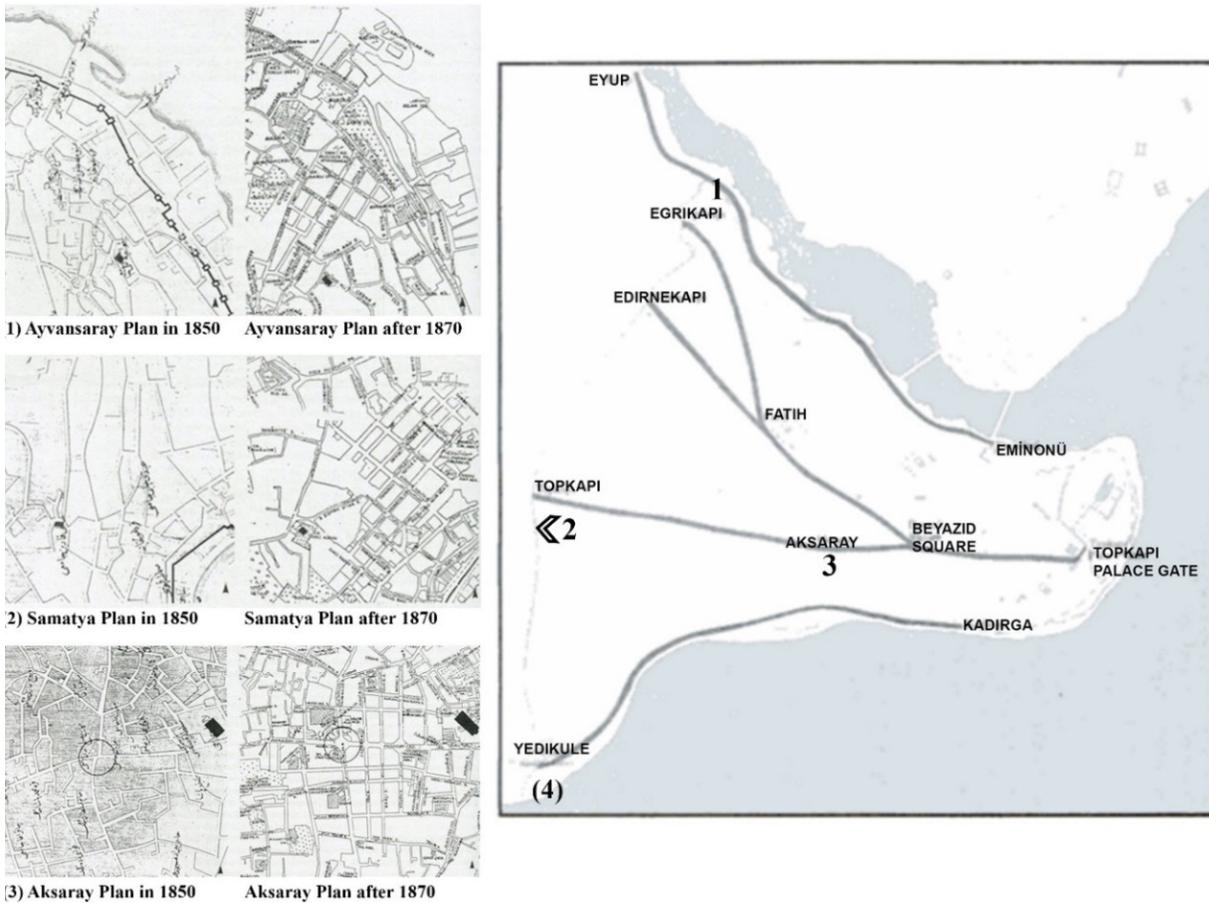


FIGURE 4 Moltke's Plan, The Proposed Transportation Axes for The Historic Peninsula of Istanbul and The Urban Pattern Transformation with New Planning Approaches

Insurance, which was then a common practice all over the world, started to be sold in Istanbul as a consequence of the economic collapse that follows a great disaster. Together with the effects of Westernization, several interactions were made with European countries to analyze the risks and results of disasters. After the 1870 fire, Charles Edouard Goad (1848-1910) developed a series of Istanbul fire insurance maps.²⁴ These are 1/600 scaled maps which consist of the functions, construction materials and sizes of buildings, the width of streets and the proximity of firefighting services and water supplies to estimate appropriate premiums (Figure 5). Existing gardens, market gardens, and historical structures were also included. These maps clearly indicate the urban development pattern and topography as well as the architectural pattern of the city.

Great fires plagued Istanbul several times in the 1870s, which made it a profitable market for insurance firms. Jacques Pervittich (1877-1945) was one of the cartographers who surveyed Istanbul.²⁵ The resulting maps systematically covered every district of the Historic Peninsula, Uskudar, and Kadikoy.²⁶ Similar to the previous insurance maps, these plans indicate construction materials, proximity to water and open green spaces as well as the functions of buildings.²⁷ The plans were completed between 1922 and 1945 (Figure 6).

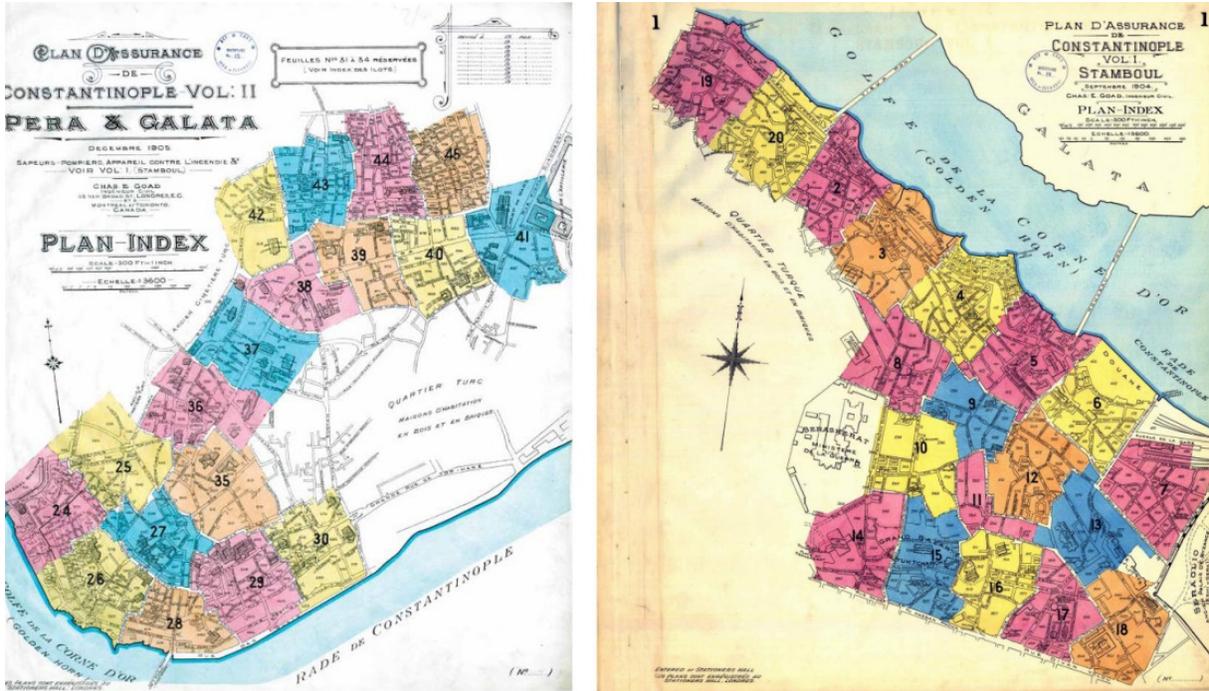


FIGURE 5 Goad's Insurance Map for Galata, Pera and South of the Golden Horn, Fatih, Eminonu

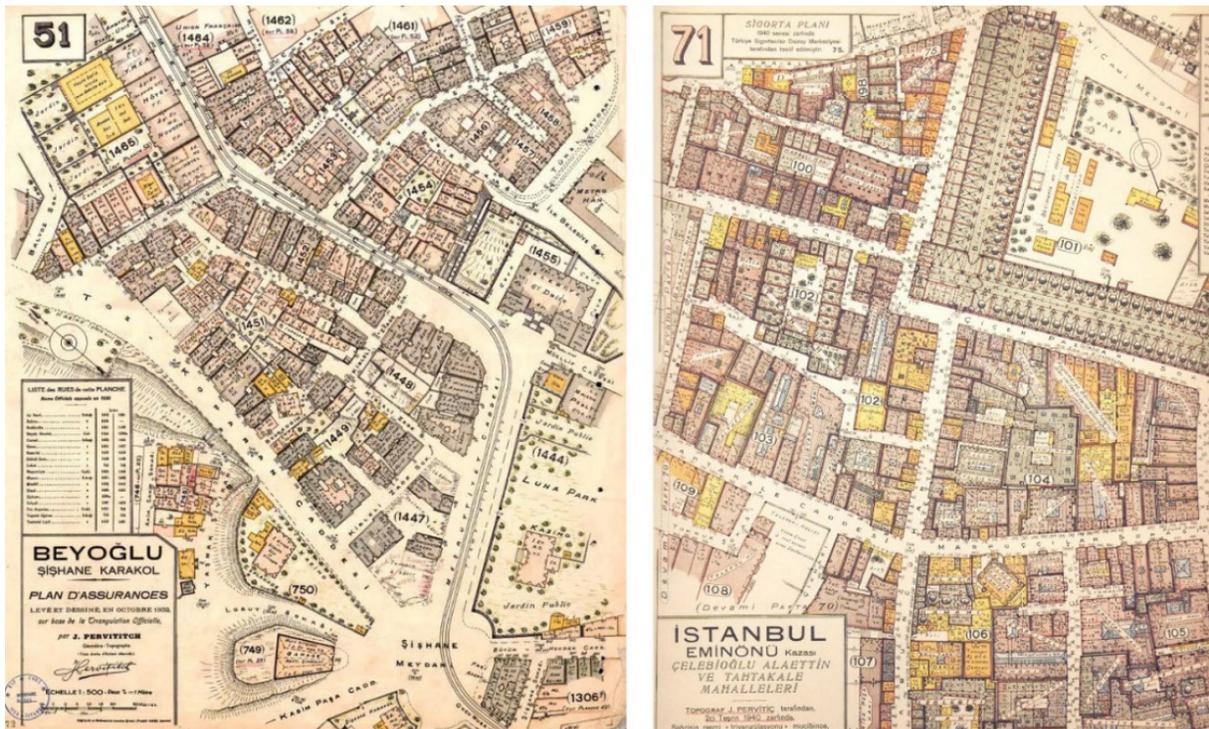


FIGURE 6 Pervititch's Insurance Plan for Beyoglu and Eminonu

The destructive effects of both the historic fires and earthquakes have made interdisciplinary conservation studies a necessity concerning the city's vulnerability to disasters. When the intervals of the historical earthquakes are studied, it becomes evident that the risk of a major earthquake will be a permanent threat to the cultural heritage of Istanbul (as well as for that of other cities in Turkey). In the 1999 earthquakes, not only monumental buildings such as the Orhan Bey Mosque, the Pertev Pasha Mosque, and the Sinan Pasha Mansion but also a significant amount of historical civil structures were damaged.

After the Izmit and Duzce earthquakes of 1999, immediate conservation actions were taken. The "Museum Disaster Preparedness Program" of 2000 and the "Seismic Conservation of Historical and Cultural Treasures of a World City" of 2003 were initiated. The aims of these programs were to provide an education for those authorities responsible for cultural heritage conservation and to equip them with the means to accurately survey the vulnerability of selected monumental heritage sites for the production of a risk-preparedness guideline. In addition to these efforts, the "Istanbul Earthquake Master Plan" was produced in 2003.²⁸ Heritage conservation is now taken into account in the physical strategic plans, and documentation, reinforcement, restitution and restoration studies on the monumental scale, and urban conservation projects at larger scales are conducted. Local action strategies are also made. Thus, the 1999 earthquakes became a catalyst for planning approaches that aims for the conservation of cultural heritage against any major disasters in Turkey.

RESULTS AND EVALUATION

An assessment of the historical maps and illustrations related to vulnerability indicates two distinct approaches: documenting major disasters and establishing post-disaster development plans. Major disaster documentation places an emphasis on destruction and includes districts and/or monumental buildings that are damaged or destroyed. Post-disaster development plans which consist of insurance maps and city plans constitute a new pattern for the city fabric with alterations in the construction of materials and its transportation network. The plans include some design recommendations; for instance, eliminating dead-end streets and establishing district squares for evacuation. Also, these plans state the need for material adjustments to sustain structural durability.

According to the historical maps and illustrations, the city transformed after each major disaster. A natural pattern of the transportation network yielded a new grid system. Timber buildings, bridges, and piers were reconstructed in stone, brick, and other more durable materials. Immediate repairs to bazaars, schools and sanctuaries were made to revitalize socio-economic activities. When the cartographic archives for the last-five-era period of Istanbul are assessed, certain improvements which were aimed at preserving the city against major disasters become noticeable. Even though there were not any special pre- or post-disaster conservation regulations, monumental buildings and structures such as the Blue Mosque, the Hagia Sophia, the Grand Bazaar, the City Walls and the Obelisk were reconstructed and had been preserved.

Today, certain national and international interventions for the conservation of at-risk historic urban sites are still discussed regarding urban planning, conservation and architectural design tools. According to the JICA and IMM report of 2002, some measures to reduce the vulnerability of buildings and urban structures are compatible with the regulations of some conservation area systems, especially in those districts of Istanbul that were developed before the 20th century.²⁹ This contradiction was also addressed by UNESCO and led to the initiation of some collaborative projects to explore management guidelines regarding the risk preparedness of World Heritage Cities in 1992.

In the twenty-year review of the Committee's activities (1992), the need for a systematic process above the national level of protection of cultural heritage was stated. In pursuit of this, a "Risk-Preparedness Manual" was published. This manual demonstrates principles and approaches of risk-preparedness for individual monuments, historic settlements, historic landscapes and archaeological sites.³⁰ It also includes site-specific guidelines and emphasizes the significance of national level involvement in improving conservation strategies against disasters. These initiatives will continue to evolve according to technological developments in the construction sector and advances among planning-related disciplines.

CONCLUSION

The old and historical plans, illustrations, and archives related to major disasters demonstrate the reiterated vulnerability of Istanbul's historic sites. These documents clearly indicate the level of destruction, reconstruction, and rehabilitation at both the neighborhood and individual structure scales. Between the 16th and 18th centuries, post-disaster implementations were mostly aimed at the rebuilding of damaged structures at the same location with an identical or similar character. During the Westernization period, these applications were transformed into new planning approaches, both in the scope of city pattern and the use of more durable construction materials.

The findings of this study illustrate two main points. First, the historical maps of Istanbul include a broad range of information related to significant disasters. Thomas Lopes' maps and the illustrations of Hartman and Deroy-Kohl give some indication of the damage caused by disasters, and the insurance maps of Pervitich and Goads' illustrate the post-disaster situation. This evidence can be interpreted as proof that the impacts of disasters on city life and city structure were too high to be ignored. Second, the historical maps constitute contemporary, site-specific solutions and recommendations for the preservation of the authenticity of the city while reducing the after-effects of great disasters. The information from these historic plans and illustrations may assist in estimating the damage from future disasters and may contribute to scenario planning and mitigation studies.

Disclosure Statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Nuran Zeren Gülersoy is a Professor of the Urban and Regional Planning Department at ITU Faculty of Architecture as well as an architect and urban planner. Her major areas of interest are conservation, urban planning, and urban design and planning history. She is the member of the ICOMOS, Council Member of EUROPE-NOSTRA and General Secretary of IPHS.

Balin Ozcan Koyunoglu is a doctorate candidate at Istanbul Technical University, the Urban and Regional Planning Department and a research assistant in FMV Işık University. Her academic works focus on subjects of historic urban conservation sites.

Endnotes

- 1 Herb Stowel. *Risk – Preparedness: A Management Manuel for World Cultural Heritage* (Rome: ICCROM, 1998).
- 2 *The United Nations Conference on Human Settlements (Habitat II) Report* (Istanbul: 1996).
- 3 Mustafa Cezar. “Osmanlı Devrinde İstanbul Yapılarından Tahribat Yapan Yangınlar ve Tabii Afetler” *Türk San’atı Tarihi Araştırmaları ve İncelemeleri* (1963) 380.
- 4 Nicholas Ambraseys and Finkel C.F. “The Marmara Sea Earthquake of 1509” *Terra Motae* 2(1990):2.167.
- 5 *Ibid.*, 169.
- 6 *Ibid.*, 170.
- 7 Hamiyet Sezer. “1894 İstanbul Depremi Hakkında Bir Rapor Üzerine İnceleme” *Ankara Üniversitesi Dil ve Tarih-Coğrafya Fakültesi Tarih Bölümü Tarih Araştırmaları Dergisi* 19 (1997): 29. 170.
- 8 *Ibid.*, 171.
- 9 *Ibid.*, 170.
- 10 Deniz Mazlum. *1766 İstanbul Depremi: Belgeler Işığında Yapı Onarımı* (Istanbul: İstanbul Arastırmaları Enstitute Publisihng, 2011). 42.
- 11 Şerife Ozata and Limoncu, S. “16. ve 20. yy Arası İstanbul ve Yakın Çevresinde Meydana Gelen Deprem Sonrası Barınma Uygulamalarının İncelenmesi” *Megaron* 9 (2014) 3. 222.
- 12 *Ibid.*, 221.
- 13 Maniyet Sezer. “1894 İstanbul Depremi Hakkında Bir Rapor Üzerine İnceleme” *Ankara Üniversitesi Dil ve Tarih-Coğrafya Fakültesi Tarih Bölümü Tarih Araştırmaları Dergisi* 19 (1997): 29.171.
- 14 Şerife Ozata and Limoncu, S. “16. ve 20. yy Arası İstanbul ve Yakın Çevresinde Meydana Gelen Deprem Sonrası Barınma Uygulamalarının İncelenmesi” *Megaron* 9(2014) 3. 222.
- 15 Hamiyet Sezer. “1894 İstanbul Depremi Hakkında Bir Rapor Üzerine İnceleme” *Ankara Üniversitesi Dil ve Tarih-Coğrafya Fakültesi Tarih Bölümü Tarih Araştırmaları Dergisi* 19 (1997): 29. 173.
- 16 Orhan Sakin. “Afetlerin Gölgesinde İstanbul”, in *Osmanlı Döneminde İstanbul’da Deprem*, ed. Ozturk, S. (Istanbul: IBB Publishing, 2009). 351.
- 17 Fatma Urekli. *İstanbul’da 1894 Depremi* (Istanbul: İletişim Publishing, 1999). 70.
- 18 Kıvanç Demirelli. “İstanbul’da Meydana Gelen Büyük Depremler ve İstanbul’un Geoteknik Açısından İncelenmesi” (Master Thesis, Istanbul Technical University, 2001). 85.
- 19 Slot, B. J. “The Fires in Istanbul of 1782 and 1784 According to Maps and Reports by Dutch Diplomatic Representatives” *Güney – Doğu Avrupa Araştırmaları Dergisi* 4 (1976). 47-65.
- 20 Ayşe Kubilay Yetişkin. *Maps of İstanbul 1422-1922* (Istanbul: Denizler Kitapevi, 2010) 37.
- 21 *Ibid.*, 37.
- 22 Bertrand Bareilles. *İstanbul’un Frenk ve Levanten Mahalleleri: Pera – Galata – Banliyöler* (Istanbul: Güncel Publishing, 2003) 47.
- 23 Zeynep Çelik. *The Remaking of İstanbul: Portrait of an Ottoman City in the Nineteenth Century* (Berkeley: University of California Press, 1993) 60.
- 24 Ayşe Kubilay Yetişkin. *Maps of İstanbul 1422-1922* (Istanbul: Denizler Kitapevi, 2010) 37 – 115.
- 25 Musemma Sabancıoğlu and Vekarić, N. “Dubrovnik’ten İstanbul’a Jaques Pervititch ve Ailesi”, *Tarih ve Toplum* 226 (2002): 38.
- 26 Jacques Pervititch. *Jacques Pervititch Sigorta Haritalarında İstanbul* (Istanbul: Tarih Vakfı Yayınları, 2003). Map no.51 and 71.
- 27 Beste Gursu and Dogan, Evrim. *Maps of Beyoğlu* (Istanbul: IMM, 2012) 25.
- 28 İstanbul Metropolitan Municipality (İMM) and Construction Directorate Geotechnical and Earthquake Investigation Department (İDMP). *Earthquake Master Plan for İstanbul* (Istanbul: IMM Publishing, 2003).
- 29 Japan International Cooperation Agency (JICA) and İstanbul Metropolitan Municipality (İMM). *The Study on a Disaster Prevention / Mitigation Basic Plan in İstanbul Including Seismic Microzonation in the Republic of Turkey* (Istanbul: IMM Publishing, 2002). 649.
- 30 Herb Stowel. *Risk – Preparedness: A Management Manuel for World Cultural Heritage* (Rome: ICCROM, 1998).

Bibliography

- Ambraseys, Nicholas and C.F. Finkel. "The Marmara Sea Earthquake of 1509" *Terra Motae* 2(1990):2. 110 – 190.
- Bareilles, Bertrand. *Istanbul'un Frenk ve Levanten Mahalleleri: Pera – Galata – Banliyöler*. Istanbul: Güncel Publishing, 2003.
- Cezar, Mustafa. "Osmanlı Devrinde İstanbul Yapılarından Tahrifat Yapan Yangınlar ve Tabii Afetler" *Türk San'atı Tarihi Araştırmaları ve İncelemeleri* (1963) 327 – 414.
- Celik, Zeynep. *The Remaking of Istanbul: Portrait of an Ottoman City in the Nineteenth Century*. Berkeley: University of California Press, 1993.
- Demirelli, Kıvanç. "İstanbul'da Meydana Gelen Büyük Depremler ve İstanbul'un Geoteknik Açından İncelenmesi" Master Thesis, Istanbul Technical University, 2001.
- Gursu, Beste and Evrim Dogan. *Maps of Beyoglu*. Istanbul: IMM, 2012.
- Istanbul Metropolitan Municipality (IMM) and Construction Directorate Geotechnical and Earthquake Investigation Department (IDMP). *Earthquake Master Plan for Istanbul*. Istanbul: IMM Publishing, 2003.
- Japan International Cooperation Agency (JICA) and Istanbul Metropolitan Municipality (IMM). *The Study on a Disaster Prevention / Mitigation Basic Plan in Istanbul Including Seismic Microzonation in the Republic of Turkey*. Istanbul: IMM Publishing, 2002.
- Mazlum, Deniz. *1766 İstanbul Depremi: Belgeler Işığında Yapı Onarımı*. Istanbul: İstanbul Araştırmaları Enstitüsü Publishing, 2011.
- Pervititch, Jacques. *Jacques Pervititch Sigorta Haritalarında İstanbul*. İstanbul: Tarih Vakfı Yayınları, 2003.
- Sabancıoğlu, Musemma, and Nenad Vekarić. "Dubrovnik'ten İstanbul'a Jacques Pervititch ve Ailesi", *Tarih ve Toplum* 226 (2002): 29 – 36.
- Sakin, Orhan. "Afetlerin Gölgesinde İstanbul", in *Osmanlı Döneminde İstanbul'da Deprem*, edited by Ozturk, S. 319 – 353. Istanbul: IBB Publishing, 2009.
- Sezer, Hamiyet. "1894 İstanbul Depremi Hakkında Bir Rapor Üzerine İnceleme" *Ankara Üniversitesi Dil ve Tarih-Coğrafya Fakültesi Tarih Bölümü Tarih Araştırmaları Dergisi* 19 (1997): 29. 169 – 197.
- Slot, B. J. "The Fires in Istanbul of 1782 and 1784 According to Maps and Reports by Dutch Diplomatic Representatives" *Güney – Doğu Avrupa Araştırmaları Dergisi* 4 (1976). 47-65.
- Stowel, Herb. *Risk – Preparedness: A Management Manuel for World Cultural Heritage*. Rome: ICCROM, 1998.
- Ozata, Şerife and Sevgül Limoncu. "16. ve 20. yy Arası İstanbul ve Yakın Çevresinde Meydana Gelen Deprem Sonrası Barınma Uygulamalarının İncelenmesi" *Megaron* 9(2014) 3. 217-227.
- United Nation. *The United Nations Conference on Human Settlements (Habitat II) Report*. Istanbul: UN, 1996.
- Urekli, Fatma. *İstanbul'da 1894 Depremi*. Istanbul: İletişim Publishing, 1999.
- Yetiskin, Kubilay Ayşe. *Maps of Istanbul 1422-1922*. Istanbul: Denizler Kitapevi, 2010.

Image sources

- Figure 1. Ambraseys, Nicholas and Finkel C.F. "The Marmara Sea Earthquake of 1509" *Terra Motae* 2(1990):2. 169.
- "Tarihsel Tsunamiler" last modified April 3, 2016, http://www.koeri.boun.edu.tr/tsunami/turkiyede_tsunami.html
- Figure 2. "Arkitera Galeri" last modified April 2, 2016, <http://www.arkitera.com/galeri/detay/53232/12/haber/11392.html>.
- "Murat Bardakçı'dan Deprem Uyarısı: Kıyametin Kopmasına Birkaç Sene kaldı" last modified April 1, 2016, <http://www.sondakika.com/haber/haber-murat-bardakci-dan-deprem-uyarisi-kiyametin-7602103/>
- Figure 3. Yetiskin Kubilay. Ayşe. *Maps of Istanbul 1422-1922* (Istanbul: Denizler Kitapevi, 2010) 37.
- "Alamy Image Galery Fire of Constantinople" last modified May 31, 2016, <http://www.alamy.com/stock-photo/fire-of-constantinople.html>
- Figure 4. Celik, Zeynep. *The Remaking of Istanbul: Portrait of an Ottoman City in the Nineteenth Century* (Berkeley: University of California Press, 1993)54-66-105.
- Figure 5. Gursu, Beste, and Evrim Dogan. *Maps of Beyoglu* (Istanbul: IMM, 2012) 25.
- "Plan d'Assurance de Constantinople" last modified May 31, 2016, <http://archnet.org/publications/10288>.
- Figure 6. Pervititch, Jacques. *Jacques Pervititch Sigorta Haritalarında İstanbul* (İstanbul: Tarih Vakfı Yayınları, 2003).

Table sources

- Table 1. Hosgoren, Yıldız. "İstanbul ve Deprem" *Türk Coğrafya Dergisi* 35 (2000). 16 – 22.
- Eyidogan, Haluk, and Uğur Güçlü. "Evolution of Earthquake Zoning Map of Turkey and a Proposal for a New Map" *Jeofizik* (1993). 101- 103 - 106.
- Nicholas Ambraseys and J.A. Jackson. "Seismicity of the Sea of Marmara (Turkey) Since 1500" *Geophys J.Int.*141 (2000). F3.
- Sezer, Hamiyet. "1894 İstanbul Depremi Hakkında Bir Rapor Üzerine İnceleme" *Ankara Üniversitesi Dil ve Tarih-Coğrafya Fakültesi Tarih Bölümü Tarih Araştırmaları Dergisi* 19 (1997): 29.