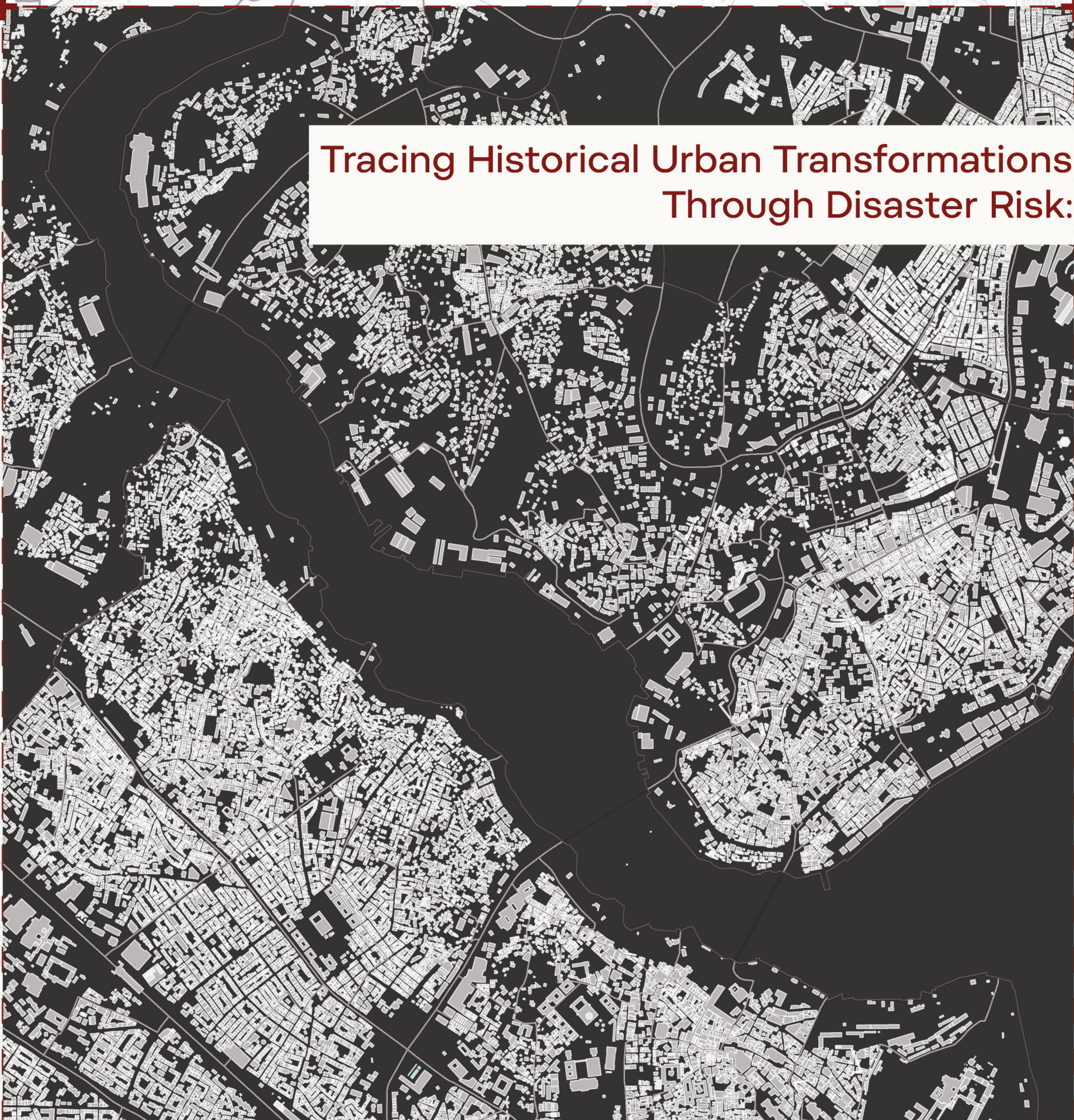
# Tracing Historical Urban Transformations Through Disaster Risk:



## An Analytical Study on Golden Horn, Istanbul's Urban History Through Hazard, Vulnerability and Exposure

POLITECNICO
DI TORINO

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Department of Architecture and Design
Architecture Costruction City

# Tracing Historical Urban Transformations Through Disaster Risk: An Analytical Study on Golden Horn (Istanbul)'s Urban History Through Hazard, Vulnerability,

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Politecnico di Torino has guided me through my whole academic and architectural career and has been an important presence in my life and the six years I have spent in Turin. I would like to thank this university for the academic framework that helped develop my design thinking and technical skills throughout my studies. This journey has not been easy but provided me with many life long skills and experiences.

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# Acknowledgements

## Abstract

Urban areas experience ongoing transformations because of disaster and risk factors which produce major impacts on their physical growth, social - economic systems and cultural heritage protection initiatives. Fires and earthquakes have played a recurring role in shaping the long-term urban and architectural development of cities, influencing planning decisions, building practices, and regulatory frameworks. In this context, disaster resilience offers a valuable analytical lens through which historical urban development can be re-examined in relation to risk, vulnerability, and adaptive responses.

This thesis develops a methodological approach to study the urban and architectural history of Istanbul through the perspective of disaster resilience, focusing on the Golden Horn (Haliç), one of the city's most historically layered and transformation-prone areas. The research re-reads its urban evolution by examining how past disasters—specifically fires and earthquakes—have interacted with planning practices, material transformations, and regulatory responses across different historical periods. Disaster resilience is thus employed as an interpretive framework to understand how urban development has been shaped in relation to disaster risk, rather than as a prescriptive tool for contemporary intervention.

Istanbul's Golden Horn, an old core of Istanbul provides a great example to explore these topics, therefore this thesis analyzes the historical urban transformation that Golden Horn has gone through over the decades after disasters such as fires & earthquakes, under the scope of five relevant and crucial parameters chosen from the Sendai Framework., and aims to provide knowledge about the DRM efforts and disaster resilience in the Golden Horn.

In order to accomplish this, the research studies the historical fire insurance maps of Istanbul and the replanning efforts of the city, comparing the material and structural changes with georeferencing the persistent landmarks and overlapping the maps created for the same zones. This comparative mapping approach allows the identification of continuities and ruptures in urban development, as well as the relationship between disaster events, rebuilding processes, and evolving building regulations.

By re-interpreting the urban history of the Golden Horn through the lens of disaster resilience, the thesis contributes to a deeper understanding of how historical urban transformations can be read in relation to disaster risk and resilience frameworks. The study aims to provide a critical and methodologically grounded reading of Istanbul's urban past, demonstrating how resilience-oriented perspectives can enrich the analysis of urban and architectural history in disaster-prone cities.

## Abstract

Le aree urbane sono soggette a trasformazioni continue a causa di fattori legati ai disastri e al rischio, che producono impatti significativi sulla crescita fisica della città, sui sistemi socio-economici e sulle iniziative di tutela del patrimonio culturale. Incendi e terremoti hanno svolto un ruolo ricorrente nel plasmare lo sviluppo urbano e architettonico di lungo periodo delle città, influenzando le decisioni di pianificazione, le pratiche costruttive e i quadri normativi. In questo contesto, la resilienza ai disastri offre una lente analitica utile attraverso cui rileggere lo sviluppo urbano storico in relazione al rischio, alla vulnerabilità e alle risposte adattive.

La presente tesi sviluppa un approccio metodologico per lo studio della storia urbana e architettonica di Istanbul attraverso la prospettiva della resilienza ai disastri, concentrandosi sul Corno d'Oro (Haliç), una delle aree più stratificate storicamente e soggette a trasformazioni della città. La ricerca rilegge l'evoluzione urbana dell'area analizzando il modo in cui i disastri del passato — in particolare incendi e terremoti — hanno interagito con le pratiche di pianificazione, le trasformazioni materiali e le risposte normative nei diversi periodi storici. La resilienza ai disastri viene quindi impiegata come quadro interpretativo per comprendere come lo sviluppo urbano sia stato modellato in relazione al rischio, piuttosto che come strumento prescrittivo per interventi contemporanei.

Il Corno d'Oro, nucleo storico della città di Istanbul, rappresenta un caso di studio significativo per l'analisi di tali tematiche. La tesi esamina pertanto le trasformazioni urbane storiche che l'area ha attraversato nel corso dei decenni a seguito di disastri quali incendi e terremoti, alla luce di cinque parametri rilevanti e cruciali selezionati dal Sendai Framework, con l'obiettivo di fornire conoscenze sugli sforzi di gestione del rischio di disastro (DRM) e sulla resilienza ai disastri nel Corno d'Oro.

A tal fine, la ricerca analizza le mappe storiche assicurative contro gli incendi di Istanbul e i successivi interventi di ripianificazione urbana, confrontando i cambiamenti materiali e strutturali attraverso la georeferenziazione dei landmark persistenti e la sovrapposizione di mappe relative alle medesime aree. Questo approccio di mappatura comparativa consente di individuare continuità e discontinuità nello sviluppo urbano, nonché di analizzare le relazioni tra eventi disastrosi, processi di ricostruzione ed evoluzione delle normative edilizie.

Attraverso la rilettura della storia urbana del Corno d'Oro mediante la lente della resilienza ai disastri, la tesi contribuisce a una comprensione più approfondita delle trasformazioni urbane storiche in relazione al rischio e ai quadri concettuali della resilienza. Lo studio mira a offrire un'interpretazione critica e metodologicamente fondata del passato urbano di Istanbul, dimostrando come prospettive orientate alla resilienza possano arricchire l'analisi della storia urbana e architettonica nelle città soggette a rischio di disastri.

## Özet

Kentsel alanlar, fiziksel büyümeleri, sosyo-ekonomik sistemleri ve kültürel mirasın korunmasına yönelik girişimler üzerinde önemli etkiler yaratan afet ve risk faktörleri nedeniyle sürekli bir dönüşüm süreci içerisindedir. Yangınlar ve depremler, kentlerin uzun vadeli kentsel ve mimari gelişimini şekillendiren, planlama kararlarını, yapı pratiklerini ve düzenleyici çerçeveleri etkileyen tekrar eden unsurlar olmuştur. Bu bağlamda afetlere karşı dirençlilik, tarihsel kentsel gelişimin risk, kırılganlık ve uyum sağlayıcı tepkilerle ilişkisi üzerinden yeniden değerlendirilmesine olanak tanıyan önemli bir analitik çerçeve sunmaktadır.

Bu tez, İstanbul'un kentsel ve mimari tarihini afet dirençliliği perspektifinden incelemek üzere metodolojik bir yaklaşım geliştirmekte ve kentin tarihsel katmanları en yoğun olan ve dönüşüme en açık bölgelerinden biri olan Haliç'e odaklanmaktadır. Araştırma, yangınlar ve depremler başta olmak üzere geçmişte yaşanan afetlerin, farklı tarihsel dönemlerde planlama pratikleri, malzeme dönüşümleri ve düzenleyici tepkilerle nasıl etkileşim içerisinde olduğunu inceleyerek Haliç'in kentsel evrimini yeniden okumaktadır. Bu kapsamda afet dirençliliği, güncel müdahalelere yönelik reçeteci bir araç olarak değil, kentsel gelişimin afet riskiyle ilişkili biçimde nasıl şekillendiğini anlamaya yönelik yorumlayıcı bir çerçeve olarak ele alınmaktadır.

İstanbul'un eski çekirdeklerinden biri olan Haliç, bu temaların incelenmesi için önemli bir örnek teşkil etmektedir. Bu nedenle tez, Haliç'in yangınlar ve depremler gibi afetler sonrasında on yıllar boyunca geçirdiği tarihsel kentsel dönüşümü, Sendai Çerçevesi'nden seçilen beş temel ve kritik parametre kapsamında analiz etmekte; bölgedeki afet risk yönetimi (DRM) uygulamaları ve afet dirençliliği süreçlerine ilişkin bilgi üretmeyi amaçlamaktadır.

Bu doğrultuda araştırma, İstanbul'un tarihsel yangın sigorta haritalarını ve kentin yeniden planlanma süreçlerini incelemekte; kalıcı kentsel odakların jeoreferanslanması ve aynı bölgelere ait haritaların üst üste getirilmesi yoluyla malzeme ve yapısal değişimleri karşılaştırmalı olarak analiz etmektedir. Bu karşılaştırmalı haritalama yaklaşımı, kentsel gelişimdeki sürekliliklerin ve kopuşların yanı sıra afet olayları, yeniden inşa süreçleri ve değişen yapı mevzuatları arasındaki ilişkilerin ortaya konulmasına olanak sağlamaktadır.

Haliç'in kentsel tarihini afet dirençliliği merceğinden yeniden yorumlayan bu çalışma, tarihsel kentsel dönüşümlerin afet riski ve dirençlilik çerçeveleriyle ilişkili olarak nasıl okunabileceğine dair daha derin bir kavrayış sunmayı hedeflemektedir. Tez, afetlere açık kentlerde dirençlilik odaklı yaklaşımların kentsel ve mimari tarih analizini nasıl zenginleştirebileceğini ortaya koyarak, İstanbul'un kentsel geçmişine eleştirel ve metodolojik olarak temellendirilmiş bir okuma sunmaktadır.

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## Acronyms

AFAD - Disaster and Emergency Management Authority of Türkiye (Afet ve Acil Durum Yönetimi Başkanlığı)
DRM - Disaster Risk Management
DRR - Disaster Risk Reduction
EMPI
İBB - Istanbul Metropolitan Municipality (İstanbul Büyükşehir Belediyesi)
ICCROM - International Centre for the Study of the Preservation and Restoration of Cultural Property
İDMP - İstanbul Deprem Master Planı (Earthquake Master Plan for Istanbul)
IFRC - International Federation of Red Cross and Red Crescent Societies
IPCC - Intergovernmental Panel on Climate Change
İRAP - İl Afet Risk Azaltma Planı (Provincial Disaster Risk Reduction Plan)
NAF - North Anatolian Fault
TAMP - Türkiye Afet Müdahale Planı (Turkish National Disaster Response Plan)
UNDRR - United Nations Office for Disaster Risk Reduction
UNESCO - United Nations Educational, Scientific and Cultural Organization
UN-SPIDER - United Nations Platform for Space-based Information for Disaster Management and Emergency Response.

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# Chapter 1

## Introduction

## 1. Introduction

Modern cities have become the main locations where large numbers of people, valuable resources and critical infrastructure systems exist which create the perfect conditions for present-day disaster risks. Cities have typically developed as a result of varied disasters and threats, reflecting the lasting impacts of natural and man-made events, such as earthquakes, floods, fires, and industrial accidents. Many urban governments, however, lack the planning capacity and enforcement needed to manage these threats. Most of the modern cities today still have and cherish a great amount of history and culture that goes hand in hand with their historical urban fabric that shapes these cities identities. Disasters are inevitable occurrences that can strike the land and people at any time, which has and can led to the destruction and loss of the core identity, urban fabric or significant cultural symbols. That is why, even today, in our developing current modern-day world, individuals and relevant authorities must educate themselves on disasters and related terminology to be adequately prepared. Emphasizing research and proactive efforts is essential to safeguarding cities, urban fabrics, and ultimately, cultural heritage. UNDRR states that cities become more vulnerable because their spatial planning remains restricted, their building regulations are weak, and their informal settlements continue to grow on peripheral land areas. In such settings, disaster risk reduction (DRR) – actions to prevent new risk and reduce existing risk, is widely promoted as a key strategy for sustainable urban development. Standardized terms enable people to better comprehend these problems. A hazard is defined as “a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage… or social and economic disruption”. The potential loss of life and injury and destruction of assets from such hazards constitutes disaster risk which depends on the combination of hazard occurrence probability and the extent of exposed assets and their level of vulnerability.

A community or system which faces hazards develops resilience through its capacity to withstand, absorb and adapt to and recover from resulting damage. The primary goal of DRR requires disaster risk reduction efforts to establish resilience which enables development targets to become achievable. Disaster Risk Management (DRM) is an efficient mechanism that entails an understanding of risks, minimizing vulnerabilities, and adopting sustainable and resilient action. DRM consists of four main components which include risk identification, hazard mitigation, emergency preparedness and recovery planning. The Sendai Framework established heritage-sensitive DRM strategies as the main focus of disaster risk management since the last few years according to international frameworks.

Disaster risk management practices involve systematic research, hazard mitigation, and preparedness strategies. Understanding the vulnerabilities and exposure of a place, city or a community is the key to create resilience and protection especially for those under high risk. Resilience and adaptive urban planning are recognized as key components of DRM through studies, which emphasize the role cultural heritage plays in maintaining community identity after disasters. Cities implementing effective DRM practices can reduce physical vulnerabilities while maintaining their cultural & historical continuity of their architecture, urban fabric or heritage.

Drawing on international perspectives, this thesis investigates the way cities should apply disaster risk management policies, particularly urban memory and possible risk preparedness as a factor of resilience.

Urban memory - the collective memory expressed via cultural symbols, building heritage, and shared histories - is essential for creating resilience and sustainability. Incorporating urban memory into disaster planning improves the ability to recover and main tainssociocultural continuity.

The study continues to examine Istanbul's historically significant Golden Horn area as the main research area, using these principles, and carry out a research about the past DRM measures and building regulations that were taken after significant disasters throughout its history.

Istanbul demonstrates the difficulties which cities face when dealing with natural disasters and protecting their historical sites and maintaining their ability to recover. It's unique location which has served as the capital to many important kingdoms, connecting Europe & Asia and lying beside the North Anatolian fault, Istanbul's long history has been punctuated by earthquakes, floods, fires and other disasters. Istanbul's growth "from Byzantium to Constantinople to Istanbul" has repeatedly been "shaken" by earthquakes, leaving both physical and historical traces on the urban landscape over centuries.[1] Throughout the 19th century, Istanbul was repeatedly reshaped by major fires, which periodically devastated large parts of the urban fabric and prompted regulatory reform efforts aimed at reconstruction and modernization.[2] In each case, disaster was not merely a natural event but the product of location, climate and the vulnerability of the city's wooden buildings and dense quarters. Istanbul contains a detailed historical database which enables this research to study how natural disasters and human activities produced its existing urban architectural heritage.

With its unique heritage and vulnerability to disasters, The Golden Horn serves as a research tool to study how hazards affect communities, regulations change and the transformation of material, spatial, and morphological characteristics of the built environment. Golden Horn offers a valuable case study for the exploration of how DRM actions can protect and develop sustainably urban cultural heritage and make the city more resilient to disasters. The study starts from the Tanzimat Period , 1839, in Istanbul, during the Ottoman Empire's reign ,when modernizing efforts started to take place and the building regulations that came along with it to protect the city from fires and earthquakes.

The Ottoman Tanzimat period which spanned from the middle of the 19th century brought significant changes to the city through modernization efforts that included disaster prevention as their main objective. The Street and Building Regulations of 1864, for instance, mandated wider street profiles than the medieval fabric. There were continuous fires occurring in the core of the city , around the Golden Horn area, one of which was the 1865 Hocapasa Fire, a very impactful event that made an influence on the city's urban fabric whilst being recorded by communities as a devastating disaster. After the fires, the government not only prohibited

1 Yerasimos, S. (1999). İstanbul: Tanzimat Dönemi Kent Planlaması. İstanbul: İletişim Yayınları.

2 See Zeynep Çelik, The Remaking of Istanbul (1993), for analysis of fires as catalysts for urban transformation during the Tanzimat period.

wooden house construction, but also prioritized using masonry materials for rebuilding the burnt structures and zones. Reconstruction commissions purposefully cut new avenues and straight thoroughfares to make it easier to transport brick, stone and sand for kargir (masonry) construction. These steps can be seen as early disaster risk management measures: by regulating building materials and urban form.

Through the analysis of important past disasters (fires and earthquakes) and current, ongoing vulnerabilities in Golden Horn, this research offers an analysis of the fire insurance maps produced by Charles E. Goad and Jacques Pervititich around the years, 1904 and 1940s , respectively, by georeferencing and overlaying these evidences of changes of materials and structures in the urban fabric of the Golden Horn. The historical maps show how the city built its architectural structure while it started to develop its initial methods for dealing with risks. Around 1900–1945, specialized fire insurance atlases of Istanbul were produced by Charles E. Goad and Jacques Pervititch under commission from European insurance companies.[3] The detailed city maps used color coding to show building materials, heights and usage which created a complete fire risk assessment through their extensive database of structural vulnerabilities. The fire-insurance plans from today function as a valuable historical archive which shows Istanbul's city structure and how building codes affected the area while showing the development of Golden Horn districts through material and design changes.

The research foundation of this thesis emerges from Istanbul's three interconnected historical patterns which include natural disasters and building development and government regulatory changes. The building regulations and modernization effects of the Golden Horn case are analyzed under five chosen parameters extracted from the Sendai Framework and context-based recommendations to harmonize DRM with heritage conservation, with the aim of contributing to the broader discussion of disaster resilience, sustainable urban development, and preservation of cultural heritage. In doing so, this thesis aims to understand whether "the past managed or is currently managing to help inform the future" of urban resilience in this ancient and dynamic city.

## 1.1 Research Question

The main research question is: *How have historically accumulated hazards, vulnerabilities, and regulatory responses shaped urban change in Istanbul's Golden Horn, and how do these processes inform current disaster risk and resilience, particularly in relation to cultural heritage?*

To respond, the research will investigate the concept of disaster risk (Chapter 2) and the relationship between risk variables (hazard, exposure, vulnerability) and cultural heritage. Then, it will investigate the principles of DRM (Chapter 3), starting with international frameworks, mainly Sendai Framework, and then principles regarding urban resilience. The Golden Horn is selected as the case study that combines theory with practice. Thus, Chapter 4 looks into the history of disasters (earthquakes, fires) and the transformation of Istanbul from the Ottoman period to the reforms that took place during the 20th century. Most

3 Dağdelen, İ. (Ed.). (n.d.). Charles Edouard Goad'ın İstanbul Sigorta Haritaları. İstanbul: İstanbul Büyükşehir Belediyesi.

importantly, however, it examines historical fire insurance maps produced by Goad and by Pervititch, which represent some of the first experiences regarding risk consciousness and planning, at least regarding the city of Istanbul. Finally, Chapter 5 examines how current DRM takes place in the Golden Horn, regarding local administration, current legislation, and current resilience plans. The series of research actions will hopefully show how through history, especially through mapping and archival research, current risk weaknesses or trends may emerge, which can contribute to current risk resilience-building, following the principle of "building back better."

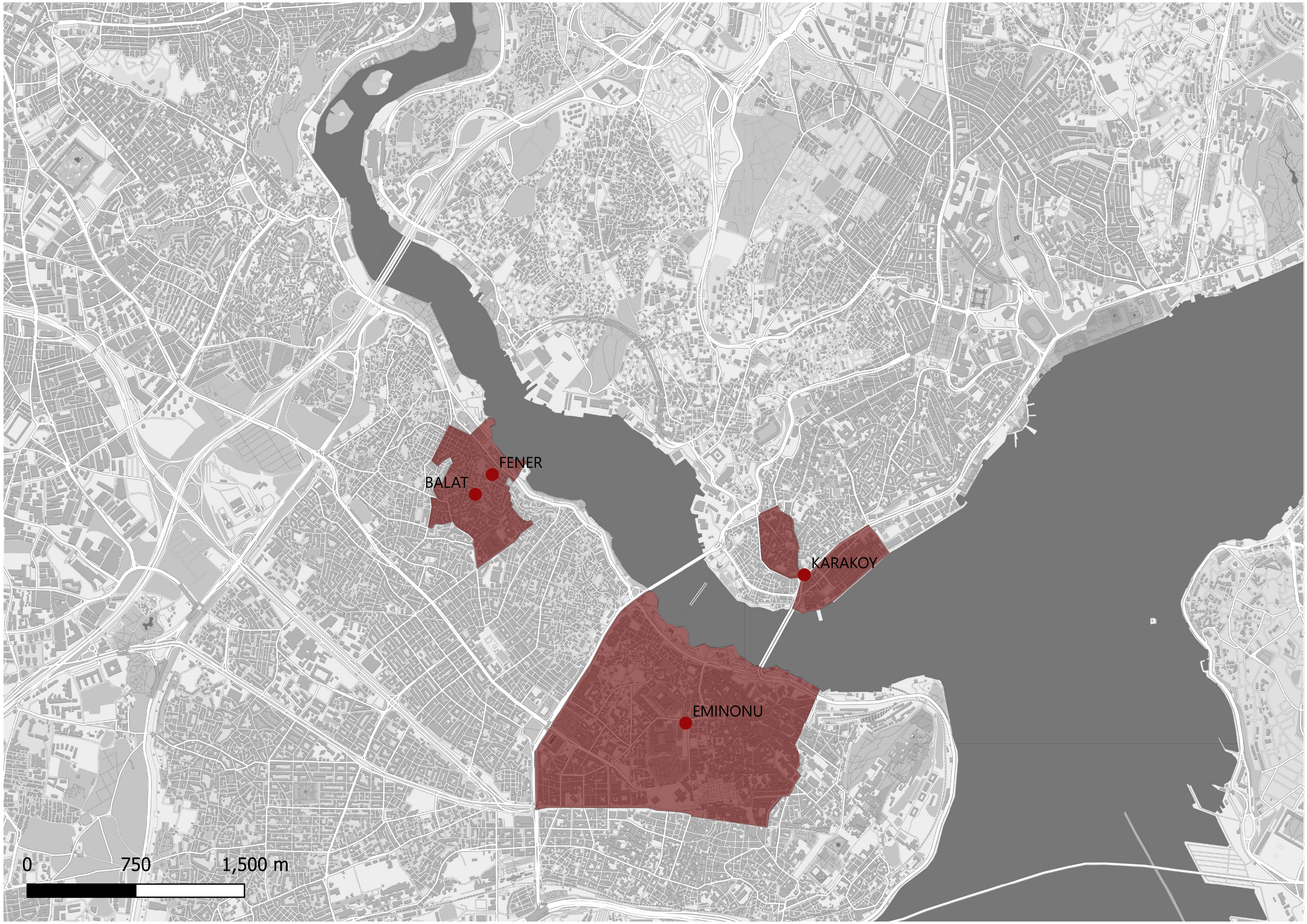
## 1.2. Case Study

The Golden Horn functions as a natural Bosphorus estuary in Istanbul which creates a perfect condition to study how disasters affect urban heritage sites. The corridor exists as a historical zone which dates back to Byzantium and the Ottoman Empire because it served as a crucial trade route and it represented the central part of imperial city planning. The urban structure of this area shows different architectural styles because it contains Ottoman wooden konaks and synagogues from **Fener** and **Balat** and stone warehouses and European-style apartments which were built during the late 19th century in **Karaköy** and **Eminönü**. (See Map 1)

The location of the city made it exposed to various threats because its strategic position made it susceptible to damage. The city experienced multiple earthquakes throughout history including the 1509 and 1894 earthquakes which together with fires and industrial accidents transformed both its physical structure and population distribution. The environmental disruptions which occurred during rebuilding phases created distinctive characteristics which architects and administrators could observe through building types and the new urban rules that emerged during Tanzimat.

The Golden Horn serves as an exemplary research subject because it contains two essential elements which make it valuable for study: its position as a historic city center and its status as a dangerous area according to modern earthquake risk assessments. The research investigates how past disruptions led to new regulatory systems and physical changes which appear in fire insurance maps and building codes while analyzing their compatibility with present-day disaster risk reduction standards including the Sendai Framework.

The dense and fine-grained urban fabric of Istanbul allows urban risk memory to be examined in detail, as it reveals both historical vulnerabilities and adaptive responses alongside its historical and present-day characteristics. The Golden Horn offers a particularly suitable context for studying the interaction between disaster risk management and historic urban fabric, as it is currently shaped by restoration practices and community-based disaster preparedness initiatives.




***Map 1:*** *Historically Predominant Architectural Typologies in the Golden Horn Area* 4

## 1.3. Methodology

This thesis uses academic literature, policy and framework documents produced by international institutions **(UNDRR, UNESCO, ICCROM),** and historical archival materials, including digital archives and repositories such as **SALT Galata**, to develop a conceptual framework, construct historical context, and conduct the case study research. The methodology combines a review of international disaster risk and urban heritage management frameworks to define the key concepts and terminology of the study. This is complemented by historical and archival research on Istanbul and the Golden Horn, including the analysis of historical maps and fire insurance maps.

The research begins by establishing a clear conceptual framework of what is; **hazard, disaster** and **disaster risk**, to set the tone and explain other key concepts such as exposure, vulnerability and risk that are the essential core of this thesis, in line with international frameworks.[5] The research defines disaster risk through **UNDRR Sendai Framework**[6] which establishes common understanding of how natural hazards create disaster risk when they affect human populations at their vulnerable points. The Sendai Framework for Disaster Risk Reduction (DRR) 2015–2030[7] established itself as a fundamental document which emphasizes that risk management needs full understanding of disaster risk through its multiple elements which include vulnerability and capacity and exposure of people, assets, environmental conditions and hazard characteristics.

The research followed the established method to identify and evaluate all risk factors which affect the case study through its assessment of hazard types, exposure levels, and urban heritage asset vulnerabilities. Sendai Framework's four priorities helped the research by underscoring the need to gather data on historical hazards in Istanbul, the exposure of the structures in the selected zone - the Golden Horn - their vulnerabilities and their structural and material changes over time after the hazards like earthquakes and fires, which are the most common two in the history of Istanbul. The Sendai Framework's guidance that disaster risk reduction must address a three dimensionality between exposure to hazards, vulnerability and hazard characteristics, provided a frame for the information that needs to be compiled in the Golden Horn case such as records of past disasters, historical building regulations, recorded social memory of disasters and insurance maps.

The research used specific resources which combined disaster risk reduction (DRR) with cultural heritage management to link risk management principles to heritage sites. The expert manual UNESCO's Managing Disaster Risks for World Heritage (2010)[8] served as a fundamental reference because UNESCO developed it together with ICCROM and ICOMOS and IUCN. The manual provided a particular method which helped organizations protect cultural and natural heritage sites from risks. The reason for picking this source is to understand how general DRR concepts can be adapted to heritage sites or the historical dense urban core of a city, in this case, Istanbul.

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5 United Nations Office for Disaster Risk Reduction (UNDRR), Terminology on Disaster Risk Reduction (Geneva: UNDRR, 2017).

6 United Nations Office for Disaster Risk Reduction (UNDRR), Sendai Framework for Disaster Risk Reduction 2015–2030 (Geneva: UNDRR, 2015), para. 15.

7 Ibid.

8 UNESCO, Managing Disaster Risks for World Heritage (Paris: UNESCO World Heritage Centre, 2010).

The first step of this research combined UNDRR definitions and the Sendai Framework's risk model with UNESCO's heritage-focused risk management approach, which later becomes the main concept to implement these ideas and frameworks for the last chapters that revisit and analyze the case study of the Golden Horn, the building regulations, replanning attempts and current day policies to mitigate disaster risk measures and prevent historical disasters. The thesis focuses on the Sendai Framework's emphasis on enhancing risk management and community resilience, an analysis of urban governance bodies like city planning departments and disaster agencies interact / work or conflict when managing heritage in hazard-prone zones.

This phase establishes the link between theoretical risk concept and practical heritage management which results in a set of criteria and considerations which are drawn from global guidelines and local experiences that would be applied when analyzing Istanbul's Golden Horn.

After establishing a solid foundation for a conceptual framework and grasping the idea of the key terms mentioned above which are essential for this thesis, the research proceeds to connect theory with context and the research question, focusing on **Istanbul, Golden Horn**. This section gives a broad understanding of the location, historical evolution, urban development and past disasters (fires & earthquakes) that occurred in the Golden Horn, to apply the risk concepts in a concrete setting. The narrative at this stage of the research depends heavily on Turkish historical and urban studies, publications and archival data. The main focus for this historical storytelling and research is to analyze how Golden Horn's landscape and risk profile have changed over time by using data like, publications and insurance maps.

**Zeynep Çelik's *The Remaking of Istanbul: Portrait of an Ottoman City in the Nineteenth Century (1993)***[9] was a pivotal source as one of the classic works on Istanbul's urban history and transition. Çelik's literature follows the modernization of Istanbul during the Tanzimat era and the later 19th century, detailing how the city's fabric was transformed by new infrastructure, regulations, and Westernizing influences. This historical knowledge is vital because many of the 19th-century transformations of Istanbul cities like the Golden Horn emerged from the need to address disasters such as frequent urban fires that frequently caused destruction in old Istanbul. Celik's narrative provided evidence and understanding for the city's adaptation to modern planning ideas. Using such historical analyses, the methodology linked the exposure of the Golden Horn area and their vulnerabilities (such as construction type & density) to specific periods of urban transformation.

Alongside Çelik, the thesis drew on the works of **Stefanos Yerasimos** and **İlhan Tekeli**, which offer comprehensive views of Istanbul's urban development across the late Ottoman and Republican periods. ***"Tanzimat'ın Kent Reformları Üzerine" by Yerasimos***[10] established the

9 Zeynep Çelik's The Remaking of Istanbul: Portrait of an Ottoman City in the Nineteenth Century (1993) is used as a foundational source on Istanbul's urban transformation. The work traces modernization processes during the Tanzimat and late nineteenth century, documenting how infrastructure, building regulations, and Westernizing reforms reshaped the city's urban fabric.
10 Stefanos Yerasimos, "Tanzimat'ın Kent Reformları Üzerine," in Modernleşme Sürecinde Osmanlı Kentleri, ed. Paul Dumont and François Georgeon (İstanbul: Tarih Vakfı Yurt Yayınları, 1999), 15–36.

Golden Horn's position through his 1999 study which examined Ottoman city development reforms. His research demonstrates that the Tanzimat reforms brought the first successful exercise of central power which established Istanbul urban governance through new building rules and municipal organizations that transformed Golden Horn area neighborhoods.

***Ilhan Tekeli's*** research, ***"The Development of the Istanbul Metropolitan Area: Urban Administration and Planning" (1994)***[11], outlines Istanbul's urban governance and planning amidst rapid population growth. He illustrates the industrial evolution of the Golden Horn area in the mid-20th century and its decline in industrial base.

The historical-contextual part of the research is grounded in an extensive review of archival documents, historical maps, planning reports, and visual materials, collected through both on-site archival research and digital repositories. Primary archival research was conducted at the **Istanbul Metropolitan Municipality (İBB) Atatürk Library** and the **SALT Galata Archives**, which provide complementary but distinct collections. The Atatürk Library holds a wide range of *Ottoman-era cartographic materials, early Republican planning documents, and municipal reports,* offering an institutional and administrative perspective on urban development. In contrast, the SALT Galata Archives provide access to fire insurance maps *(Goad and Pervititch series*), historical photographs, and private archival collections, allowing a more detailed reading of building materials, urban fabric, and neighborhood-scale transformations.

To document and analyze historical disaster events, multiple sources were consulted. Records of major fires were compiled using data from the **İBB and İBB Fire Department archives**, complemented by **Tarık Özavcı's *İstanbul Yangınları (1965)*[12],** which remains a key reference for historical fire incidents. For seismic activity, data related to the North Anatolian Fault system were obtained from the **United States Geological Survey (USGS)**. A comprehensive list of earthquakes affecting the broader region was extracted, after which events with direct or significant impact on the Golden Horn were selected. These datasets were organized in spreadsheet format and subsequently imported into **QGIS** to generate spatial representations of earthquake distribution relevant to the case study.

A central component of the methodology is the *spatial analysis of fire insurance maps*, particularly Charles Edward Goad and Jacques Pervitich, which constitute the main empirical material to identify how risk factors, urban fabric and building materials have changed or been managed over time. Goad's maps (1904–1906) and Pervititch's maps (1920s–1940s) are detailed urban plans that document building characteristics and urban infrastructure, essential for assessing fire risks.

These maps, obtained from the SALT Galata Archives and the Atatürk Library, were georeferenced in QGIS by aligning persistent urban elements—such as the coastline, major streets, and landmark structures—with contemporary base maps (Carto Light and OpenStreetMap). Throughout the research, QGIS was used as the primary tool for spatial analysis, georeferencing, and map production. This process enabled the comparison of

11 İlhan Tekeli's The Development of the Istanbul Metropolitan Area: Urban Administration and Planning (1994) provides a key reference for understanding the evolution of Istanbul's urban governance and planning frameworks in the context of metropolitan growth.
12 Tarık Özavcı, İstanbul Yangınları: 1923–1965 (İstanbul: Sigorta ve Reasürans Şirketler, 1965).

historical and present-day urban configurations and allowed the identification of areas where fires, regulations, and planning interventions led to measurable spatial transformations. The methodology in this section is therefore a combination of spatial/archival analysis and policy analysis, allowing a comparison between past and present risk management in this historic urban core of the city.

The research method utilized qualitative and visual analysis, alongside basic GIS-based overlay, to examine maps relevant to disaster risk. The Goad map of Eminönü and Pera / Galata from 1904 provided insights into fire vulnerability through its depiction of wooden versus masonry structures. By comparing these maps with Pervititch's 1940s maps, historical study is proven with evidence, such as a decrease in wooden housing and an increase in industrial facilities, indicating new risks. The comparative analysis illustrated significant urban changes, including the replacement of historic structures with industrial developments, while highlighting persistent vulnerabilities in densely built market areas near the shoreline.

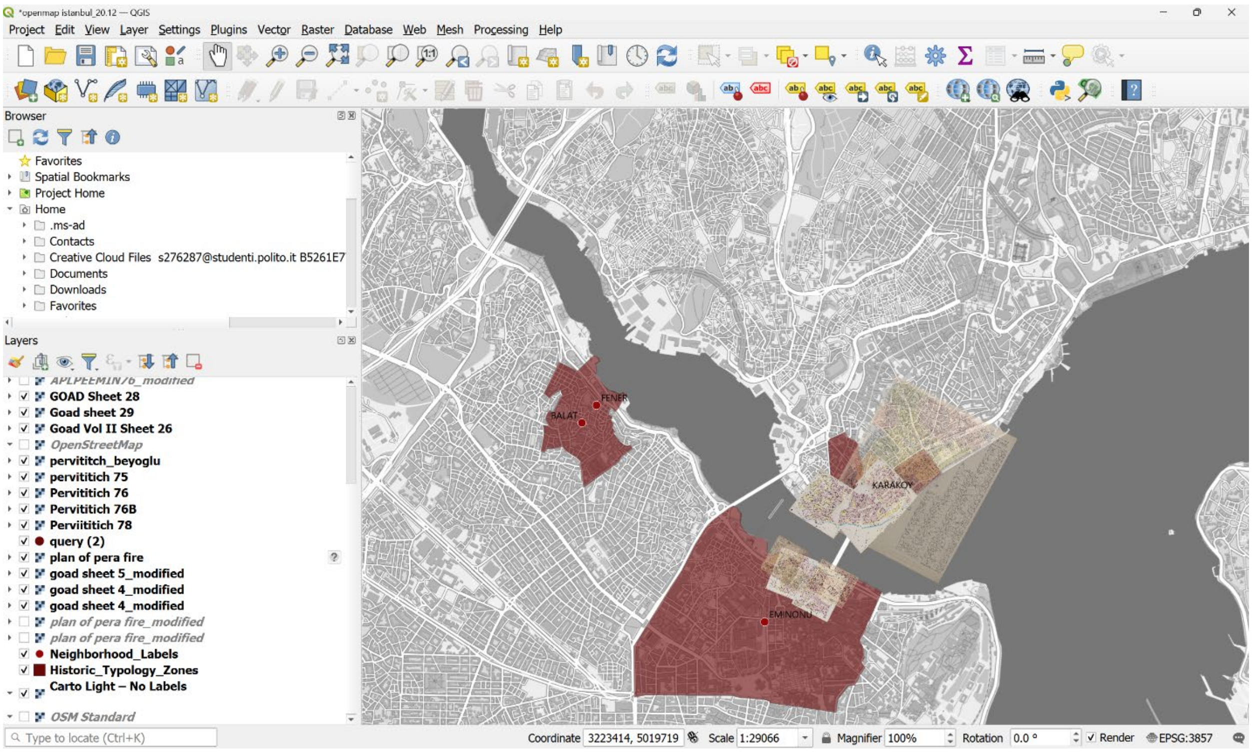


***Figure 1 :*** *QGIS workflow for historical cartographic analysis of the Golden Horn*
*Screenshot from QGIS showing the georeferencing and overlay of historical fire insurance maps (Goad and Pervititch) onto a contemporary base map, used to compare changes in urban fabric and street patterns over time.* 13

13 Author's screenshot from QGIS. Historical maps sourced from the SALT Galata Archives and the Istanbul Metropolitan Municipality Atatürk Library.

By carrying out this archival map analysis and overlay, the thesis established that the Golden Horn was a well-documented area in terms of historical risk mapping. The methodology therefore could reliably use these maps to discuss how **exposure** (number of buildings or assets in hazard-prone zones) and **vulnerability** (flammability of structures, access to emergency services) changed from the Ottoman era to the mid-20th century.

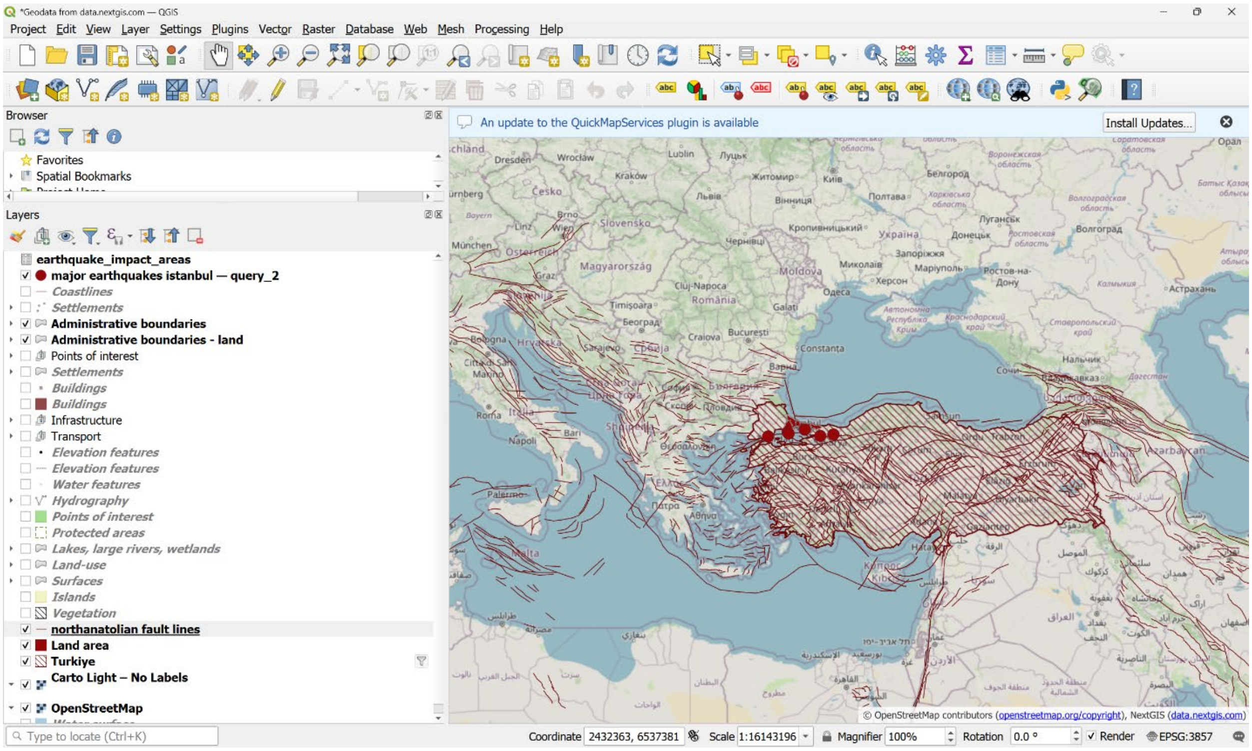


***Figure 2:*** *QGIS-based integration of seismic data and administrative boundaries. Screenshot from QGIS showing the spatial integration of historical earthquake events (imported from tabular earthquake datasets obtained from the United States Geological Survey) and North Anatolian Fault line data (imported from a public geodata repository), used to visualize seismic exposure relative to the Golden Horn.* [14]

14 Author’s screenshot from QGIS. Earthquake data sourced from the United States Geological Survey (USGS).

Following the historical and spatial analysis, the findings were interpreted in Chapter 5 through five selected parameters derived from the Sendai Framework for Disaster Risk Reduction, enabling a structured evaluation of how historical urban transformations relate to contemporary disaster resilience concepts.

Chapter 5 evaluates disaster risk management in Istanbul's Golden Horn area, focusing on the role of AFAD (Disaster and Emergency Management Authority of Turkey)[15], established in 2009. The research reviewed AFAD's strategic plans, guidelines, and project reports to identify any initiatives focused on cultural heritage or urban districts like the Golden Horn. AFAD's introduction of an "Integrated Disaster Management System" shifting emphasis from reactive crisis management to proactive risk reduction  guided the thesis in evaluating how well this principle is applied in a heritage-rich, high-density urban setting. The analysis examines whether heritage-rich areas like the Golden Horn have benefited from new risk mitigation measures, including building retrofitting and enhanced emergency response planning.

Later, the Provincial Disaster Risk Reduction Plan for Istanbul (IRAP)[16], focusing on local implementation and its impact on cultural heritage is used to evaluate the latest DRR measures in action in Istanbul. As of 2022, Turkey has established Local Disaster Risk Reduction Plans for all provinces, with Istanbul's plan being one of the first. The research involved reviewing IRAP documents to assess current hazards such as earthquake zones and flood risks, in conjunction with historical data. This comparative analysis aimed to evaluate the continuity and change in risk profiles, examining whether historically high-risk areas remain concerning today, the effectiveness of building codes, and the integration of heritage preservation with disaster planning.

The research methodology followed academic standards throughout all stages by verifying data through different information sources. Books, peer-reviewed articles, historical documents, maps, and official websites were all important source categories and are cited accordingly. The research design started with general concepts before moving to particular local information which followed a timeline from historical periods to current times. The research design combined conceptual analysis with empirical case study data to achieve a complete investigation of disaster risk management in Istanbul's Golden Horn area through its essential sources which included UN frameworks and UNESCO guidelines and Ottoman-era records and urban plans and modern DRR project reports.

15 Republic of Türkiye, Disaster and Emergency Management Authority (AFAD). About AFAD. Ankara: AFAD, established 2009. Accessed 31 December 2025. https://www.afad.gov.tr.

16 Republic of Türkiye, Disaster and Emergency Management Authority (AFAD). Istanbul Provincial Disaster Risk Reduction Plan (İRAP). Ankara: AFAD, 2022.

## 1.4. Structure of the Thesis

This research employs an interdisciplinary historical-methodological approach, combining archival analysis, spatial mapping, and qualitative synthesis. The thesis is structured in three parts. Part I (Chapters 2-3) establishes the global and theoretical context: it reviews the definition of disaster, risk , risk management, disaster risk reduction frameworks (e.g. Sendai, Hyogo, national laws), concepts of risk governance and assessment, and literature on cultural heritage and urban memory. Part II (Chapter 4) transitions to the Istanbul context: it surveys Golden Horn and the city's disaster history, the impact of these disasters and institutional changes such as building regulations, establishment of municipal fire brigades, creation of the Disaster and Emergency Management Authority, (AFAD), and planning evolution in the Ottoman and Republican periods. This includes analysis of major legislative milestones like building regulations after disasters, historic fire insurance maps & master plans and their impact on heritage zones. Analyzing the changes between the years of two major cartographers who produced the fire insurance maps of Istanbul by georeferencing the maps and comparing the maps one on top of the other in order to support the research and be able to make evidence based comments and analyses.

The Sendai Framework establishes a framework for analysis through its four main pillars which focus on risk understanding, governance enhancement, resilience investment and preparedness for better recovery.[17] The research framework uses historical qualitative analysis, theoretical research, analyzing historical maps and georeferencing to study how disaster management approaches from past to present influence cultural heritage sites in the Golden Horn. The research uses knowledge from different fields to establish links between past disaster events and their impact on both natural environments, human communities and modern risk management systems. The interdisciplinary approach integrates historical disaster knowledge and past disaster stories with DRM measures and necessities to represent the multifaceted nature of urban heritage resilience.

The analysis proceeded by organizing and reviewing the selected case study under the collected data in **Part III (Chapter 5)** (historical events, maps, policies, etc.) around **five key thematic parameters** derived from the Sendai Framework and the literature review carried out in previous chapters. This provided a consistent lens to examine the Golden Horn case. The five analytical parameters being:

**(1) Understanding Risk in the Golden Horn Region:** The research theme focused on determining and identifying the particular risks exist in the Golden Horn region. The research examined the specific hazards and their exposure and vulnerability levels within the Golden Horn region. This parameter is analyzed under the information about past risk awareness through historical accounts of earthquake damage reports and fire danger assessments of the wood-built residential districts. Modern data, such as GIS layers, were analyzed to map current

17 UNDRR. (n.d.). What is the Sendai Framework? United Nations Office for Disaster Risk Reduction. Retrieved November 5, 2025, from https://www.undrr.org/implementing-sendai-framework/what-sendai-framework#:~:text=Priority%201

risk factors (e.g. proximity of heritage structures to industrial facilities or water levels). By coding all such information under "Understanding Risk," the research assembled a comprehensive picture of the risk landscape of the Golden Horn. The parameter guaranteed that the analysis would examine disaster risk through its complete spectrum which includes physical hazard features and cultural exposure to risk and social weaknesses of affected communities. The findings under this theme later informed how well the case study region understands its risks and how that understanding has evolved.

**(2) Local DRR Strategies and Governance:** The Golden Horn case evaluated the institutional and governance systems for disaster risk reduction which align with Sendai Framework requirements for risk governance. The research and data gathering for this theme targeted any references to planning, policies, or organizational roles in managing disaster risk. The Ottoman municipal fire response activities and early warning system development archival documents received governance classification. The research examined existing policy documents which included municipal emergency plans, building regulations and fire insurance plans to determine the current practices of local governments and stakeholders for DRR efforts today. The recorded evidence showed how different time periods implemented various strategies and regulations and collaboration systems which started with neighborhood fire brigades in the past and evolved into the current disaster management framework that includes Golden Horn's cultural districts in Istanbul. The thematic approach enabled this research to evaluate the development of local DRR governance systems and their performance while determining if a unified strategy exists as Sendai requires for effective disaster risk governance at local levels.

**(3) Build Back Better:** Historical and Contemporary Practices: The "Build Back Better" initiative supports the main objective of the Sendai Framework to enhance disaster recovery and reconstruction operations. This theme focused on how the Golden Horn region has recovered from past disasters and whether post-disaster reconstructions embraced improvements or mitigations to reduce future risk. The researcher analyzed post-disaster reconstruction efforts through the assessment of how earthquake and fire-affected neighborhoods received better construction resources and design elements (such as firebreak streets and masonry instead of timber and elevated buildings near water sources). Records from significant events are studied for this,  the earthquakes with major impact and destruction in the Golden Horn region and the 19th–20th century fires that occurred in the city to detect evidence of contemporary construction methods. Accordingly, the research reviewed recent redevelopment projects and restoration initiatives in the Golden Horn to see if modern principles of "building back better" are applied – such as strengthening historic buildings during restoration. All such instances were coded under this theme. The research investigates how Build Back Better functions as a recovery resilience enhancement opportunity through a study of Golden Horn historical and contemporary practices. This provided a basis to evaluate learning over time and the continuity or change in recovery strategies in the face of recurrent risks.

**(4) Resilient Infrastructure and Services:** The theme of Resilient Infrastructure and Services examines the physical elements which strengthen the Golden Horn's resistance to disasters according to Sendai's focus on disaster risk reduction through resilience investments. This parameter studies data related to the built environment – including critical infrastructure (bridges, roads, ports, seawalls), public services (water supply, electricity, transportation networks), and structural features of buildings, in particular regarding their ability to withstand risks. Changes in infrastructure development through time, such as the strengthening of buildings after previous earthquakes are studied. The study includes documentation of technical solutions which included drainage systems for flood protection and fireproofing of historic buildings and seismic strengthening of heritage structures. By analyzing infrastructure investments in relation to past disasters, this section highlights the physical capacity of the city to withstand and recover. It ties into the Sendai notion of structural measures for resilience. The research looks at how infrastructure improvements often followed disasters It also covers the maintenance (or neglect) of critical structures like sea walls along the Golden Horn.

**(5) Community Engagement and Urban Memory:** This parameter focuses on heritage by investigating the connection between cultural heritage values and collective memory in relation to disaster events throughout the history of Golden Horn. The Sendai framework's people-centered approach extends through this parameter which includes both physical risk factors and community-based learning and memory of past disasters. This part of the research explores the role of local communities, social networks, and collective memory in DRM. This involves assessing how residents of the Golden Horn have historically been involved in disaster response and preparedness. It also delves into urban memory: how disasters are remembered or commemorated in the community & communities reacted to disasters through their storytelling about rebuilding cultural sites and their commemoration of tragic events. Qualitative descriptions from archives (letters, diaries, oral tradition) are used to illustrate community attitudes toward recurring hazards. This community-centric perspective supports the Sendai Framework's call for an "all-of-society" engagement in DRR, recognizing that effective risk management is shared among government, civil society, and citizens.

Using these five themes as an analytical framework, the data were thematically coded and synthesized. Archival narratives, map observations, and regulatory developments were categorized according to the parameters. For example, a particular historic fire would yield data under several categories: the governance response (e.g. was a new fire brigade formed?), regulatory outcome (new building law passed), infrastructure impact (water wells or fire towers built), community memory (stories recorded about that fire). This structured coding enabled a comprehensive yet organized analysis, ensuring that each dimension of DRM was evaluated for the Golden Horn case.

# Chapter 2

## Conceptual Framework of Disaster Risk: Hazards, Exposure and Vulnerability

# 2. Conceptual Framework of Disaster Risk: Hazards, Exposure, and Vulnerability

## 2.1. Disaster

A disaster is characterized by UNDRR Terminology on Disaster Risk Reduction[18] report as "a serious disruption of the functioning of a community or society", causing widespread human, material, economic, or environmental losses that exceed the affected community's or society's ability to cope using its own resources. Disasters can result from natural hazards (like earthquakes, floods, hurricanes) or human-made events (such as industrial accidents or conflicts). Disasters can be caused by many different kinds of hazards and can have devastating impacts on people and communities. The frequency, complexity and severity of their impacts are likely to increase in the future due to factors such as climate change, displacement, conflict, rapid and unplanned urbanization, technological hazards and public health emergencies. [19]

As stated in The Sendai Framework for Disaster Risk Reduction Report: *"Over the same 10 year time frame, however, disasters have continued to exact a heavy toll and, as a result, the well-being and safety of persons, communities and countries as a whole have been affected. Over 700 thousand people have lost their lives, over 1.4 million have been injured and approximately 23 million have been made homeless as a result of disasters. Overall, more than 1.5 billion people have been affected by disasters in various ways, with women, children and people in vulnerable situations disproportionately affected. The total economic loss was more than $1.3 trillion. In addition, between 2008 and 2012, 144 million people were displaced by disasters….. All countries – especially developing countries, where the mortality and economic losses from disasters are disproportionately higher – are faced with increasing levels of possible hidden costs and challenges in order to meet financial and other obligations."*[20]

A hazard is defined by the UNDRR as *" a process, phenomenon, or human activity that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources."*[21]

Economic development and environmental hazards are rooted in the same ongoing processes of global change. As the world population grows, more people are exposed to hazards. As that population becomes more prosperous, more personal and corporate wealth is placed at risk. As agriculture intensifies and urbanization spreads, more complex and expensive infrastructure is exposed to damaging events

A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading

18 United Nations Office for Disaster Risk Reduction (UNDRR), Terminology on Disaster Risk Reduction (Geneva: UNDRR, 2017), "Disaster."

19 International Federation of Red Cross and Red Crescent Societies. What is a Disaster? Accessed June 21, 2017. https://www.ifrc.org/our-work/disasters-climate-and-crises/what-disaster.

20 United Nations Office for Disaster Risk Reduction (UNDRR), Sendai Framework for Disaster Risk Reduction 2015–2030 (Geneva: UNDRR, 2015), I. Preamble, para. 4.

21 United Nations Office for Disaster Risk Reduction (UNDRR), Terminology on Disaster Risk Reduction (Geneva: UNDRR, 2017), "Hazard."

to one or more of the following: human, material, economic and environmental losses and impacts.

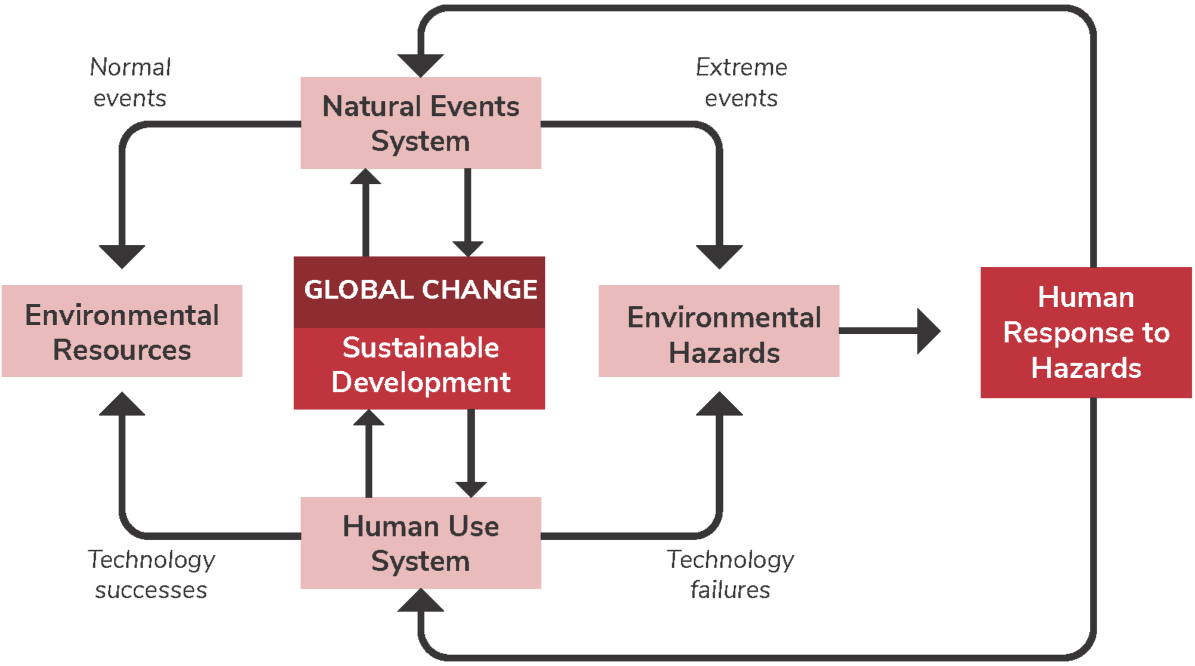


***Figure 1:*** *Conceptual diagram illustrating the relationship between environmental resources, natural events, human use systems, and environmental hazards, adapted from Keith Smith, Environmental Hazards: Assessing Risk and Reducing Disaster (1993).*
*Hazard systems conceptual model (natural events, human systems, environmental hazards, and responses), based on Burton, Kates & White, The Environment as Hazard (2nd ed., 1993).*
*Diagram redrawn and graphically modified by the author.*

The last decades have witnessed a series of costly disasters that have struck cultural centers: the 1997 earthquake in Assisi, which destroyed priceless Giotto frescoes; the 1996 earthquakes in Yunnan Province in China, which reduced to rubble parts of the World Heritage city of Lijang, the fire in Madagascar, which destroyed the national archive; the 1997 floods in eastern Germany; and the 1998 Central American hurricanes.[22]

22 Cannon, Terry. (1994). Vulnerability Analysis and The Explanation Of 'Natural' Disasters. Disasters, Development and Environment.

## 2.2. Definition and Classification of Hazards

A hazard is defined as any source of potential damage, harm, or adverse impact on people, property, and the environment[23] Hazard is best viewed as a naturally occurring, or human-induced, process or event with the potential to create loss, i.e. a general source of future danger.[24] Hazards can be classified into various categories based on their origin and effects. The two primary categories of hazards are **natural hazards** and **human-made hazards**, though some hazards may result from a combination of both.[25]

As this thesis aims to explore the disaster risks affecting the Golden Horn region of Istanbul, the primary focus will be on natural hazards, specifically earthquakes and fires. Throughout the city's history, these two risks have significantly influenced built environment and risk management systems, as well as its architectural and urban development. Urbanization and industrial development have intensified these threats, often exacerbating existing vulnerabilities through poor planning, inadequate regulations, and aging infrastructure. Given that the Golden Horn region has historically been a center for industry and maritime activity, understanding the intersection of both natural and human-induced hazards is essential for developing a comprehensive disaster risk framework. This broader analysis will provide the foundation for assessing how disaster risks have influenced urban planning decisions and continue to shape regeneration strategies in Istanbul today.

Thus, we may define hazard – the cause – as a potential threat to humans and their welfare arising from a dangerous phenomenon or substance that may cause loss of life, injury, property damage, and other community losses or damage.[26]

23 United Nations Office for Disaster Risk Reduction (UNDRR), Terminology on Disaster Risk Reduction (Geneva: UNDRR, 2017), "Hazard."
24 Smith, Keith (2013). Environmental hazards: assessing risk and reducing disaster. Routledge physical environment series (Reprint ed.). London: Routledge.
25 Wisner, B., Gaillard, J. C., & Kelman, I. (2012). Handbook of Hazards and Disaster Risk Reduction. Routledge.
26 Smith, K. (2013). Environmental Hazards: Assessing Risk and Reducing Disaster. Routledge.

## TYPES OF HAZARDS

| | CLASSIFICATION | EXAMPLE | COMMON EFFECT |
|---|---|---|---|
| **Natural Hazards** | Geophysical, Meteorological, Hydrological, Climatological, Biological | Earthquake, Flood, Hurricane, Wildfire, Epidemic | Infrastructure damage; fatalities; ecosystem loss |
| **Anthropogenic (Human-induced)** | Engineering; Urban; Industrial; Societal | Building collapse; Traffic accident; Industrial fire; Chemical leak | Casualties, economic loss, and social disruption |
| **Technological** | Industrial accidents; Technological failures | Chemical spill; Nuclear meltdown; Oil rig explosion | Toxic/radiation exposure; long-term health damage |
| **Environmental** | Ecosystem/Atmospheric disturbances | Oil spill; Air/Water pollution; Deforestation | Habitat degradation; health impacts; biodiversity loss |
| **Natech (Natural-technological)** | Natural-triggered Technological | Earthquake-induced nuclear disaster; Hurricane-triggered oil spill | Compound disasters; cascading failures; contamination |

***Table 1:*** *Types of Hazards, table produced by the author*

### 2.2.1. Natural Hazards

Natural Hazards are defined by the UNISDR, 2009 as " any natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption or environmental damage."[27] This type of description is well rooted in the literature but fails to provide a scale of loss. It is most suitable for hazards like earthquakes and volcanic eruptions, where the damaging processes are truly 'natural' in origin because they remain unaffected by human actions.[28]

These hazards originate from environmental or geological processes and are beyond direct human control. The category includes geophysical events (earthquakes, volcanic activity) together with meteorological/hydrological phenomena (storms, floods, droughts) and climate-related extremes. (See Figure 3). Earthquakes and storms represent fast-onset natural hazards, but climate change produces enduring environmental threats, which include heatwaves, rising sea levels, and severe droughts because of temperature and precipitation pattern changes. They include:

- **Geologic / Geophysical hazards:** Earthquakes, tsunamis, volcanic eruptions, landslides, avalanches
- **Atmospheric:** Tropical cyclones, tornadoes, hail, ice and snow
- **Hydrologic hazards:** Floods, storm surges, drought
- **Meteorological hazards:** Hurricanes, tornadoes, extreme temperatures.
- **Biologic:** Wildfires, epidemic diseases [29]

The main types of natural hazards that affect cultural assets are fire, flooding, earthquakes and related disasters, tsunamis, land and mudslides and avalanches, winds and tropical storms, and sea level rise. Examples of types of damage to historic buildings and their contents, historic districts, archaeological sites, and cultural landscapes follow.

This thesis will explore how urban transitions have been shaped around the Golden Horn in İstanbul after each influential and impactful earthquake and fire throughout the years starting from the Tanzimat Era, which corresponds to circa 1839, which requires a research about these two significant natural hazard that shaped the urban transformations happened in the 19th century Istanbul.

27 UNISDR, 2009 , as citated in Keith Smith, Environmental Hazards: Assessing Risk and Reducing Disaster, reprint ed. (London: Routledge, 2013), 4.
28 Keith Smith, Environmental Hazards: Assessing Risk and Reducing Disaster, reprint ed. (London: Routledge, 2013), 5.
29 List summarized from Keith Smith, Environmental Hazards: Assessing Risk and Reducing Disaster, reprint ed. (London: Routledge, 2013), 5.

## NATURAL HAZARDS

| | DESCRIPTION/ EFFECTS | EXAMPLE |
|---|---|---|
| **Geologic / Geophysical** | Ground shaking, volcanic eruption; structural damage, | Earthquake, Volcano, Tsunami, Landslide |
| **Atmospheric** | High winds, heavy rain; wind damage, flooding, extreme snow | Hurricane, Tornado, Tropical cyclones, Hail , Ice & Snow |
| **Hydrologic** | Inundation; property damage, drownings | Flood (riverine, flash), Storm Surges, Drought |
| **Meteorologic** | Prolonged heat/drought; crop failure, wildfires, health stress | Hurricane, Tornadoes, Extreme Temperature |
| **Biologic** | Rapid spread of disease; casualties, healthcare strain | Epidemic diseases (influenza, plague), Wildfires |

***Table 2:*** *Classification of Natural Hazards* [30]

### 2.2.1.a. Earthquakes

UNDRR defines an earthquake as "a term used to describe the sudden slip on a fault and the ground shaking that occurs from the radiated seismic energy during the slipping event, that are primarily driven by natural geological processes." [31]

Earthquakes can damage property and cultural heritage both directly and indirectly, resulting in various types of damage. Damage to buildings and their contents consists of structural collapse and damage related to lateral forces transmitted to buildings. Historic districts, in addition to damage to component structures and objects, may also suffer damage to their infrastructure and transport systems. Archaeological sites and cultural landscapes may suffer the types of damage noted for individual monuments and buildings as well as damage to landscape features, increased risk of secondary damage from fire and flooding, and loss of habitat.

30 Table produced by the  author using Keith Smith, Environmental Hazards: Assessing Risk and Reducing Disaster, reprint ed. (London: Routledge, 2013), 5.
31 United Nations Office for Disaster Risk Reduction (UNDRR), Earthquake (GH0201) – Hazard definition, n.d., accessed at https://www.undrr.org/understanding-disaster-risk/terminology/hips/gh0201.

landscape features, increased risk of secondary damage from fire and flooding, and loss of habitat.

The impacts of an earthquake can vary from the extent of the relation to the intensity of the quake, the number and intensity of aftershocks, the vulnerability of the built environment and the time of the event.[32]

The UNDRR hazard classification system identifies earthquakes as geophysical hazards because they depend on their location and intensity and frequency and probability of occurrence.[33] The primary hazards of earthquakes appear as physical effects which include ground shaking, surface rupture, ground movement and subsidence. The occurrence of secondary hazards follows primary hazards through soil liquefaction and landslides and tsunamis and fire and flooding and additional secondary effects.

Seismic hazard exists independently from the actual occurrence of disasters. The risk framework from UNDRR shows that disaster risk develops through the combination of hazard elements with exposed people and infrastructure and vulnerable assets that face damage risks.[34]

A region with high seismic hazard will not experience significant seismic risk when its population density remains low and its buildings demonstrate earthquake resistance. The areas with the highest risk for earthquakes are urban zones that have large numbers of people, poor building standards and are located near fault lines that show current activity. The distinction between hazard and risk serves as a core principle for disaster risk reduction and planning according to UNDRR.[35]

#### 2.2.1.b. Fires

UNDRR recognizes two primary fire categories which consist of wildland fires and urban fires because these uncontrolled fires rapidly spread to threaten human populations and structures and environmental resources.[36] The combination of combustible materials with oxygen and an ignition source under suitable conditions leads to fire propagation. Most urban and peri-urban fires originate from human activities through electrical system failures and industrial mishaps and heating equipment malfunctions and human carelessness.

UNDRR identifies fire as a hazard which results from human activities and hydro-meteorological factors because hot weather, dry conditions, strong winds and poor land management create conditions for fires to start and spread.[37] The risk of fires in urban areas

32 Ibid.
33 United Nations Office for Disaster Risk Reduction (UNDRR), Hazard, n.d., retrieved April 8, 2025, from https://www.undrr.org/terminology/hazard.
34 United Nations Office for Disaster Risk Reduction, “Disaster risk”, n.d.
35 United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER). Disaster Risk and Vulnerability. Vienna: United Nations Office for Outer Space Affairs. Accessed 31 December 2025. https://www.un-spider.org.
36 United Nations Office for Disaster Risk Reduction (UNDRR). Terminology on Disaster Risk Reduction. Geneva: UNDRR, 2017, “Fire,” “Hazard.”
37 United Nations Office for Disaster Risk Reduction (UNDRR), Terminology on Disaster Risk Reduction (Geneva: UNDRR, 2017); UNDRR, Global Assessment Report on Disaster Risk Reduction (Geneva: UNDRR, 2019); United

depends on three main factors which include the amount of combustible materials, the state of buildings and their infrastructure status and emergency response readiness. The United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) organization explains that fire risk develops through the interaction of fire hazard with exposure and vulnerability factors which affect densely populated areas with dangerous building materials and inadequate emergency preparedness.[38]

A fire does not become a "disaster" on its own. A key conceptual distinction in UNDRR's disaster-risk framework is that a disaster only happens when an ignition event intersects with **high exposure** (buildings, people, infrastructure) and **high vulnerability** (flammable materials, narrow streets, weak fire safety regulations).

Property and cultural heritage suffer dual forms of destruction from fires which lead to permanent losses. The primary effects of fires result in total or partial destruction of buildings together with their contents while heat smoke and other byproducts lead to major deterioration. The fire extinguishing methods which use substantial water quantities lead to additional structural and material destruction. Historic districts face exceptional risk because fires damage both individual structures and artifacts and disrupt municipal infrastructure systems. Archaeological sites together with cultural landscapes experience similar destruction patterns which include the loss of built structures and harmed natural environments and elevated chances of secondary threats like flooding and mudslides that result from vegetation destruction and terrain instability.

### 2.1.2. Anthropogenic (Human-Made) Hazards

Anthropogenic hazards, or human-induced hazards, are induced entirely or predominantly by human activities and choices. This term does not include the occurrence or risk of armed conflicts and other situations of social instability or tension which are subject to international humanitarian law and national legislation.[39] These hazards result from human activities, industrial processes, or poor urban planning. They are synonymous with human-induced hazards and apply to dangerous situations or events that stem from human actions or technological failures. These hazards are distinct from natural hazards as human behavior largely determines their frequency and severity and they result from human activities, industrial processes, or poor urban planning. Anthropogenic threats include technological disasters, environmental degradation, and other social disruptions that beset societies globally.

Globalization. and rapid urbanization have increased these threats, and the urgency associated with remediation efforts has grown. Anthropogenic hazards encompass diverse types commonly grouped into technological, environmental, and sociological hazards. Technological hazards involve *failure or malfunctioning of engineered systems, such as*

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Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), Disaster Risk and Vulnerability, accessed 31 December 2025, https://www.un-spider.org. Summarized.

38 United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER). Disaster Risk and Vulnerability.

39 United Nations General Assembly, Report of the Open-ended Intergovernmental Expert Working Group on Indicators and Terminology Relating to Disaster Risk Reduction, A/71/644 (New York: United Nations, 1 December 2016), 18/41, https://www.preventionweb.net/files/50683_oiewgreportenglish.pdf.

*infrastructure collapse* or *industrial accidents*. Environmental hazards encompass man-made ecological degradation, for instance, *pollution*, *deforestation*, and *climate change*.

- **Technological hazards:** Industrial explosions, nuclear accidents, dam failures. "Technological hazards are dangers originating from human-made technological or industrial conditions, including accidents, dangerous procedures, infrastructure failures, or specific human activities."[40]
- **Environmental hazards:** Pollution, deforestation, hazardous material "Environmental hazards arise through degradation of the natural systems and ecosystem services upon which humanity depends. Environmental degradation threatens ecosystem services like air, water, land, biodiversity, and key earth processes. It can be gradual, causing biodiversity loss, land salination, and loss of permafrost."[41]
- **Urban hazards:** Structural collapses, fires, and transportation accidents [42]

While natural hazards are inevitable, their impact on human settlements is often exacerbated by human actions, including poor urban planning, inadequate infrastructure, and lack of disaster preparedness.[43]

Since human beings have been living on this earth, they have always left an impact either in a positive or negative way, and it is inevitable not to discuss how these contributions, impacts and changes over time have influenced nature, hazards, possible disasters, and built environment, that the world has faced and most probably keep facing in the upcoming future.

40 Ibid., 19/41.

41 UNDRR, Global Assessment Report on Disaster Risk Reduction 2019, 71–72.

42 This discussion synthesizes established disaster risk literature on anthropogenic hazards and human-induced risk, drawing on: United Nations Office for Disaster Risk Reduction (UNDRR), Terminology on Disaster Risk Reduction (Geneva: UNDRR, 2017); David E. Alexander, Confronting Catastrophe (Oxford: Oxford University Press, 2000); Piers Blaikie et al., At Risk (London: Routledge, 2014); Keith Smith, Environmental Hazards (London: Routledge, 2013); International Federation of Red Cross and Red Crescent Societies (IFRC), Technological and Biological Hazards. Summarized and synthesized by the author.

43 Susan L. Cutter et al., "Social Vulnerability to Environmental Hazards," Social Science Quarterly 84, no. 2 (2003): 242–244.

## ANTHROPOGENIC HAZARDS (HUMAN-INDUCED) HAZARDS: OPERATIONAL CATEGORIES IN URBAN CONTEXTS

| | DESCRIPTION/ EFFECTS | EXAMPLE |
|---|---|---|
| **Structural/ Engineering** | Collapse of structures; fatalities, economic loss | Building collapse, Dam failure |
| **Transportation** | Collisions; injuries, transport disruptions | Road/Train accident |
| **Industrial** | Explosions or leaks; fires, toxic release, injuries | Factory fire, Chemical spill |
| **Urban** | Poor air quality; respiratory illness, heat stress | Air pollution (smog), Heat island |
| **Social** | Violence; casualties, social disruption | Civil unrest, Terrorist attack |

***Table 3:*** *Classification of Anthropogenic Hazards*[44]

Identifying and understanding anthropogenic processes and their spatio-temporal relevance is therefore of importance when assessing the potential of natural hazards occurring, developing holistic multi-hazard frameworks for a given region, and determining possible disaster risk reduction (DRR) measures which will be explained in the following chapters.

44 Note: This table was produced by the author through the synthesis of anthropogenic and technological hazard classifications discussed in UNISDR (2009), Smith et al. (2013), Blaikie et al. (2014), and Gill and Malamud (2016) 659–679..Summarized and synthesized by the author.

## TECHNOLOGICAL HAZARDS

| | DESCRIPTION/ EFFECTS | EXAMPLE |
|---|---|---|
| **Chemical** | Release of toxins; poisoning, fire, long-term health issues | Toxic chemical spill, Oil spill, Gas Leaks |
| **Radiological/ Nuclear** | Radiation release; contamination, mass evacuation | Nuclear power plant failure |
| **Industrial** | Release of toxic or radioactive materials, structural damage | Factory explosion and fires |
| **Biological** | Biological substances that threaten the health of humans and other living beings | Infectious disease outbreaks, epidemics, animal plagues |

***Table 4:*** *Classification of Technological Hazards* [45]

45 Source: Adapted from International Federation of Red Cross and Red Crescent Societies (IFRC), "Technological and Biological Hazards," accessed 31 December 2025, https://www.ifrc.org/our-work/disasters-climate-and-crises/what-disaster/technological-and-biological-hazards.

## ENVIRONMENTAL HAZARDS

| | DESCRIPTION/ EFFECTS | EXAMPLE |
|---|---|---|
| **Chemical Pollution** | Water/soil contamination; wildlife harm, long-term ecosystem damage | Oil spill, Toxic waste |
| **Air Pollution** | Respiratory illness; ecosystem acidification | Smog, Acid rain |
| **Land Degradation** | Habitat loss; reduced agricultural productivity | Deforestation, Soil erosion |
| **Climate Change** | Global warming; sea-level rise, extreme weather | Greenhouse gas buildup |
| **Biological** | Ecosystem imbalance; crop damage, health impacts | Invasive species, Pesticide use |

***Table 5:*** *Classification of Environmental Hazards0F*[46]

46 Note: This table is a conceptual classification synthesized by the author based on disaster risk and environmental hazard literature, including: United Nations Office for Disaster Risk Reduction (UNDRR), Terminology on Disaster Risk Reduction (Geneva: UNDRR, 2017); Intergovernmental Panel on Climate Change (IPCC), Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (Cambridge: Cambridge University Press, 2012); Keith Smith, Environmental Hazards: Assessing Risk and Reducing Disaster (London: Routledge, 2013). Summarized and synthesized by the author.

### 2.1.3. Na-tech Hazards

One group of hazards has a clear hybrid identity. These are the natural-technological 'natech' hazards that arise when extreme natural processes lead to the failure of industrial structures and other assets within the built environment. Although triggered by natural forces, the main threat often comes from pollution in the atmosphere or surface waters, due to accidental releases of dangerous substances.[47]

The Sendai Framework for Disaster Risk Reduction specifically addresses Natech hazards through its recommendation of integrated approaches that combine risk assessment with emergency preparedness and resilient infrastructure planning to manage complex disaster scenarios.[48]

Both natural and human-made hazards have played a significant role in shaping urban environments.[49] Historically, cities have evolved in response to these threats by adopting stricter zoning regulations, upgrading building materials, and implementing disaster risk reduction measures. While natural hazards such as earthquakes and floods have influenced seismic codes and flood protection infrastructure, human-made hazards like fires have led to advancements in fire-resistant construction techniques and emergency response systems.[50] For example, large urban fires in history, such as the Great Fire of London (1666) and the Chicago Fire (1871), "resulted in the widespread adoption of non-combustible materials and modern firefighting systems".[51] Similarly, earthquake disasters such as the San Francisco Earthquake (1906) prompted the development of seismic building codes that later became a global standards.[52]

Human populations are especially at risk on the margins of hazard tolerance, where small physical changes create large socio-economic impacts, like the effects of rainfall variability on agriculture in semi-arid areas. Over a long period of time, "frequent but unpredictable low-level variability around a critical threshold may have as much significance as the rare occurrence of more extreme events."[53] Sudden change is an integral part of all natural systems, but the very rarest events may not be recognized as threats. It is often only when such changes are observed by humans – and perceived as a threat – that a hazard exists. In

47 P. S. Showalter and M. F. Myers, "Natural Disasters in the United States as Release Agents of Oil, Chemicals, or Radiological Materials Between 1980–1989: Analysis and Recommendations," Risk Analysis 14, no. 2 (April 1994): 169–182.
48 UNDRR, Asia-Pacific Regional Framework for NATECH Risk Management (Bangkok: UNDRR Regional Office for Asia-Pacific, 2020), citing the Sendai Framework's emphasis on risk assessment and preparedness alongside resilient infrastructure
49 Kenneth Smith, Environmental Hazards: Assessing Risk and Reducing Disaster, 5th ed. (New York: Routledge, 2013), especially chapter on resource capacity and vulnerability.
50 Smith, Environmental Hazards, 15.
51 John Tinniswood, By Permission of Heaven: The True Story of the Great Fire of London (London: Jonathan Cape, 2003), describing adoption of non-combustible materials.
52 Lisa C. Hansen and Clare Condon, "Earthquake Codes after San Francisco 1906," Journal of Architectural History 48, no. 1 (1989): 23–38, summarized from the authors' analysis of how the 1906 earthquake influenced seismic code development in the U.S. and globally.
53 Kenneth Smith, Environmental Hazards, 15-16.

## NATECH HAZARDS (NATURAL-TECHNOLOGICAL)

| | DESCRIPTION/ EFFECTS | EXAMPLE |
|---|---|---|
| **Tsunami/ Earthquake-triggered** | Natural disaster triggers nuclear accident; radiation release, evacuation | 2011 Japan tsunami → Nuclear meltdown |
| **Hurricane-triggered** | Hurricane damages oil infrastructure; spills, fires | 2005 Hurricane Katrina → Oil/gas facility damage |
| **Flood-triggered** | Flooding inundates industrial sites; toxic leaks | 2011 Thailand floods → Chemical plant spills |
| **Wildfire-triggered** | Wildfires trigger industrial accidents; explosions, infrastructure loss | 2018 California wildfires → Gas pipeline explosion |

***Table 6:*** *Classification of Natech Hazards*[55]

55 Source: United Nations Office for Disaster Risk Reduction (UNDRR), Natech hazards terminology.

## 2.2. Exposure

"Exposure refers to the inventory of elements in an area in which hazard events may occur." [56] Hence, if population and economic resources were not located in (exposed to) potentially dangerous settings, no problem of disaster risk would exist. While the literature and common usage often mistakenly conflate exposure and vulnerability, they are distinct. "Exposure is a necessary, but not sufficient, determinant of risk."[57] It is possible to be exposed but not vulnerable (for example by living in a floodplain but having sufficient means to modify building structure and behavior to mitigate potential loss). However, to be vulnerable to an extreme event, it is necessary to also be exposed.[58]

Exposure is a related but distinct concept. "*It is defined as the presence of people, assets, or systems in places that could be adversely affected by hazards"*[59]*.* In other words, exposure describes who or what could be hit by a hazard. UNISDR terminology specifies exposure as *"people, property, systems, or other elements present in hazard zones that are thereby subject to potential losses*".[60] Measures of exposure often include the population size, buildings, or economic assets located in areas prone to particular hazards. Unlike vulnerability, which is about the **susceptibility to damage**, **exposure** is simply about being in harm's way – a necessary condition for risk, since one cannot be affected by a hazard if one isn't exposed to it.

*"Exposure refers to the manmade structures and people that will be affected by the hazard and includes information such as population and gross domestic product (GDP)"*[61] on a national level all the way down to detailed, site-specific information about the contents of a structure. Vulnerability describes the damage or loss to a given exposure (such as a commercial, public, or private structure) caused by a hazard with a specific intensity (for example, a certain wind speed). When we add hazards into this equation we reach the "Crichton risk triangle" in risk modeling.[62] (See Figure 2)

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56 Omar D. Cardona, "The Need for Rethinking the Concepts of Vulnerability and Risk from a Holistic Perspective," in Mapping Vulnerability: Disasters, Development and People, ed. Greg Bankoff et al. (London: Earthscan, 2004), 37.
57 Cardona et al., "System of Indicators for Disaster Risk Management," IDB Technical Paper Series (Washington, D.C.: Inter-American Development Bank, 2012), 9.
58 Ibid.
59 UNISDR, Terminology on Disaster Risk Reduction (Geneva: United Nations, 2009), 12.
60 Ibid.
61 Agastra, "What Is the Difference Between Exposure and Vulnerability?", Agastra Risk Solutions, 2024, https://agastra.com/exposure-vs-vulnerability/.
62 D. Crichton, "The Risk Triangle," in Natural Disaster Management, ed. J. Ingleton (London: Tudor Rose, 1999), 102–103, summarized.


***Figure** 2: Crichton risk triangle (coined by David Chrichton) associated with a natural disaster. Risk can be defined as a composite of the hazard, exposure, and vulnerability associated with an event. If any of the three factors is magnified, then the total risk increases, sometimes nonlinearly.*

Historical claims experience was a reliable indicator of future risk in the past. However, this only works if the risk is changing at a predictable rate. Crichton predicted in 1999 that when "*the climate is changing, this adds more uncertainty to any predictions, and climate change presents the biggest potential challenge faced by insurers in the next century, perhaps even the next millennium."* [63] He suggested using the concept of "Risk Triangle" for anyone involved in disaster reduction. (Figure 2)

The impact of a hazardous event depends on the elements at risk, such as population or buildings and their associated vulnerability to damage or change as a result of the event. The total risk may be decreased by reducing the size of any one or more of the three contributing variables (Figure 8) : the hazard, the elements exposed and/or their vulnerability. This can be illustrated by assuming the dimension of each of the three variables represents the side of a triangle, with risk represented by the area of the triangle. "The reduction of any one of the three factors to zero consequently would eliminate the risk. "[64]

"'*Risk is the* ***probability of a loss****, and this depends on three elements, hazard, vulnerability and exposure."*[65] For example with property insurance, we have to consider the frequency and severity of the hazard, such as a flood or storm; the vulnerability of the insured property to that hazard, that is the extent to which it will suffer damage or loss, and the exposure of the property to the hazard, for example its value and location. According to Crichton's description of the triangle, By using basic geometry, we can determine that the amount of the risk relies on the size of each of the three "sides" of the risk triangle if we consider the size of the risk to be equal to the area of the triangle. "There is no danger if any one of the triangle's "sides" or components is zero."[66] For instance, we can lower our risk if we can decrease exposure by lowering the number of properties we insure. This will also decrease the area of the triangle.

63 David Crichton, The Risk Triangle (London: Benfield Greig Hazard Research Centre, 1999), 2.
64 Ministry of Housing & Urban Poverty Alleviation (India), National Institute of Urban Affairs, and UNDP, Disaster Resilient Cities: A Primer on Reducing Vulnerabilities to Disasters (New Delhi, 2016), 7.
65 Crichton, The Risk Triangle, 2–3.
66 Ibid.

Naturally, doing this also lowers our income, and the remaining risk must still be covered by society (or other insurers).[67]

It is essential to identify the interaction between those conditions and the hazards. Catastrophe risk is normally expressed as a function of hazard, vulnerability, and exposure. If there is no risk of catastrophe, a high-intensity hazard offers little catastrophe danger if nothing is exposed to it (e.g., a massive earthquake in an uninhabited area caused no catastrophe.)

Alternatively, even a low or moderate hazard can cause catastrophe for inhabitants with high exposure and vulnerability. The Sendai Framework for Disaster Risk Reduction 2015-2030 stresses the need to examine "the entire dimension of vulnerability, capacity, exposure of persons and assets, risk characteristics, and context." [68]

Increases in disaster risk and the occurrence of disasters have been in evidence over the last five decades.[69] This trend may continue and may be enhanced in the future as a result of projected climate change, further demographic and socioeconomic changes, and trends in governance, unless concerted actions are enacted to reduce vulnerability and to adapt to climate change, including interventions to address disaster risks.[70]

Some global processes are significant drivers of risk and are particularly related to vulnerability creation.[71] There is high confidence that these include population growth, rapid and inappropriate urban development, international financial pressures, increases in socioeconomic inequalities, trends and failures in governance (e.g., corruption, mismanagement), and environmental degradation.[72] Vulnerability profiles can be constructed[73] that take into consideration sources of environmental, social, and economic marginality. This also includes the consideration of the links between communities and specific environmental services, and the vulnerability of ecosystem components climate change-related impact assessments, integration of underlying 'causes of vulnerability' and adaptive capacity is needed rather than focusing on technical aspects only. [74]

67 Crichton, The Risk Triangle, 2. Summarized from the same source.
68 UNDRR (United Nations Office for Disaster Risk Reduction), Sendai Framework for Disaster Risk Reduction 2015–2030 (Geneva: UNDRR, 2015), 10.
69 Munich Re, *NatCatSERVICE* (Munich: Munich Re, 2011), summarized.
70 See Alejandro Lavell, *Disaster Risk Reduction* (1996, 1999a, 2003); ICSU-LAC, *Reducing Vulnerability in Latin America* (2010a, b); and UNISDR, *Global Report on Disaster Risk Reduction* (2011), summarized.
71 Omar D. Cardona et al., *Integrated Risk Governance in Latin America* (Washington, DC: IDB, 2012), summarized.
72 Mike Maskrey, *Disasters of the Poor?* (1993, 1994, 1998); María Mansilla, *Urban Risk in the Andes* (1996); and Ben Cannon, *Vulnerability and Risk* (2006), summarized.
73 See Wisner, *At Risk* (2003); Renaud, *Ecosystem Vulnerability* (2006); Williams et al., "Urban Ecosystems" (2008); Décamps, *Freshwater Interfaces* (2010); Dawson et al., *Wetland Vulnerability* (2011), summarized.
74 See Julie Ribot, *Vulnerability and Adaptation* (1995); O'Brien et al., "Climate Change Impact Assessments" (2004), summarized.

## 2.3. Vulnerability

Vulnerability is defined in the Hyogo Framework for Action as: "The conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards."[75]

Studies on urban vulnerability tend to portray it as the degree to which a city, population, infrastructure, or economic sector (i.e., a system of concern) is susceptible to and unable to cope with the adverse effects of hazards or stresses, such as heat waves, storms, and political instability.[76] Urban vulnerability is a relational concept that captures a complex and dynamic reality. In addition to referring to the possibility that a system may be negatively affected by a hazard or stress, it is also a relative property defining both the sensitivity and the capacity to cope with that stressor. Therefore, vulnerability cannot be defined by the hazard alone, nor can it be represented strictly by the internal properties of the system is stressed. Instead, it must be looked at as an interaction of these factors.[77]

**Social vulnerability** is defined in terms of the characteristics of a person or community that affect their capacity to anticipate, confront, repair, and recover from the effects of a disaster. Some examples of factors that might affect a person's social vulnerability include socioeconomic status, household composition, minority status, and vehicle access. The social vulnerability literature reveals that "populations living in a disaster-stricken area are not affected equally."[78] Socially vulnerable communities are more likely to experience higher rates of mortality, morbidity, and property destruction, and are "less likely to fully recover in the wake of a disaster compared to communities that are less socially vulnerable."[79]

75 UNDRR. Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters, United Nations Office for Disaster Risk Reduction, 2015.

76 Revi, Aromar, et al. "Towards Transformative Adaptation in Cities: The IPCC's Fifth Assessment." Environment and Urbanization 26, no. 1 (2014): 11–28.

77 Romero-Lankao, Patricia, and Huiping Qin. "Conceptualizing Urban Vulnerability to Climate Change: An Update." Current Opinion in Environmental Sustainability 3, no. 3 (2011): 201–207, summarized.

78 Bolin, Bob. "Race, Class, Ethnicity, and Disaster Vulnerability." In Handbook of Disaster Research, edited by Havidán Rodríguez, Enrico L. Quarantelli, and Russell R. Dynes, 113–129. Springer, 2006.

79 Juntunen, Tomi. Social Vulnerability and Disasters: An Analysis of Recovery and Resilience. Helsinki: University of Helsinki, 2005.

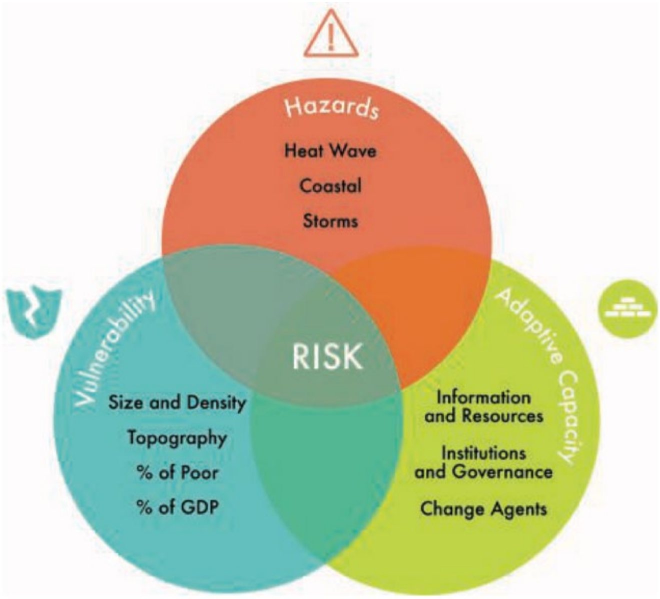


*Figure 3: Urban climate change vulnerability and risk assessment framework. Source: Mehrotra et al., 2011*[80]

The concept of vulnerability has been a key concept in disaster studies for decades and has led to various theoretical frameworks. One of the most influential models is the **"Pressure and Release (PAR) model"** proposed by Blaikie Wisner and colleagues.[81] The PAR model views disaster as the intersection of two opposing forces: the "pressure" of a hazard event and the "pressure" of vulnerability, which is built up through a progression of factors from root causes (e.g. poverty, political instability) to dynamic pressures (e.g. rapid urbanization, lack of institutions) to unsafe conditions (e.g. fragile physical infrastructure, living in hazard-prone locations). In this view, hazards are the trigger, but vulnerability is the underlying cause of disasters – essentially, disasters are "unreleased pressure" resulting from vulnerabilities not addressed in development. This model underlines that what turns an earthquake or storm into a humanitarian disaster is often long-term processes like social inequalities or environmental mismanagement that "pressurize" communities over time.

The analysis presents multiple viewpoints which focus on different elements. The social vulnerability approach defined by Cutter (1996) examines how socioeconomic factors determine community sensitivity and coping capacity regarding hazards through measurements of income levels and education and health status and social network strength.[82] The human–environment ecology perspective examines vulnerability through the study of connected systems which demonstrate how environmental changes interact with

80 Source: Shagun Mehrotra et al., Climate Change and Cities: First Assessment Report of the Urban Climate Change Research Network (Cambridge: Cambridge University Press, 2011), Fig. 2.1, p. 9. Framework illustrates how climate hazards, vulnerability, and adaptive capacity interact to determine urban climate risk.
81 Piers Blaikie, Terry Cannon, Ian Davis, and Ben Wisner, At Risk: Natural Hazards, People's Vulnerability, and Disasters, 2nd ed. (London: Routledge, 1994), 49–60. This paragraph includes direct phrases such as "Pressure and Release (PAR) model," "root causes," "dynamic pressures," "unsafe conditions," "unreleased pressure," and "pressurize," as well as a summarized explanation of the PAR model's conceptual structure and interpretation.
82 Summarized from Susan L. Cutter, "Vulnerability to Environmental Hazards," Progress in Human Geography 20, no. 4 (1996): 529–539.

human society to generate new vulnerabilities.[83] These theories share a fundamental agreement that vulnerability exists across multiple dimensions including physical aspects and social elements and economic factors and environmental components while being shaped by specific contexts. Building strength represents only a technical aspect of vulnerability because it extends beyond construction to include the characteristics of individuals and their lifestyle and the environmental systems that influence their existence.[84]

The  capacity to cope is the other side of vulnerability (positive definition/ capacities).[85] An additional extension of the concept of vulnerability can be seen in the shift from a double structure to a multi-structure,[86] encompassing not only susceptibility (negative definition of vulnerability) and coping capacity, but also adaptive capacity, exposure, and the interaction with perturbations and stresses. This implies a fourth sphere, by widening further the concept of vulnerability. Lastly, also the thematic dimensions can be broadened within the discourse of vulnerability. While formerly – mainly engineering based approaches and earthquake research – vulnerability. was primarily associated with physical aspects (likelihood of a building to collapse), the current debate clearly shows that "vulnerability captures various thematic dimensions, such as physical, economic, social, environmental and institutional aspects."[87] (fifth sphere, see Figure 4).

83 Summarized from Omar D. Cardona et al., "Determinants of Risk: Exposure and Vulnerability," in Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, ed. C.B. Field et al. (Cambridge University Press, 2012), 69–98.

84 Ibid.

85 Jörn Birkmann and Ben Wisner, "Measuring the Un-Measurable: The Challenge of Vulnerability," SOURCE No. 12 (2006): 10–11.

86 Summarized from B. L. Turner et al., "A Framework for Vulnerability Analysis in Sustainability Science," Proceedings of the National Academy of Sciences 100, no. 14 (2003): 8074–8079.

87 Jörn Birkmann and Ben Wisner, Measuring the Un-Measurable: The Challenge of Vulnerability, SOURCE No. 12 (Bonn: UNU-EHS, 2006), 11. Quoted and summarized.

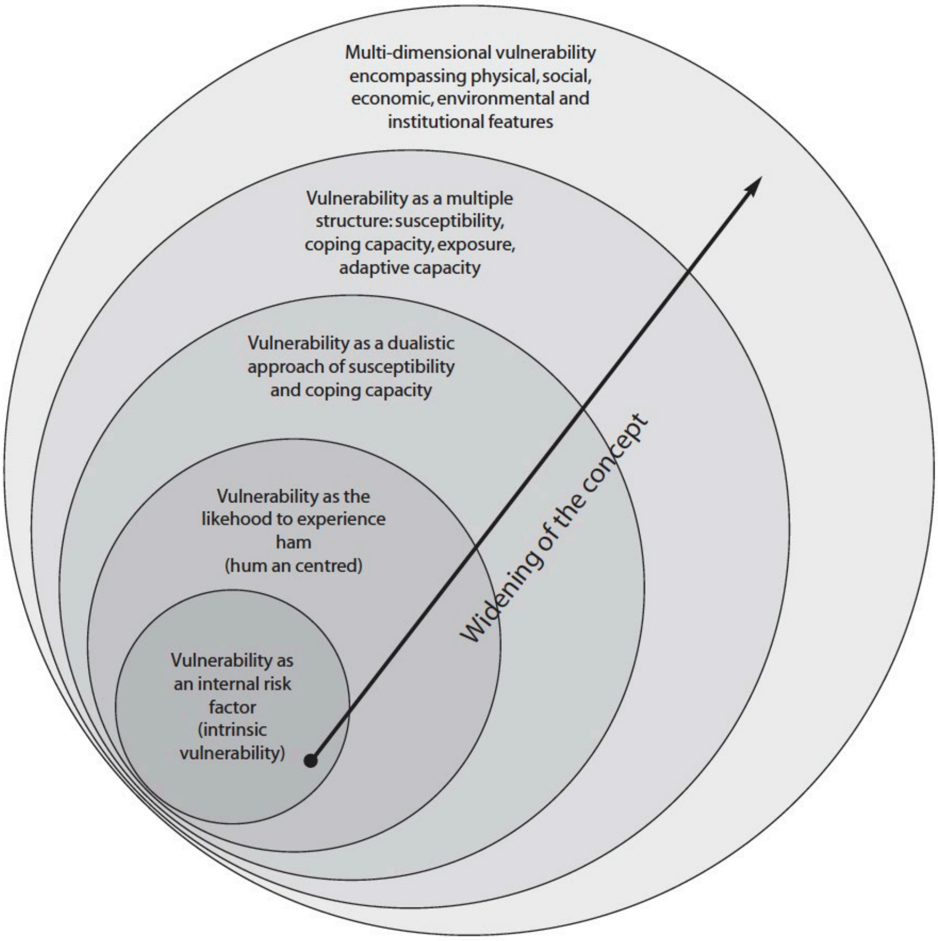


***Figure 4:*** *Key Spheres of the Concept of Vulnerability.*
*Illustrates the widening conceptual scope of vulnerability, from intrinsic risk to multi-dimensional constructs.*
*Source: Jörn Birkmann and Ben Wisner, Measuring the Un-Measurable: The Challenge of Vulnerability, SOURCE No. 12 (Bonn: United Nations University – Institute for Environment and Human Security, 2006), 11.*

The nature of vulnerability changes over time. The level of vulnerability either grows or diminishes throughout time. The spread of informal settlements into floodplains would increase a city's vulnerability but improved building codes and education would decrease it. A community does not naturally possess high vulnerability because it emerges from multiple interconnected processes. The IPCC report on climate and extremes explains that "vulnerable groups face risk because of their exposure to hazards as well as their social marginality and limited resource access in daily life."[88] The process of vulnerability reduction requires tackling fundamental development and inequality issues which connect to humanitarian work and climate adaptation and sustainable development initiatives.

The concept of exposure differs from vulnerability because it directly measures the extent to which something faces potential dangers. The patterns of urbanization together with land use

88 Omar D. Cardona et al., "Determinants of Risk: Exposure and Vulnerability," in Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX), eds. C.B. Field et al. (Cambridge: Cambridge University Press, 2012), 69.

and habitation show direct connections to exposure. The speed of urban development leads to increased exposure risks mainly in areas that already face natural hazards. The expansion of cities into mountainous areas and coastal territories and seismic fault regions puts more people and property at risk.

Istanbul is a pertinent example: since this metropolis sits in a high seismic hazard region, and its population boom and urban sprawl in the 20th century have greatly expanded the exposure of buildings and infrastructure to earthquakes.[89] Uncontrolled urban expansion "beyond the limits of habitability in a safe way" and increasing population density in certain districts mean that a greater number of structures (including many vulnerable ones) would be impacted by any given earthquake or flood.[90] Similarly, faulty urbanization (such as inadequate drainage or building on former wetlands) can change hazard patterns such as ; altering flood boundaries and putting previously safe areas at risk.[91]

The analysis of disaster risk requires an evaluation of what specific elements are at risk. The analysis includes the assessment of population numbers, residential buildings, medical facilities, educational institutions and historical sites that could face potential dangers. The presence of exposure alone does not guarantee a disaster will occur because it needs to combine with actual hazards and the risk vulnerability of exposed populations. High exposure levels increase the likelihood of disasters when combined with vulnerable populations at risk. The high population density and economic concentration in urban areas creates a dangerous environment for disasters to occur. A megacity contains millions of residents (high exposure) and poor neighborhoods with aged vulnerable buildings (high vulnerability). The combination of these factors guarantees that no risk reduction measures will prevent minor hazards from causing major problems. The United Nations Office for Disaster Risk Reduction (2024) explains that high exposure combined with high vulnerability leads to a higher probability of hazard events becoming disasters.[92]

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89 Summarized from Şevket Vatan and Zeynep Yaraşan, "Urban Development and Disaster Risk in Istanbul," in Urban Planning and Disaster Risk Management in Turkey, ed. Ayşe Karakaya (Ankara: Turkish Disaster Studies Press, 2020), 112–115.

90 Şevket Vatan and Zeynep Yaraşan, Urban Development and Disaster Risk in Istanbul, in Urban Planning and Disaster Risk Management in Turkey, ed. Ayşe Karakaya (Ankara: Turkish Disaster Studies Press, 2020), 114.

91 Ibid., 114.

92 United Nations Office for Disaster Risk Reduction (UNDRR), Global Risk Assessment Report 2024 (Geneva: UNDRR, 2024), 45.

# Chapter 3

## Disaster Risk and Urban Heritage Management

# 3. Disaster Risk and Urban Heritage Management

## 3.1. Risk Models

"**Risk** is generally defined as the combination of the probability of an event and its negative consequences."[93] Risk is, thus, the probability that the occurrence of a hazard will result in disaster. E.g. an earthquake striking a community where all buildings are earthquake resistant and the community is fully prepared for it does not result in a disaster. Thus, the earthquake risk at a place is dependent on the vulnerability of the building stock and the coping capacities of the community.[94]

UNISDR defines risk as "*the combination of the probability of an event and its negative consequences*".[95] It is important to acknowledge that there is not one common definition of risk within academic and professional communities. At times it has been used to mean probability, hazard, threat, or some combination of all three.[96] Within disaster and emergency management communities, risk is generally understood to involve some combination of hazard, exposure, and vulnerability. All three elements are needed for risk to exist: a hazard that has the potential to cause harm; exposure to a hazard; and a vulnerable target. In fact, the notions of hazard and vulnerability are intertwined, as each only has meaning within the context of the other.[97]

Risk, has two well-defined sub concepts which are: **acceptable risk** and **residual risk**, defined in UNDRR/UNISDR terminology[98] and subsequently adopted in climate and disaster risk discussions, including IPCC Working Group II (Impacts, Adaptation and Vulnerability) assessment reports.[99]

Acceptable risk, or tolerable risk, is therefore an important sub term; the extent to which a disaster risk is deemed acceptable or tolerable depends on existing social, economic, political, cultural, technical and environmental conditions. In engineering terms, acceptable risk is also used to assess and define the structural and non-structural measures that are needed in order to reduce possible harm to people, property, services and systems to a chosen tolerated level, according to codes or "accepted practice" which are based on known probabilities of hazards and other factors.[100]

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93 United Nations Office for Disaster Risk Reduction (UNISDR), Terminology on Disaster Risk Reduction (Geneva: UNISDR, 2009), 25. As cited in Mamuji, Azar, and David Etkin. "Disaster Risk Reduction: A Practitioner's Guide," in Disaster and Emergency Management Methods, ed. David Etkin (Boca Raton: CRC Press, 2019), 46.
94 Summarized from Ministry of Housing and Urban Poverty Alleviation et al., National Disaster Management Guidelines: Management of Earthquakes (New Delhi: Government of India, 2016), 18.
95 Mamuji, Azar, and David Etkin. "Disaster Risk Reduction: A Practitioner's Guide," in Disaster and Emergency Management Methods, ed. David Etkin (Boca Raton: CRC Press, 2019), 46.
96 Piers Blaikie et al., At Risk: Natural Hazards, People's Vulnerability and Disasters, 2nd ed. (London: Routledge, 2014), 8–9.
97 Mamuji, Azar, and David Etkin. "Disaster Risk Reduction: A Practitioner's Guide,", 46.
98 United Nations Office for Disaster Risk Reduction (UNDRR), "Disaster Risk," UNDRR Terminology on Disaster Risk Reduction, accessed June 2026, https://www.undrr.org/terminology/disaster-risk.
99 IPCC, Climate Change 2022: Impacts, Adaptation and Vulnerability, Working Group II, Chapter 16: "Key Risks across Sectors and Regions," 2022, https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_Chapter16.pdf.
100 UNDRR, "Disaster Risk," UNDRR Terminology on Disaster Risk Reduction.

Residual risk is the disaster risk that remains even when effective disaster risk reduction measures are in place, and for which emergency response and recovery capacities must be maintained. The presence of residual risk implies a continuing need to develop and support effective capacities for emergency services, preparedness, response and recovery, together with socioeconomic policies such as safety nets and risk transfer mechanisms, as part of a holistic approach.[101]

Risk is often modeled as **probability × impact**, or via a *risk triangle of hazard, exposure and vulnerability.* Such models quantify how likely a hazard is and how great its consequences would be. Once we have an estimate of risk from these models, disaster planners must decide which risks can be prevented and which must be accepted. No practical system can reduce all risk to zero, so a level of acceptable risk must be chosen – the maximum losses deemed tolerable under current conditions.[102] The remaining risk (after mitigation measures are applied) is the residual risk. Framing risk in this way is important for disaster planning: it helps decision-makers set safety targets (acceptable risk levels) and to ensure preparedness for the inevitable residual risk. In sum, conceptual risk formulas (e.g. R = P×I or hazard × exposure × vulnerability) provide the quantitative basis, while the categories of acceptable and residual risk tell us which portion of that risk is targeted for reduction and what portion must be endured or insured against.[103] This linkage is crucial in urban disaster planning because it translates abstract risk estimates into concrete planning objectives: keeping risk below a socially "acceptable" threshold and managing any residual risk through preparedness and resilience measures.

**Risk = f ( p x E x V )**

This formula expresses that risk (R) is a function of three key components:

- P = Probability (or intensity) of a hazard occurring
- E = Exposure – the people, property, or systems at risk (e.g., buildings, populations)
- V = Vulnerability – the susceptibility of exposed elements to harm

Capacity and resilience are also considered to be parts of vulnerability by some[104], with risk being inversely proportional to them. The process of deconstructing vulnerability becomes difficult because databases remain incomplete and knowledge about the subject is limited. Social constructionism introduces a culturally dependent subjective factor, making objective risk difficult to capture. Risk functions as a socially developed concept which people use to create meaning and make decisions. The evaluation of risk definitions requires assessment of their contextual usefulness together with their internal logic and user goals. Risk analysis requires consistent methodologies and metrics to enable proper comparison between

101 UNISDR, Terminology on Disaster Risk Reduction (Geneva: UNISDR, 2017).
102 UNISDR, Global Assessment Report on Disaster Risk Reduction 2017 (Geneva: UNISDR, 2017), 22.
103 UNISDR, Terminology on Disaster Risk Reduction (Geneva: UNISDR, 2017).
104 Kathleen Tierney and Michel Bruneau, "Conceptualizing and Measuring Resilience: A Key to Disaster Loss Reduction," TR News 250 (2007): 14–17.

different risks. Risk assessments need to be transparent while incorporating expert judgment and they must clearly state their uncertainty levels.

This model is common in UNDRR, IPCC, and risk assessment literature.It emphasizes that risk is not just about the hazard, but about what is exposed and how vulnerable it is.[105]

In addition to hazard and risk identification, impact analysis, and risk assessments, other major components of the European Union (EU) disaster prevention framework include risk matrices, scenario development, risk management measures, and regular reviews at all levels of government."[106] (See Chapter 3.6)

High hazard and vulnerability aggravate the risk at a place while high community capacities reduce the risk. An oversimplified way of projecting the interdependencies of these factors and the risk at a place is .[107]

**Hazard X Vulnerability / Capacity = Risk at a Place**

This formula builds on the same logic as the previous formula but explicitly includes capacity as a reducing factor.

- Hazard = the event or process (e.g. earthquake, fire)
- Vulnerability = how sensitive or fragile the exposed system is
- Capacity = the ability of people/institutions to cope, adapt, or respond (e.g. emergency services, building codes) : the resilience of a society

**The higher the Hazard & Vulnerability and the lower the Capacity = The Greater the Risk**

Hazard and disaster can be ranked according to impact criteria, and the probability of a hazardous event can be placed on a scale from zero to certainty (0 to 1). The overall level of risk can then be determined by examining the correlation between a hazard and its probability. Risk is sometimes taken as synonymous with hazard, but the risk has the additional implication of the statistical chance of experiencing a particular hazard.

105 Summarized from Joern Birkmann, Measuring Vulnerability to Natural Hazards: Towards Disaster Resilient Societies (Tokyo: United Nations University Press, 2006); United Nations Office for Disaster Risk Reduction (UNDRR), Sendai Framework for Disaster Risk Reduction 2015–2030 (Geneva: UNDRR, 2015).
106 Azar Mamuji and David Etkin, "Disaster Risk Reduction: A Practitioner's Guide," in Disaster and Emergency Management Methods, ed. David Etkin (Boca Raton: CRC Press, 2019), 42.
107 Ministry of Housing & Urban Poverty Alleviation, National Institute of Urban Affairs, and UNDP India, India: National Disaster Risk Reduction Portal – Urban Risk Assessments and Resilience Strategies (New Delhi: Government of India, 2016), 27.

### 3.2. Disaster Risk

Disaster risk is widely understood as a function of three interlinked components: hazard, vulnerability, and exposure. While hazards (natural or human-induced events with damaging potential) are often uncontrollable, the susceptibility of people and assets (vulnerability) and their presence in harm's way (exposure) are critical in determining whether a hazard event results in a disaster. In fact, high levels of vulnerability and exposure can transform even moderate hazard events into severe disasters.[108]

Disaster risk is the consequence of the interaction between a hazard and the characteristics that make people and places vulnerable and exposed. It is defined as the potential loss of life, injury, or destroyed or damaged assets that could occur to a system, society, or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability, and capacity.[109] Human interactions with technology and nature, or, in a slightly different form, risks, are an inevitable consequence of the pursuit of benefits that are significant to communities and societies, like increased industrial productivity and better human health.

Disaster Risk increases when:

- the hazard is more likely,
- more people & assets are exposed
- they are more vulnerable

Disaster risk reduction and climate change adaptation are the cornerstones of making cities resilient to a changing climate. Integrating these activities with a metropolitan region's development vision requires a new, systems-oriented approach to risk assessments and planning. Moreover, since past events can only partially inform decision-makers about emerging and increasing climate risks, risk assessments must incorporate knowledge about both current climate conditions and future projections. [110]

### 3.3. Disaster Risk Management (DRM)

As confirmed by the 2009 Global Assessment Report on Disaster Risk Reduction, Risk and Poverty in a Changing Climate[111] , the number of disasters around the world increases every year. To a great extent this is due to growing exposure in terms of people and assets, in turn caused by rapid economic development and urban growth in cyclone coastal areas and earthquake-prone cities, combined with poor governance and the decline of ecosystems. At the same time, climate change has been associated with the occurrence of more frequent and intense extreme weather events in some parts of the world. Disasters are today considered as one of the main factors contributing to poverty, especially in developing regions.[112]

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108 United Nations Office for Disaster Risk Reduction (UNDRR), Global Risk Assessment Report 2024 (Geneva: UNDRR, 2024), chap. 2, summarized.

109 UNISDR, Terminology on Disaster Risk Reduction (Geneva: UNISDR, 2017), 7.

110 Ezgi Gencer, The Interplay between Urban Development, Vulnerability, and Risk Management: A Case Study of the Istanbul Metropolitan Area (Washington, D.C.: World Bank, 2013), 18.

111 UNISDR, 2009

112 United Nations International Strategy for Disaster Reduction (UNISDR), Global Assessment Report on Disaster Risk Reduction: Risk and Poverty in a Changing Climate (Geneva: UNISDR, 2009), summarized.

Cultural and natural properties are increasingly impacted by occurrences that are less "natural" in their dynamics, if not in their source, even if heritage is typically not included in worldwide statistics about disaster risks. Due in part to the important role that heritage plays in promoting social cohesion and sustainable development, especially during stressful times, the gradual loss of these properties due to floods, mudslides, fire, earthquakes, civil unrest, and other disasters has become a major concern. Surprisingly few World Heritage properties have created a suitable catastrophe risk reduction plan in light of these difficulties. This frequently results from a number of misconceptions. There is a common perception that disasters are uncontrollable and outside of human will, and that there is little that can be done to stop them. However, heritage managers and policymakers typically focus their attention and resources on what they believe to be the true priorities for their properties, which include development pressure and the daily deterioration of sites due to gradual, cumulative processes that are "observable." Unfortunately, most of the time , the media and donor community typically acknowledge heritage properties' disaster susceptibility after a catastrophic event has occurred, which is frequently too late.

The reality, of course, is different. Disasters are the combined product of hazards and vulnerabilities resulting from the complex interaction of numerous interlocking factors, many of which are very much within human control. It is, therefore, possible to prevent them, or at least considerably reduce their effects, by strengthening the resilience of the assets to be safeguarded. In general, moreover, the impact of a single disaster on cultural and natural properties far outstrips the deterioration caused by long-term, progressive decay and may sometimes lead to their complete obliteration. Often, therefore, disaster risks constitute the most urgent priority that heritage managers should address.[113]

113 UNESCO, Managing Disaster Risks for World Heritage (Paris: United Nations Educational, Scientific and Cultural Organization, 2010), summarized.

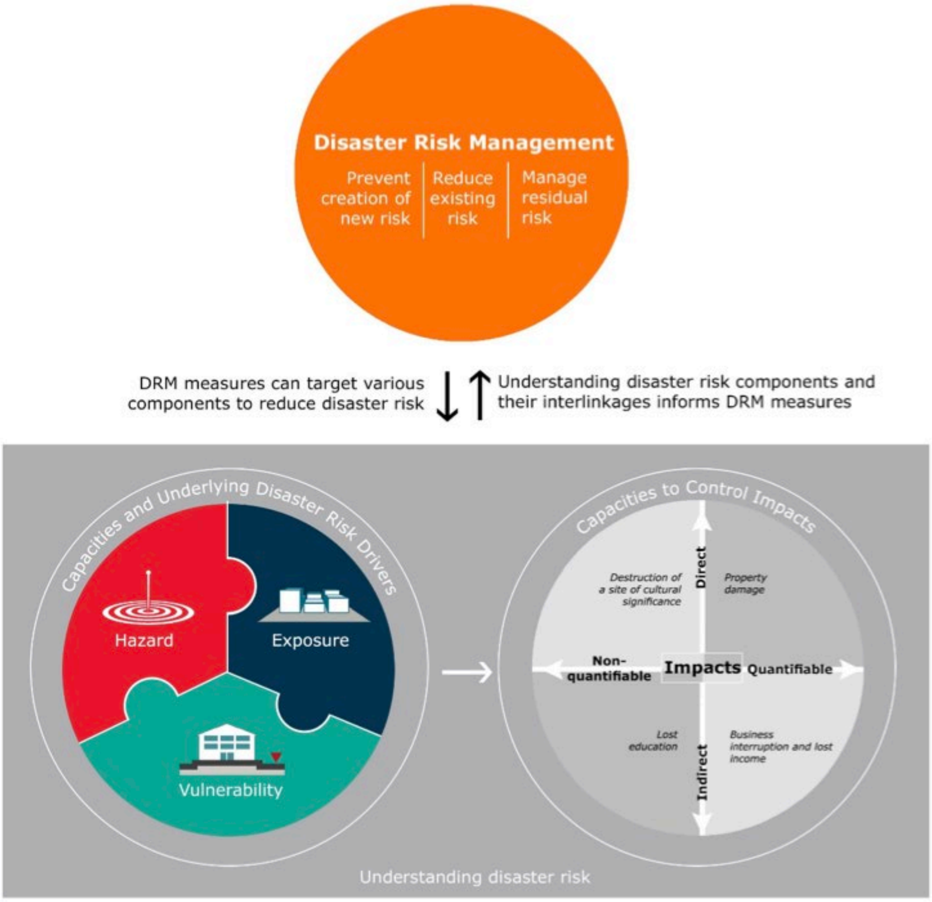


***Figure 5 :*** *Holistic understanding of disaster risk empowers effective and comprehensive disaster risk management Source: UNISDR, 2015, p. 15.*[114]

An additional commonplace is the idea that heritage, in particular **cultural heritage**, would constitute a liability in the face of disaster, either because it "requires efforts and resources for its protection – at a time when attention should be devoted to saving lives and properties – or because it adds to the risk, especially within traditional settlements where buildings do not conform to modern engineering standards of safety."[115] Experience shows, on the contrary, that heritage if well maintained can positively contribute to reducing disaster risks. This is true not only for natural heritage resources that guarantee the proper functioning of ecosystems and the beneficial effect of their goods and services, but also for cultural heritage properties that – "as a result of traditional knowledge accumulated over centuries – have proved to be resilient to disasters while providing shelter and psychological support to affected communities."[116]

114 Adapted from UNISDR, Global Assessment Report on Disaster Risk Reduction 2015: Making Development Sustainable: The Future of Disaster Risk Management (Geneva: United Nations Office for Disaster Risk Reduction, 2015), p. 15.
115 ICCROM, Protecting Cultural Heritage in Times of Disaster: Risk Management Tools and Guidelines, ICCROM 2012 and 2020 Editions, https://www.iccrom.org/themes/preparedness-and-resilience (accessed July 18, 2025). The quotation and ideas in this paragraph are summarized and cited from various programmatic documents and web publications by ICCROM, particularly those related to resilience and cultural heritage in risk-prone areas.
116 Ibid.

## 3.4. DRM for Cities in Sendai Framework

### 3.4.1 Core Principles of the Sendai Framework

Since the adoption of the Yokohama Strategy and Plans for Action in 1994, global DRR frameworks have been assessed. That was more over thirty years ago. The Paris Agreement on Climate Change, the Sustainable Development Goals (SDGs), and the Sendai Framework for Disaster Risk Reduction (SFDRR)[117] are three major international frameworks that the United Nations adopted in 2015 to address how climate change is affecting human society. This section of the literature review will concentrate on the Sendai Framework , it's principals and it's way of addressing cities for urban resilience.


***Figure 6:*** *DRR Frameworks over years (adapted from UN, 2020)*[118]

The Sendai Framework (SFDRR) represents a concerted shift in how we approach disasters: moving from reacting to events towards a stronger focus on managing and reducing risk before disasters occur. It is a "*concise, forward-looking, and action-oriented framework", as described in its own preamble, with the overarching aim of "substantially diminishing global disaster losses by 2030."* One of the clearest indications of Sendai's innovative approach is its stated expected outcome: "*The substantial reduction of disaster risk and losses in lives, livelihoods and health, and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries."* [119] This language is significant. It is not merely about reducing disaster losses (deaths, damage, etc.), but explicitly about reducing disaster risk.

Success by 2030 is measured by fewer risks being created and existing risks being mitigated, thus leading to fewer disasters. To achieve this outcome, the framework sets a clear goal: "Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive measures that prevent and reduce hazard exposure and vulnerability

117 Ibid.
118 Adapted from United Nations Office for Disaster Risk Reduction (UNDRR), Human Cost of Disasters: An Overview of the Last 20 Years (2000–2019) (Geneva: UNDRR, 2020), 17.
119 Ibid.

and thus strengthen resilience"[120] Rather than only emergency response, this goal emphasizes preventive and risk reduction by including everything from structural safety to social policies.

Key innovations of Sendai include its broader multi-hazard scope (covering natural, technological, and biological hazards), its measurable global targets, and its recognition that states hold primary responsibility while requiring an "all-of-society" approach for effective risk governance.[121]

Crucially, Sendai also supports other international accords that acknowledge the need for catastrophe risk reduction for sustainable development, such as the Paris Climate Agreement and the 2030 Agenda for Sustainable Development.

The Sendai Framework contains seven worldwide targets which work to decrease disaster damage while building disaster resistance throughout the world by 2030. The targets work to lower death rates and protect most people while minimizing economic harm and protecting essential infrastructure and service networks. The targets include two main objectives: to develop national and local disaster risk reduction strategies and to enhance international support for developing nations and to establish more multi-hazard early warning systems and risk information systems. The development of local disaster risk reduction strategies in Target (e) holds particular significance for Istanbul as a city.

In summary, the Sendai targets provide a roadmap for achieving the framework's goal in concrete terms: fewer lives and assets lost, more preparedness on the ground, and stronger global solidarity in DRR.

The Sendai Framework provides ethical and strategic guidelines for global disaster risk reduction (DRR), integrating knowledge from previous frameworks to show how social, cultural, political and economic factors affect disaster risk.[122] The framework recognizes that states must prevent and reduce disaster risk at home but also requires international cooperation especially with weaker countries.[123] It advocates for an all-of-society approach for effective disaster risk management.[124]

The guiding tenet protects people and their belongings, health, work, cultural heritage, and natural environment in ways that respect human rights principles.[125] The practice of disaster risk management combines technical aspects with ethical considerations because it understands cultural heritage serves as a foundation for community survival and rebuilding processes.[126]

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120 Ibid.
121 Ibid.
122 United Nations Office for Disaster Risk Reduction (UNDRR), Sendai Framework for Disaster Risk Reduction 2015–2030 (Geneva: UNDRR, 2015), 10–12.
123 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, paras. 19–20.
124 Ibid.
125 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, para. 19(a).
126 Fabbricatti, K., L. Boissenin, and M. Citoni, "Heritage Community Resilience: Towards New Approaches for Urban Resilience and Sustainability," City, Territory and Architecture 7, no. 17 (2020).

The Sendai Framework also calls for the application of a gender-sensitive, age-responsive, and disability-inclusive strategy to all DRR policies and practices.[127] This includes the integration of cultural context and indigenous knowledge so that diverse needs and contributions are respected and leveraged in attempts to reduce risk. [128]

The framework calls for adopting a multi-hazard approach and utilizing science, technology, and indigenous knowledge in risk understanding and management. This entails coordinated risk assessments that consider interconnected hazards and vulnerabilities, as well as unrestricted access to risk information, to facilitate informed decision-making. [129]

### 3.4.2. Sendai Framework's Way of Addressing Cities and Urban Resilience

Among the characteristics of the Sendai Framework is its heightened applicability to **urban risk reduction**.[130] As the world has become increasingly urbanized, cities bring people, wealth, and economic activity together—but also vulnerability.[131] Sendai acknowledges this by calling for local DRR plans (Target (e)) and emphasizing disaster risk governance at all levels , including local.[132] It also implicitly supports initiatives like UNISDR's Making Cities Resilient campaign and its successor, the MCR 2030 program, [133] which help cities align with Sendai.

Several aspects of Sendai's approach especially benefit cities:

**Understanding Risk:** Sendai Priority 1 requires complete understanding of disaster risk through its four essential elements which include hazard characteristics and exposure and vulnerability and capacity assessment.[134] The city of Istanbul conducts seismic microzonation studies and creates detailed risk maps[135] to analyze soil behavior and ground shaking potential and facility vulnerability. The Istanbul Metropolitan Municipality (IMM) together with Boğaziçi University scientists have created multiple urban hazard databases since 2000 for urban planning activities.[136] The scientific tools have enhanced local understanding of disaster risks which enabled officials to locate Golden Horn districts that experience multiple threats from earthquakes and fires and land elevation issues.

127 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, paras. 7, 19(d).
128 UNDRR, Words into Action: Using Traditional and Indigenous Knowledges for Disaster Risk Reduction (Geneva: UNDRR, 2022).
129 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, paras. 23–24.
130 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, paras. 6, 27.
131 UN-Habitat, Global Report on Human Settlements 2011: Cities and Climate Change (Nairobi: UN-Habitat, 2011).
132 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, Target (e), para. 27.
133 United Nations Office for Disaster Risk Reduction (UNDRR), Making Cities Resilient 2030 (MCR2030), accessed April 2, 2025, https://mcr2030.undrr.org/.
134 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, Priority 1.
135 Istanbul Metropolitan Municipality (IMM) and JICA, Istanbul Earthquake Master Plan (Istanbul: IMM Publications, 2003).
136 Boğaziçi University et al., Earthquake Master Plan for Istanbul (Istanbul Metropolitan Municipality, 2003).

**Local DRR Strategies and Governance:** The Target (e) of Sendai requires local DRR strategies to expand by 2020 because it emphasizes the need for disaster planning at the municipal level. The framework demonstrates how municipal authorities together with subnational actors should convert national targets into plans that match their specific areas.[137] The national policy received support from numerous municipalities throughout the world including Istanbul which established official local DRR strategies.

The city and district governments of Istanbul work together to coordinate DRR initiatives through urban planning processes which implement hazard mapping and preparedness strategies according to Sendai's requirements for multi-level governance. The Sendai Framework emphasizes that national and local governments need to establish specific roles and performance-based incentives to handle disaster risks effectively. The governance system enables Golden Horn policies to receive guidance from Sendai's requirement for evidence-based planning that includes all stakeholders.

**Build Back Better:** Sendai Priority 4 establishes the "Build Back Better" principle[138] which guides recovery and rehabilitation and reconstruction activities. The approach now focuses on building safer structures with sustainable designs and inclusive features during reconstruction efforts. The "Build Back Better" initiative has driven cities across the world to adopt safer building methods and protect historic buildings during renovation projects and implement environmentally friendly infrastructure systems. The Golden Horn experienced multiple fires and earthquakes which resulted in destructive redevelopment projects that eliminated traditional architectural styles. The current reconstruction initiatives in the Golden Horn demonstrate both the challenges and benefits of implementing the "Build Back Better" approach.[139] The recovery efforts in the Golden Horn area followed Sendai's "build back better" approach through infrastructure and housing reconstruction with enhanced safety standards and new protective measures.

**Resilient Infrastructure & Services:** The Sendai Target D requires nations to decrease the harm disasters cause to vital infrastructure systems[140] and their ability to deliver essential services like: health facilities, educational institutions, transportation systems and utility networks.

The city of Istanbul dedicated substantial funds to protect vital infrastructure which serves the Golden Horn area. The World Bank/GFDRR project implemented earthquake-resistant upgrades to 1,086 public buildings in Istanbul which provided healthcare to 8.7 million patients and education to 1.1 million students.[141]

The city implements infrastructure reinforcement of bridges and sewer systems and electrical grids and transit lines surrounding the Golden Horn to minimize service disruptions during

137 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, Target (e).
138 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, Priority 4.
139 Pica, V., "Beyond the Sendai Framework for Disaster Risk Reduction: Vulnerability Reduction as a Challenge Involving Historical and Traditional Buildings," Buildings 8, no. 4 (2018): 50.
140 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, Target D.
141 World Bank, "World Bank Extends Additional Funding to Türkiye for Construction of Rural Homes in Earthquake-Hit Areas," press release, March 18, 2025.

earthquakes and floods.[142] The essential urban systems of Istanbul receive protection through Sendai's investment in resilience which includes backup power systems and emergency communication networks.[143] The infrastructure resilience in Golden Horn's older quarters remains inconsistent because this pattern exists in multiple heritage districts across low-income urban areas globally.[144]

**Community Engagement and Urban Memory:** The Sendai framework promotes a complete societal involvement through joint efforts between local communities and their officials and volunteers for disaster risk reduction.[145] The approach requires using local knowledge to protect cultural heritage while making sure communities take part in the process.

The local implementation of Sendai **Priority 4** and **"people-centered early warning"** targets becomes possible through the establishment of community-based disaster response networks and training programs.[146] The Golden Horn area maintains disaster memories through historical accounts and monuments and surviving wreckage which serve as protective warnings for upcoming disasters. The memory of past disasters plays a crucial role in resilience according to researchers who support the preservation of physical disaster remnants to maintain public awareness about urban resilience. Communities will actively work to reduce risks when they receive proper respect and involvement from authorities and fight against risk reduction measures which fail to recognize their cultural heritage.

These five urban parameters reflect how the Sendai Framework translates into actionable resilience planning at the city level, and will be the main parameters of this thesis to explore and understand how İstanbul – Golden Horn has transformed after hazards (fires and earthquakes).

Sendai defines **resilient cities** as the essential foundation for building **resilient nations**.[147] The success of Sendai's global targets depends heavily on city-level achievements because most people worldwide reside in urban areas. The focus on local authorities has resulted in the development of specific tools and guidelines such as the UNDRR's Disaster Resilience Scorecard for Cities which includes a cultural heritage addendum.[148]These assessment tools enable urban managers to evaluate their progress toward Sendai's targets through self-assessment.

142 Istanbul Metropolitan Municipality, Afet Yönetimi Faaliyet Raporu 2023 (Istanbul: Department of Urban Resilience, 2023).
143 United Nations Office for Disaster Risk Reduction (UNDRR), Sendai Framework for Disaster Risk Reduction 2015–2030 (Geneva: UNDRR, 2015), Target D.
144 Fabbricatti, K., L. Boissenin, and M. Citoni, "Heritage Community Resilience: Towards New Approaches for Urban Resilience and Sustainability," City, Territory and Architecture 7, no. 17 (2020).
145 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, paras. 7, 19(d).
146 United Nations Office for Disaster Risk Reduction (UNDRR), Sendai Framework for Disaster Risk Reduction 2015–2030 (Geneva: UNDRR, 2015), Priority 4;
World Meteorological Organization, "Preserving Heritage Boosts Disaster Resilience," May 26, 2017.
147 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, para. 27.
148 UNDRR, Disaster Resilience Scorecard for Cities: Detailed Assessment (Geneva: UNDRR, 2017); UNDRR, Disaster Resilience Scorecard for Cities – Cultural Heritage Addendum, accessed April 2025.

Such examples of this being:

- Does the city maintain updated hazard maps?
- Have they mapped vulnerable populations?
- Are heritage sites included in risk scenarios?

The Cultural Heritage Addendum to the Cities Scorecard emerged directly from understanding that urban resilience needs cultural heritage integration[149] which leads to our upcoming discussion.[150]

The Sendai Framework presents its action priorities as interconnected components which form a unified systemic approach to resilience. The framework addresses both disaster risk origins and effects while providing solutions that work at various scales from local communities to national governments across different sectors including health, education, infrastructure and heritage. The Sendai Framework's main objective becomes achievable through these priorities which work together to establish integrated and inclusive measures that reduce disaster risks and enhance resilience for sustainable development.[151]

The research bases its foundation on Sendai Framework urban resilience priorities , urban risk reduction aspects and approach (listed above) to benefit cities as which serve as thematic analysis tools for studying Istanbul's historic Golden Horn area. The research evaluates how local disaster risk reduction (DRR) strategies together with stringent building regulations (especially seismic-safe codes) and protection of critical infrastructure and community preparedness and engagement and cultural heritage safeguarding have influenced the Golden Horn's development before and after past disasters. The Sendai-style resilience measures including regulatory, infrastructural and cultural aspects will be evaluated in Chapter 5 regarding their persistence or decline in the Golden Horn's urban development particularly during earthquake and fire disasters.

149 UNESCO World Heritage Centre, Managing Disaster Risks for World Heritage (Paris: UNESCO, 2010); UNDRR, Disaster Resilience Scorecard for Cities – Cultural Heritage Addendum.

150 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030 (Geneva: UNDRR, 2015), 9.

151 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030 (Geneva: UNDRR, 2015), 9.

### 3.4.3. Relevance for Urban Heritage in the Sendai Framework

One notable aspect of the Sendai Framework is its recognition of **culture** and **cultural heritage** within the disaster risk reduction discourse – an area that was not prominently featured in the previous Hyogo Framework.[152] Sendai explicitly mentions the importance of protecting cultural assets and incorporates cultural heritage into its vision of resilience.[153] This is a reflection of growing awareness that disasters affect not only lives and economic development but also the **identity and history of communities**.

Paragraph 5 of the Sendai Framework states the urgency to *"effectively protect persons and communities and their livelihoods, health, cultural heritage, socioeconomic assets and ecosystems*".[154] This phrasing puts cultural heritage on par with other fundamental aspects of society that need safeguarding from disasters. Furthermore, the framework in paragraph 30(d) calls on public and private sectors to "*promote the resilience of new and existing critical infrastructure, including... cultural heritage sites"*[155], recognizing heritage sites as critical assets.

The inclusion of cultural heritage serves two purposes: it acknowledges the intrinsic value of heritage (historical monuments, museums, traditions) to communities, and it highlights that the loss of heritage in disasters (think of the loss of historic architecture in an earthquake, or destruction of archives in flood) can have long-lasting impacts on community well-being and identity.

International heritage institutions such as UNESCO, ICCROM, and ICOMOS played a key role in advocating for culture during Sendai negotiations. UNESCO celebrated the inclusion of cultural references in the framework, and ICCROM's First Aid and Resilience for Cultural Heritage in Times of Crisis (FAR) program explicitly aligns with Sendai[156], training professionals and responders to integrate heritage protection into crisis situations. Heritage is also linked to resilience: traditional knowledge, historic construction techniques, and cultural practices can support communities in preparing for, responding to, and recovering from disasters.[157]

*Why is heritage considered so important in DRR?* Beyond the moral imperative to save humanity's treasures, there is a resilience rationale: cultural heritage and traditions can be sources of resilience.[158] They carry knowledge of past disasters (traditional architectural styles often have embedded resilience, like the flexible timber frame houses in seismic areas), they foster a sense of place and continuity that can psychologically help communities recover, and

152 United Nations Office for Disaster Risk Reduction (UNDRR), Hyogo Framework for Action 2005–2015 (Geneva: UNDRR, 2005);
UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030 (Geneva: UNDRR, 2015).
153 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, paras. 19(a), 30(d).
154 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, para. 5.
155 UNDRR, Sendai Framework, para. 30(d).
156 International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM), "Disaster Risk Management for Cultural Heritage," accessed April 9, 2025, https://www.iccrom.org/section/disaster-resilient-heritage/disaster-risk-management-cultural-heritage
157 Fabbricatti, K., L. Boissenin, and M. Citoni, "Heritage Community Resilience," City, Territory and Architecture 7, no. 17 (2020).
158 Jigyasu, R., "Reducing Disaster Vulnerability through Local Knowledge and Capacity," in The Cultural Turn in International Aid (London: Routledge, 2019).

heritage sites often double as community centers or emergency shelters[159] (many historic courtyards or religious buildings have served as refuge in times of crisis).

The Sendai Framework indirectly supports leveraging these aspects. For instance, one of Sendai's guiding principles says a "cultural perspective should be integrated in all policies and practices."[160]

From an academic perspective, the Sendai Framework's integration of cultural heritage has been analyzed as part of a broader shift toward people-centered DRR. Scholars Stanton-Geddes and Soz[161] remarked that "*The Sendai Framework advocates for a culturally-sensitive approach to DRR in general and calls for the protection of cultural heritage from disaster risks across its four priority areas of action*."[162]

Indeed, we can map heritage onto each of the four priorities:

- **Understanding Risk (Priority 1):** Include cultural heritage sites in risk assessments and use local indigenous knowledge (which is cultural) as part of understanding hazards. For example, studying the design of heritage buildings might reveal traditional quake-resistant features that can inform modern practice.[163]

- **Risk Governance (Priority 2):** Ensure heritage authorities (like ministries of culture or local heritage councils) are part of DRR coordination. Develop policies for heritage risk management – many countries now have national committees or plans specifically for cultural heritage risk reduction.[164]

- **Investing in DRR (Priority 3):** Allocate funds to strengthen or retrofit heritage structures and to create inventories and backups of cultural artifacts (to prevent total loss if a museum is hit, for instance). Also, invest in reducing risk in heritage tourism, an economic driver for many cities.[165]

- **Preparedness and BBB (Priority 4):** Have emergency plans for heritage sites (e.g., what to do if a historic library catches fire – how to evacuate collections). When rebuilding, apply Build Back Better to Heritage: If a historic building is damaged, restore it with improved methods to withstand future hazards while still respecting its authenticity.[166]

159 Colette, A., Climate Change and World Heritage: Predicting and Managing Impacts (Paris: UNESCO, 2007).
160 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, para. 19(d).
161 Stanton, Geddes and Soz, 2017.
162 UNESCO World Heritage Centre, Managing Disaster Risks for World Heritage (Paris: UNESCO, 2010); Mowla, Q., "Disaster Risk Reduction in Architectural Heritage of Urban Areas," Pratnatattva 25 (2019): 195–202.
163 Fabbricatti, Boissenin, and Citoni, 2020.
164 ICCROM, "Programme Partners," accessed April 8, 2025.
165 UNESCO World Heritage Centre, World Heritage and the Sendai Framework for Disaster Risk Reduction 2015–2030 (Paris: UNESCO, 2015).
166 Ibid.

**Vulnerability Reduction:** Sendai's central task is to lessen both the conditions of vulnerability (root causes) and the physical exposure that transforms hazards into disasters. There are many dimensions of vulnerability – physical (substandard structures), social (poverty, marginalization), environmental (damaged ecosystems), etc.[167][168] Cultural heritage connects to vulnerability and resilience in complex manners. First, heritage structures themselves may be physically vulnerable (such as old buildings that have not been retrofitted). Second, communities that have a strong link with their heritage may have social resilience The framework's call to address the underlying risk drivers is very pertinent to historic areas where socio-economic vulnerabilities (poverty, building neglect, etc.) increase disaster risk. By improving living conditions via rehabilitation projects and involving communities in preservation, some root causes of vulnerability are lessened simultaneously.[169]

**Resilience Building:** Resilience is the other face of vulnerability – "the capacity of a system or community to absorb disturbance and still retain its basic function and structure".[170] While resilience is often associated with the ability to resist disturbances in an urban context, its meaning is more about "adapting and growing from those changes."[171] In general, cultural heritage contributes to resilience by maintaining continuity and offering a sense of identity and support. [172]

The latter perspective is in sync with Sendai's position that disaster risk reduction must be people-centered and drawn from all knowledge systems (both modern science and traditional wisdom).[173] So, one might think of Sendai as creating an enabling environment in which, hypothetically, saving a historic wooden mosque in a village is not just about the building but about not only the social fabric and knowledge (how it was built to sway in earthquakes) that make different cultures know to live with and recover from disasters.[174]

**Implementation of Heritage Protection in Sendai**

The Sendai Framework includes cultural heritage in disaster risk reduction through its recognition that heritage sites become vulnerable because they serve as vital components for community health. Key studies show that disasters lead to major destruction of heritage sites which weakens their ability to recover from damage.[175][176] The protection of heritage sites

167 Cannon, Terry, "Vulnerability Analysis and the Explanation of 'Natural' Disasters," in Disasters, Development and Environment (1994);

168 Wisner, B., J. C. Gaillard, and I. Kelman, Handbook of Hazards and Disaster Risk Reduction (London: Routledge, 2012).

169 UNESCO World Heritage Centre, "Reducing Disaster Risks at World Heritage Properties," accessed January 13, 2026, https://whc.unesco.org/en/disaster-risk-reduction/.

170 Argonne National Laboratory, Resilience: Theory and Applications (Argonne, IL: Argonne National Laboratory, 2012).

171 Holling, "Resilience and Stability of Ecological Systems," 1973.

172 "Fostering Resilient Communities Through the Interaction of Heritage, Policy, and Participation: Insights from a Lithuanian Case Study," Sustainability 17, no. 9 (2023).

173 UNESCO World Heritage Centre, World Heritage and the Sendai Framework for Disaster Risk Reduction 2015–2030, Paris: UNESCO, 2015.

174 Fabbricatti, K., Boissenin, L., and Citoni, M., "Cultural Heritage as a Resource for Disaster Risk Reduction," Sustainability 12, no. 7 (2020).

175 Rohit Jigyasu, Reducing Disaster Risk for Cultural Heritage: Progress and Challenges (Rome: ICCROM, 2019).

176 Robin Coningham, Cultural Heritage, Crisis, and Disaster Risk Reduction (Paris: UNESCO, 2018).

remains essential but disaster planning systems that focus on emergency responses do not solve this vital problem.[177]

The Sendai Framework establishes that disaster risk management requires protection of cultural and environmental assets together with lives and livelihoods and property.[178] Priority 1 calls for evaluating and accounting for cultural heritage impacts, while Priority 3 emphasizes safeguarding cultural institutions and historically significant sites. These inclusions confirm that heritage is considered part of the critical assets required for resilient societies. The framework contains insufficient cultural heritage references which creates confusion when organizations try to use its principles. The framework lacks legal authority which requires countries to create their own protection systems through their local authorities. The protection of cultural heritage stands as a lesser priority in disaster risk reduction plans because countries tend to focus their immediate response on humanitarian aid following disasters.[179]

Climate adaptation plans fail to include cultural heritage as an essential element when they are being developed. Research indicates that heritage policies fail to demonstrate adequate climate resilience because they encounter the same threats which affect disaster risk management.[180]

A detailed method must be used to protect historic buildings from damage because it needs to maintain their original structure and execute risk reduction measures.[181]The main challenge to achieving long-term funding support. The majority of disaster recovery funding goes toward building housing and infrastructure instead of protecting cultural heritage sites.[182] The Sendai Framework identifies heritage as a vital asset yet its insufficient operational direction results in irregular execution which exposes heritage sites to risk especially in historic urban areas like the Golden Horn.

## 3.5. Reducing Vulnerability and Exposure: Linking to Heritage and DRR

An early view of vulnerability in the context of disaster risk management was related to the physical resistance of engineering structures, but more recent views relate vulnerability to characteristics of social and environmental processes.[183] It is directly related, in the context of climate change, to the susceptibility, sensitivity, and lack of resilience or capacities of the exposed system to cope with and adapt to extremes and non-extremes.[184]

177 Eva Rosa, Paolo Valent, and Marco Di Tanna, “Heritage Risk Management under the Sendai Framework: A Critical Assessment,” International Journal of Disaster Risk Reduction 64 (2021): 102522.
178 Valentina Pica, “Cultural Heritage and Disaster Risk Reduction: Sendai’s Guiding Principles Revisited,” International Journal of Cultural Property (2018).
179 Rosa, Valent, and Di Tanna, “Heritage Risk Management,” 2021.
180 Amir Shirvani Dastgerdi and Giancarlo De Luca, “Cultural Heritage and Sustainable Development: Criticism of World Heritage Practices,” Sustainability 10, no. 11 (2018): 3958;
181 Cornelius Holtorf, “Embracing Change: How Cultural Resilience Is Framed in Heritage Discourse,” World Archaeology 50, no. 4 (2018): 639–650.
182 Zin and Ismail, “Cultural Heritage Preparedness,” 2023.
183 IPCC, Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX), chap. 2, “Determinants of Risk: Exposure and Vulnerability” (Cambridge: Cambridge University Press, 2012).
184 Ibid.

Recognizing the role of vulnerability and exposure shifts how we manage disasters. Rather than seeing disasters as unavoidable "natural" events, they are understood as preventable crises fueled by human and societal conditions. Thus, reducing vulnerability and exposure is a cornerstone of disaster risk reduction (DRR). The Sendai Framework (2015) stresses investing in risk reduction through improved building standards, poverty alleviation, environmental protection, and preparedness, all of which tackle root causes of vulnerability. It also calls for "policies and practices for disaster risk management [to] be based on an understanding of risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment"[185] Risk-informed development must consider who and what is at risk. Hazards alone are not enough.

In practical terms, reducing vulnerability might mean retrofitting weak buildings, strengthening livelihoods, educating the public about risks, or preserving ecosystems (like wetlands) that buffer hazards.[186] Reducing exposure could mean avoiding high-risk zones for new development or relocating critical infrastructure. These actions directly mitigate potential disaster impacts. For instance, the Istanbul Seismic Risk Mitigation Project (ISMEP) in the 2000s focused on reinforcing schools and hospitals (reducing physical vulnerability) and land-use planning revisions (to guide future growth away from the highest hazard areas, thus limiting exposure).[187] Likewise, in heritage contexts, initiatives have emerged to catalog and reinforce historic structures – acknowledging that cultural heritage assets require tailored risk reduction because their loss is irreversible.[188] Measures include improving fire suppression in museums, bracing ancient walls without altering their character, and training staff in emergency response, all aimed at lowering vulnerability.

Vulnerability reduction connects disaster risk reduction and climate change adaptation. The IPCC stated resilience development (through vulnerability reduction) is very important for managing climate extremes and changes later.[189] If communities gain more ability plus assets receive protection today, benefits will result when climate hazards become more intense. In this way, giving protection to a historic coastal city, such as Venice or Istanbul's Golden Horn region, from flooding does more than cultural heritage preservation; it also helps adaptation to climate change effects. The area where disaster risk reduction and heritage protection intersect becomes clear when ancient drainage systems, traditional building designs, or old urban layouts are considered, as they can provide ideas for sustainable adaptation strategies.

Vulnerability and exposure are necessary parts of disaster risk assessment. They show reasons similar hazard events cause very different results in diverse communities or regions. For a master plan in Disaster Risk Management and Heritage Protection, this understanding helps. It lets planners see places of greatest risk. This includes not just hazards, but people most

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185 Whitworth, MRZ, S Boulton, and J Jones. "Implementing the Sendai Framework in Developing Countries Using Remote Sensing Techniques for the Evaluation of Natural Hazards." Lowland Technology International, (2020). https://core.ac.uk/download/326247790.pdf.
186 IPCC, Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX), chap. 2, "Determinants of Risk: Exposure and Vulnerability" (Cambridge: Cambridge University Press, 2012).
187 World Bank and Global Facility for Disaster Reduction and Recovery (GFDRR), Stories of Impact: Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP) (Washington, DC: World Bank, 2015).
188 Vatan, M., and H. Yaraşan, "Disaster Risk Management of Cultural Heritage in Urban Areas: The Case of Turkey," A+ArchDesign 6, no. 2 (2020): 115–136.
189 IPCC, Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) (Cambridge: Cambridge University Press, 2012), chap. 2.

vulnerable plus items most exposed. It also helps prioritize interventions. These interventions make communities and their treasured heritage safer. Through socio-economic development, better engineering as well as inclusive governance, vulnerabilities become lower. Through planning that is wise and protective infrastructure, exposure is managed. This reduces disaster risk. As UNDRR succinctly puts it, extreme natural events need not lead to extreme disasters if we manage the conditions of risk beforehand.[190]

### 3.5.1. Cross-Cutting Factors Influencing Disaster Risk Reduction

Throughout the world communities have accumulated knowledge through generations to endure environmental variability and hazards. **Traditional knowledge systems** that include earthquake-resistant building methods and drought management practices and natural weather forecasting techniques are now recognized as essential resources for climate change **adaptation** and **disaster risk reduction**. The Sendai Framework for DRR requires countries to use traditional indigenous and local knowledge and practices when appropriate to enhance scientific knowledge in disaster risk assessment and planning.[191] The Intergovernmental Panel on Climate Change (IPCC) observed that indigenous local and traditional knowledge systems and practices represent a significant adaptation resource for climate change but these resources have not been reliably used in current adaptation initiatives.[192]

Indigenous and traditional knowledge (often referred to as traditional knowledge (TK) or indigenous knowledge (IK)) refers to the long-standing understandings, skills, practices, and beliefs developed by indigenous peoples and local communities over rough generations of interaction with their environment.[193] This knowledge is accumulative (built over centuries), adaptive (tailored to local culture and ecology), and communal (shared and passed down orally or through practice). The acquired knowledge shows disaster risk reduction methods which modern technological systems do not recognize because it demonstrates how physical and social elements at particular locations determine disaster outcomes. Kong shows that uniting IK/TK systems with scientific DRR methods will produce superior disaster response results.[194]

When cultures and community practices are specific to non-indigenous communities, then it can be termed **local knowledge**.[195] It comes from the continuously generated collective, inter-generational and place-based knowledge that is based on personal and collective experiences, which are often shaped by historical and social processes.[196] The Sendai framework together with other international DRR frameworks understand that IK/TK systems bring important advantages to disaster risk reduction because these systems have traditionally received little

190 United Nations Office for Disaster Risk Reduction (UNDRR), Sendai Framework for Disaster Risk Reduction 2015–2030 (Geneva: UNDRR, 2015), 6.
191 UNDRR, Words into Action Guidelines; Sendai Framework, 2015.
192 IPCC, Climate Change 2014: Impacts, Adaptation, and Vulnerability, Contribution of Working Group II to the Fifth Assessment Report (Cambridge: Cambridge University Press, 2014).
193 UNDRR & ICCROM, Using Traditional and Indigenous Knowledge for Disaster Risk Reduction (2022).
194 Kong, F., Indigenous Knowledge and Disaster Risk Reduction: Insight Towards Perception, Response, Adaptation and Sustainability, 2024.
195 FAO, Local Knowledge Systems and Sustainable Agriculture (Rome: Food and Agriculture Organization, 2018).
196 Arturo Escobar, Whose Knowledge? Whose Nature? Biodiversity, Conservation, and the Political Ecology of Social Movements, 1998.

attention yet they offer vital warning systems and flexible farming practices and local emergency response strategies.

The local environment led to the creation of earthquake-resistant buildings through the development of stilt houses and timber-laced masonry systems which builders used in their residential construction methods. The indigenous social systems which include oral traditions and rituals and customary laws function as readiness tools which help communities maintain their ability to respond as first responders.

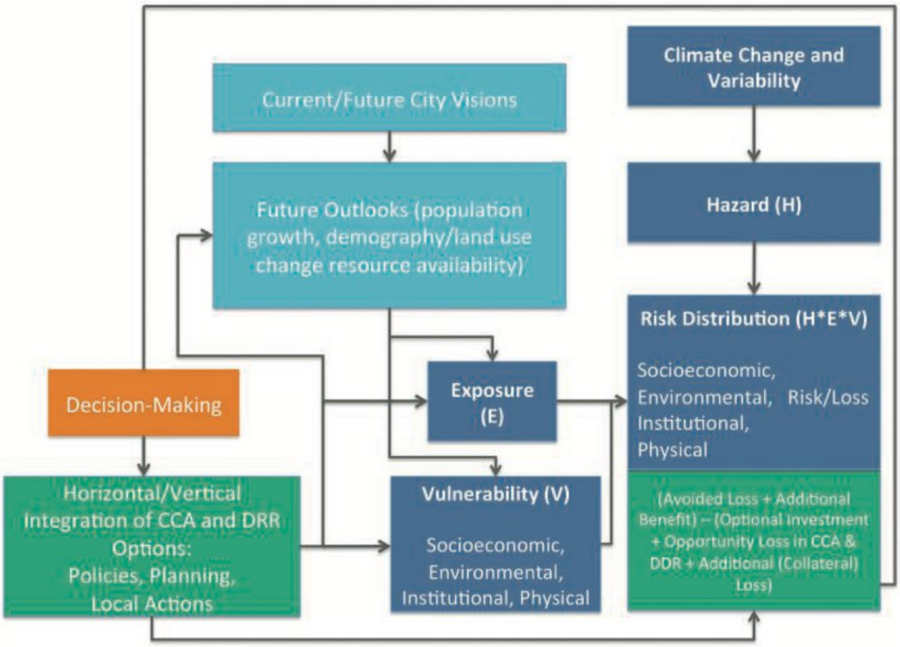


***Figure 7 :*** *Risk Assessment Framework, developed for UCCRN ARC3.2. Source: Xiaoming Wang and Ebru Gencer, 2014*[197]

In the Urban Climate Change Research Network (UCCRN)'s First Urban Climate Change Research Network Assessment Report on Climate Change and Cities (ARC3.1), an urban climate change vulnerability and risk assessment framework was introduced that was based on the interplay of hazard, vulnerability, and adaptive capacity to develop climate adaptation and disaster management.[198] (see Figure 7).

UCCRN's Second Urban Climate Change Research Network Assessment Report on Climate Change and Cities (ARC3.2) uses the framework of risk (R) expressed as a function of hazard (H), exposure (E), and vulnerability (V). The IPCC Working Group II report (IPCC, 2014b) explains that risks from climate change impacts arise from the interactions among hazard

197 Ebru Gencer, Regina Folorunsho, Megan Linkin, Xiaoming Wang, Claudia E. Natenzon, Shiraz Wajih, Nivedita Mani, et al., "Disasters and Risk in Cities," in Climate Change and Cities: Second Assessment Report of the Urban Climate Change Research Network, ed. Cynthia Rosenzweig et al. (Cambridge: Cambridge University Press, 2018), 61–98.
198 Shagun Mehrotra, Cynthia Rosenzweig, William D. Solecki, Somayya Ali Ibrahim, and Shobhakar Dhakal, Climate Change and Cities: First Assessment Report of the Urban Climate Change Research Network (ARC3.1) (Cambridge: Cambridge University Press, 2011).

(triggered by an event or trend related to climate change), vulnerability (susceptibility to harm), and exposure (people, assets, or ecosystems at risk).[199]

Hazard events are more likely to become disasters when people, assets, or ecosystems are exposed and vulnerable. Unsustainable development, including inequalities, increases exposure and vulnerability, building the risks of compounding or cascading impacts, as well as polycrises. The challenge for all countries, especially those with high levels of disaster risk, is to build resilience.[200]

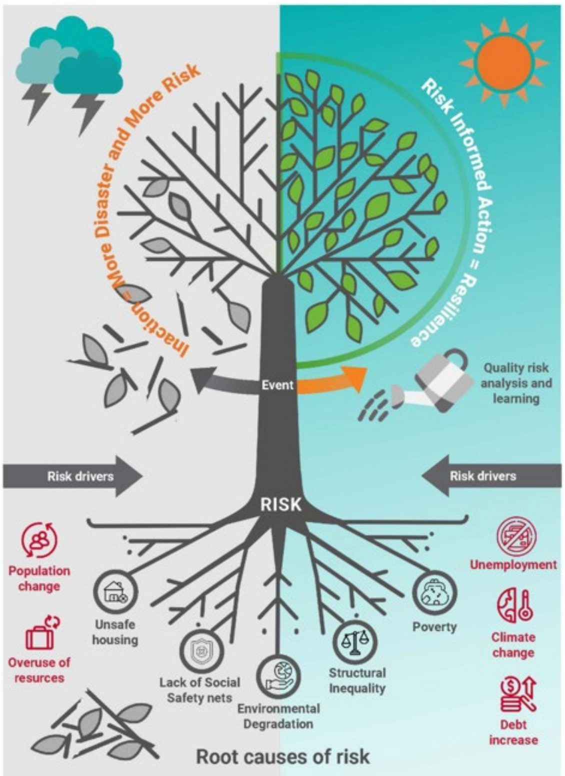


**Figure 8 :** Root Causes for Risk , Source: United Nations Office for Disaster Risk Reduction (UNDRR), Forensic Insights for Future Resilience: Learning from Past Disasters (Global Assessment Report 2024), Geneva, 2024.

Sendai Framework points out that "Disasters, many of which are exacerbated by climate change and which are increasing in frequency and intensity, significantly impede progress towards sustainable development. Evidence indicates that exposure of persons and assets in all countries has increased faster than vulnerability has decreased, thus generating new risks and a steady rise in disaster related losses, with a significant economic, social, health, cultural and environmental impact in the short, medium and long term, especially at the local and community levels."[201]

199 Intergovernmental Panel on Climate Change (IPCC), Climate Change 2014: Impacts, Adaptation, and Vulnerability, Working Group II Contribution to the Fifth Assessment Report (Cambridge: Cambridge University Press, 2014).
200 United Nations Office for Disaster Risk Reduction (UNDRR), Forensic Insights for Future Resilience: Learning from Past Disasters (GAR Special Report 2024) (Geneva: UNDRR, 2024).
201 UNDDR, 2015.

Climate change represents an increasing concern because changes in temperature, precipitation, moisture, wind intensity, and sea level rise can destabilize social and environmental conditions [202] These gradual climatic variations, together with the rise in extreme events, are already affecting cultural heritage sites and increasing their vulnerability.[203] At many World Heritage Sites, climate change acts as a threat multiplier by exacerbating pollution, unplanned tourism, habitat fragmentation, and the loss of intangible cultural heritage.[204]

UNESCO and the World Heritage Committee have repeatedly emphasized that climate change presents long-term risks to the conservation of cultural and natural heritage, noting that impacts on integrity and Outstanding Universal Value are increasing.[205] Studies indicate that disasters intensified by climate change have significant economic, cultural, and social implications, affecting people's lives, livelihoods, and cultural identity in the short, medium, and long term.[206] Although climate change is not the primary hazard focus of this thesis, its role as a cross-cutting factor demonstrates how environmental stressors can heighten vulnerability and necessitate stronger disaster risk reduction measures for cities and heritage sites.

The FORIN (Forensic Investigations of Disasters) methodology of UNDRR helps to simplify the process of studying disasters and shine a light on insights that may one day save many lives. It has several features which help to improve the understanding of disaster risk, offering policy options and other evidence-based recommendations that can be integrated with development policy and processes to reduce the risk of disaster. It consists of three main steps. Respectively; understanding the variables, the outcome and the possible main source of the disaster, future trends and forensic learning.

[202] UN-Habitat, 2011.
[203] (Sesana et al., 2021).
[204] Markham, Osipova, Lafrenz Samuels, & Caldas, 2016.
[205] UNESCO, 2008; 2011; Dastgerdi, Sargolini & Pierantoni, 2019.
[206] UNDDR, 2015.

| STEP 1 | STEP 2 | STEP 3 |
|---|---|---|
| UNDERSTANDING THE DISASTER RISK | FUTURE TRENDS | FORENSIC LEARNING |
| What happened? (Hazard)<br><br>Where was the damage concentrated? (Exposure)<br><br>Who suffered most and why? (vulnerability)<br><br>What was resilient? | Look deeper at the identified key areas of disaster DNA and predict potential future trends up to 2050. For example, if urbanization and informal settlements were major contributors to flood damage, then what are the current and likely future trends for urbanization and informal settlements? | Facilitate a multi-stakeholder discussion to review and refine the analysis, co-creating potential policy and practical actions to reduce the risk associated with each identified DNA strand, considering the disaster's |
| Result of Step 1 =Identification of the key DNA strands (unique inflection points) that made this disaster unique. The inclusion of disaster narratives and conversations with impacted people can deepen the analysis and provide a reality check for proposed risk reduction actions. | Result of Step 2 = Conduct a future foresight analysis to identify which areas of current risk are likely to increase in the future. | |

***Table 7 :*** *The FORIN (Forensic Investigations of Disasters) methodology, UNDRR, 2024, table produced by the author*

## 3.6. Risk Assessment in Disaster Risk Reduction

Disaster risk assessment is defined by UNDDR 2017 as " A qualitative or quantitative approach to determine the nature and extent of disaster risk by analyzing potential hazards and evaluating existing conditions of exposure and vulnerability that together could harm people, property, services, livelihoods and the environment on which they depend."[207] Disaster risk assessment evaluates the likelihood and consequences of hazardous events on people, assets and systems.

Risk is enormously complex and assessing it in a robust way requires a detailed and thorough understanding of many factors, for which communities may not have sufficient knowledge, data, or even a general agreement on values.[208]

Risk accumulation, dynamic changes in vulnerabilities, and the different phases of crises and disaster situations constitute a complex environment for identifying and assessing risks and vulnerabilities, risk reduction measures, and adaptation strategies. Understanding of extreme events and disasters is a pre-requisite for the development of adaptation strategies in the context of climate change and risk reduction in the context of disaster risk management. Current approaches to disaster risk management typically involve four distinct public policies or components (objectives)[209] :

[207] UNISDR, 2017.
[208] Mamuji & Etkin, 2019.
[209] IDEA, 2005; Carreño, 2006; IDB, 2007; Carreño et al., 2007b.

**1) Risk identification** (involving individual perception, evaluation of risk, and social interpretation)
**2) Risk reduction** (involving prevention and mitigation of hazard or vulnerability)
**3) Risk transfer** (related to financial protection and in public investment)
**4) Disaster management** (across the phases of preparedness, warnings, response, rehabilitation, and reconstruction after disasters).[210]

The risk assessment process flow outlined in the international standards on risk management (ISO 31000:2009) and on risk assessment (31010:2009) is the most commonly used. [211]

The first three actions are mainly ex ante – that is, they take place in advance of disaster – and the fourth refers mainly to ex post actions, although preparedness and early warning do require ex ante planning.[212] Risk identification, through vulnerability and risk assessment can produce common understanding by the stakeholders and actors. It is the first step for risk reduction, prevention, and transfer, as well as climate adaptation in the context of extremes.

Until recent decades, the focus of disaster management remained largely on attributes of the physical world, primarily risk assessments of the threat of natural and anthropogenic hazards to the built environment. The concept of social vulnerability within a disaster management context received increasing attention when researchers recognized that a more complete assessment of risk must also include the socioeconomic and demographic factors that affect community resilience.[213]

### 3.6.1. Risk Identification

From a national disaster risk assessment perspective, this step is concerned with a very high-level scoping of hazard, exposure and vulnerabilities to define the direction for the rest of the assessment process. It uses the knowledge and experience of stakeholders, data on past disasters and risk information to draw initial conclusions about the importance of a specific hazard, assets, known vulnerabilities and major impacts of concern for an NDRA.[214]

The effective communication of climate change risks to policymakers and the public faces significant obstacles because it demands better comprehension of social vulnerabilities and adaptive capacities. Different social groups show distinct perceptions of risk because their cultural beliefs and values and social norms differ. Risk assessment methods need to be adapted according to the requirements of particular decision-making situations. Risk awareness improvement requires communication strategies which present uncertainty and complexity in a transparent manner. [215]

[210] IPCC, 2012.
[211] UNISDR, 2017.
[212] Cardona, 2004; IDB, 2007.
[213] Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011; Juntunen, 2005.
[214] UNISDR,2017.
[215] Summarized from Patt et al., 2005; Bohle & Glade, 2008; Renn, 2008; Birkmann et al., 2009; ICSU-LAC, 2011a,b.

Accurate, context-specific information and expertise are essential for effective risk identification and assessment in the context of climate change. These are necessary to promote risk-aware actions and well-informed choices. A thorough grasp of the dynamic interactions between exposed and vulnerable elements—such as livelihoods, critical infrastructure, and the environment—as well as the possibility of hazardous events, such as both slow-onset irreversible changes (like sea-level rise) and sudden-onset disasters (like extreme weather) is essential to this process.[216]

Creating such comprehension requires several elements:

**Exposure Analysis:** A key component of assessing the possible effects of risks is determining how people, assets, and systems are exposed to them both spatially and temporally.

**Vulnerability assessment:** Entails examining the underlying ecological, social, and economic elements that impact coping ability and susceptibility, such as unequal resource allocation, which has a direct impact on resilience levels.[217]

**Dynamics of Hazards:** An evaluation of the ways in which human-environment interactions contribute to the production and evolution of hazards is necessary since climate change brings with it new or increased dangers, such as NaTech (natural hazard-triggered technological) risks.[218]

**Knowledge Integration:** To capture new risk trends and societal views, a thorough risk identification process must integrate a variety of knowledge systems, including scientific information, local observations, and indigenous knowledge.[219]

**Methodological Innovation:** Models for analyzing long-term changes like sea level rise or changes in the frequency and size of hazards are among the new instruments needed to evaluate emerging risks and adaptation solutions.[220]

**Governance and Adaptive Capacity:** Vulnerability and resilience are significantly shaped by governance systems. It's critical to comprehend how both official and informal networks can facilitate adaptive governance systems, particularly in uncertain times.[221] Additionally, determining the social boundaries of adaptation guarantees that plans are practical and fair for all demographic groups.

### 3.6.2. Risk Assessment

The International Standards Organization defines risk assessment as a process to comprehend the nature of risk and to determine the level of risk (ISO, 2009a,b). Additionally, communication within risk assessment and management are seen as key elements of the

[216] IPCC, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX)*, chap. 2, p. 90.
[217] Cutter & Finch, 2008; Birkmann, 2011a.
[218] Bohle & Glade, 2008.
[219] Renn & Graham, 2006; ICSU-LAC, 2011b.
[220] Füssel, 2007; Cardona, 2010).
[221] Biermann et al., 2009; Birkmann, 2011a.

process (Renn, 2008). More specifically, vulnerability and risk assessment deal with the identification of different facets and factors of vulnerability and risk, by means of gathering and systematizing data and information, in order to be able to identify and evaluate different levels of vulnerability and risk of societies – social groups and infrastructures – or coupled socioecological systems at risk. [222]

Vulnerability and risk assessments are key strategic activities that inform both disaster risk management and climate change adaptation. These require the use of reliable methodologies that allow an adequate estimation and quantification of potential losses and consequences to the human systems in a given exposure time.[223]

A new framework for disaster risk assessment and risk-based hazard management decision-making is based on a comprehensive concept encompassing the dynamics of urban development and the complexity of cities. This requires a paradigm change in urban DRM, making it a more comprehensive policy agenda that incorporates DRM and CCA agendas into a comprehensive policy and agenda for sustainable urban development.[224]

**Risk Assessment On Natural Disaster Risk**

According to basic elements of natural disaster risk, a conceptual model for natural disaster risk assessment can be created which is divided into three steps- hazard analysis, vulnerability assessment relative to the outcomes and the integrated risk assessment. It is charted in Fig.13. [225]

**Vulnerability Assessment**

The presence of a potential hazard is not sufficient by itself to determine a disaster if it is not correlated with actual damages. Vulnerability is used to describe the conditions or elements at risk which usually determine the potential impacts or loss. Therefore, the risk of a natural disaster can be viewed as a product of hazard probability and vulnerability. Vulnerability reveals the disastrous outcomes, involving loss of lives, injuries, property damages, and so on. Although vulnerability is a key issue in understanding disaster risk, the quantification of vulnerability assessment is less advanced than hazard analysis.

The word "vulnerability" was originally derived from its Latin root vulnerary meaning "to wound", and the concept of vulnerability was first used in the field of environmental ecology, referring to an ecosystem's non-reversible conversion from one state to another.[226]

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[222] IPCC, 2012.
[223] IPCC, 2012.
[224] Gencer et al., 2013.
[225] Du & Lin, 2012.
[226] Du & Lin, 2012.

**National Disaster Risk Assessment Methodologies and Frameworks**

National Disaster Risk Assessment (NDRA) is a systematic process used by governments to understand the risks of disasters at a country-wide scale. It underpins effective disaster risk management by identifying what hazards pose the greatest threats, who or what is exposed and vulnerable, and how to prioritize risk reduction measures. International frameworks like the Sendai Framework for Disaster Risk Reduction recognize the importance of NDRA – the first priority for action in Sendai is "understanding disaster risk" in all its dimensions (hazard, exposure, vulnerability, etc.)[227] The Sendai Framework's vision is for every country to have a central system that regularly produces and updates national risk information to inform prevention, preparedness, and resilience-building. [228]In essence, NDRA provides the evidence base for policies and investments that aim to prevent new risks and reduce existing risks.

The following chapter applies theoretical concepts to Istanbul through its analysis of the Golden Horn area which serves as a real-world environment to study these concepts. The city of Istanbul provides researchers with an exceptional chance to study how disasters have built up throughout time because it has experienced numerous earthquakes and fires and fast-paced urban development and diverse social and cultural elements. The Golden Horn functions as a particular research example because it holds a vital location while preserving its cultural value and facing ongoing dangers to its conservation status. The analytical section of Chapter 4 connects worldwide disaster risk management systems to their actual implementation in a metropolitan area which has experienced numerous disasters throughout its history. The thesis starts to analyze how resilience and vulnerability and governance and cultural heritage interact with each other through its transition from theoretical concepts to specific locations in Istanbul's urban growth process. The research establishes its historical context through this section which introduces the fundamental elements of the case study. The research requires two main tasks which involve demonstrating the Golden Horn's significance for Istanbul's political development and social structure and urban growth and describing the pre-1839 conditions of Istanbul and studying how Tanzimat reforms changed the city. The thesis establishes its historical framework by studying the period which started in 1839 while it examines all relevant events which occurred before and after this time to understand how disaster risk and resilience developed in the Golden Horn throughout history.

[227] UNISDR, 2015).
[228] Ibid.

# Chapter 4

## Istanbul's Golden Horn: Linking Theory and the Context of the Case Study

# 4. Istanbul's Golden Horn: Linking Theory and the Context of the Case Study

The previous chapters developed a theoretical base about hazards, exposure , vulnerability, risk, and disaster risk reduction (DRR) by examining frameworks including the Sendai Framework, urban heritage protection, and risk assessment methodologies. The current chapter uses Istanbul's Golden Horn as a case study to apply theoretical concepts to a genuine historic urban setting. The thesis explains and supports each selected point through Golden Horn historical context to establish their importance for this research.

The extensive historical background and recurrent disasters of Istanbul create an ideal environment to study DRR and urban resilience implementation in real-world settings. To ensure continuity, the analysis of Istanbul's Golden Horn will be structured around five key parameters derived from the Sendai Framework and the literature review in Chapters 1 and 2:

1. Understanding Risk
2. Local DRR Strategies and Governance
3. Build Back Better
4. Resilient Infrastructure & Services
5. Community Engagement and Urban Memory

**Understanding Risk**

The first priority for action requires people to understand disaster risk. The approach requires complete knowledge of all risk aspects which include hazard characteristics and population and asset exposure and vulnerability and community resilience levels.[229] The Sendai Framework requires governments to conduct systematic risk assessments while sharing risk information through hazard maps and vulnerability data. The approach demands complete risk understanding from governments and stakeholders to enable proactive planning instead of emergency responses.

Relevance to the Golden Horn: The authorities of Istanbul together with its communities learned about local disaster risks through their own painful experiences throughout history. The late-Ottoman era brought about the first organized risk assessment through fire-insurance maps created by Charles E. Goad (1904–06) and Jacques Pervititch (1920s–40s) which showed the city's building materials and density and fire risk areas.[230] The maps served to locate areas that presented fire dangers. The Ottoman chronicles from before documented which areas experienced frequent fires and earthquakes but the new cartographic surveys introduced an evidence-based institutional approach to risk assessment. Sultan Abdülhamid II conducted seismological studies following the 1894 earthquake which demonstrated the same approach of using hazard mapping for safer urban development.[231] The process of risk understanding in

229 UNDRR (2015), Sendai Framework for Disaster Risk Reduction 2015–2030, Geneva: United Nations.
230 Jean-François Pérouse, "The Fire Insurance Maps of Istanbul by Ch. E. Goad and J. Pervititch," in Shared Heritage: Ottoman-Turkish Documents and Maps (BNF – IFEA, 2017).
231 Amit Bein, "The Istanbul Earthquake of 1894 and Science in the Late Ottoman Empire," Middle Eastern Studies, 44 (5), 2008.

Golden Horn shifted from traditional oral stories about major fires to become a structured system based on data and maps that pinpointed the city's most dangerous areas.

**Local DRR Strategies and Governance**

The second priority under “Strengthening disaster risk governance” requires governments to establish defined institutional roles and coordination systems with empowered authorities. Governments need to create DRR strategies and enforce building regulations and land-use plans while working with civil society and private sector entities.[232]

Relevance to the Golden Horn: Risk governance in Istanbul has developed through an unsteady process that spans many centuries. The city experienced unorganized firefighting and reconstruction practices until the mid-19th century because its wooden buildings created severe fire hazards. The Tanzimat reforms which started in 1839 brought modern urban administration to the city along with its first building regulations. The Ebniye Nizamnamesi (1848) established the Ottoman Empire's first building code which mandated masonry construction in critical areas and created uniform street dimensions for fire prevention purposes.[233] The government established the Sixth Municipality District and a reconstruction commission after the Great Beyoğlu Fire of 1870 to implement European-style urban planning with broader streets.[234] The old guild-based system gave way to special commissions and new bylaws and municipal oversight which established institutionalized disaster governance. The early 20th century brought dedicated Fire Directorate and building inspection services to Istanbul which established DRR governance structures that align with Sendai's requirements for local accountability and integrated strategies.

**Build Back Better**

Sendai under Priority 4 “Enhancing disaster preparedness for effective response and to Build Back Better” recommends that post-disaster reconstruction efforts should focus on creating better versions of what was lost.[235] The BBB framework requires enhanced planning processes and new building standards and safer construction materials and social programs to minimize future disaster risks.

Relevance to the Golden Horn: The city of Istanbul has made numerous attempts to construct better infrastructure following all major disasters including fires and earthquakes. masonry buildings which they partially implemented to enhance urban resilience.[236] The 1918 Fatih The Beyoğlu Fire of 1870 led planners to suggest Haussmannian boulevards and Fire led the city to establish a new grid pattern and create Fevzi Paşa Boulevard (1928) as a broad fire prevention zone.[237] The Ottoman government constructed the Harikzedegân (Tayyare) Apartments (1919–1922) as fire-resistant concrete housing for victims which Mimar Kemaleddin Bey designed.[238] The project introduced stronger building materials and enhanced sanitation and security features to replace the dangerous wooden construction

232 UNDRR (2015), Sendai Framework, pp. 12–13.
233 Stefanos Yerasimos, İstanbul: Tanzimat Dönemi Kent Planlaması (Istanbul: İletişim, 1999), 45–52.
234 Nur Akın, İstanbul’un 100 Yangını (Istanbul: Kültür A.Ş., 2009), 88–95.
235 UNDRR (2015), p. 14.
236 Akın (2009), pp. 90–92.
237 Nazım İbrahim, İstanbul Yangınları (Istanbul: Türkiye Yayınları, 1934), 132–40.
238 Istanbul Municipality Archives, Harikzedegân (Tayyare) Apartmanları Projesi, 1919–22.

before the term "build back better" became popular. The city applied disaster events to drive urban design improvements throughout its development from Tanzimat reforms to early Republican modernization in line with Sendai principles.

**Resilient Infrastructure and Services**

The third priority requires funding for disaster-resistant infrastructure and service systems which enable cities to operate during emergency situations.[239] The infrastructure development includes transportation systems and energy networks and water supply and emergency response systems which must resist natural disasters.
Relevance to the Golden Horn: The contemporary development of Istanbul's infrastructure network made the city more resistant to disasters. The 1874 reorganization of the professional fire brigade under Count Ödön Széchenyi brought steam engines and permanent regiments for the peninsula and Galata districts and introduced drilling practices.[240] The Terkos Works established piped water distribution in the 1880s which brought firefighting hydrants to the city and the Galata Bridge from 1875 improved district-to-district travel and the Silahtarağa Power Plant from 1914 eliminated the need for open-flame gas lighting.[241] Sendai identifies these infrastructure improvements as fundamental elements which form the core of urban resilience because they decrease exposure to hazards and speed up emergency responses.

**Cultural Heritage and Community Memory**

Sendai expanded the definition of DRR through its focus on cultural heritage protection and implementation of local knowledge systems. The document acknowledges that disaster-related losses affect cultural heritage and identity and promotes the use of traditional and indigenous knowledge for risk evaluation.[242]

Relevance to the Golden Horn: The historic center of the Golden Horn has faced an ongoing struggle between protecting its heritage and ensuring public safety. The rulers of the time focused on rebuilding important landmarks after disasters such as the 1766 earthquake when they built the Fatih Mosque with enhanced structural elements and Abdülhamid II conducted wall repairs of Byzantine structures following the 1894 earthquake.[243] The local population in Balat and Eyüp maintained collective knowledge about flood patterns and building instability through oral traditions which they transmitted across generations. The current heritage protection system in Istanbul bases its approach on UNESCO standards by uniting preservation efforts with memory conservation to build resilience.[244]

These parameters connect the theoretical aspects of the thesis to the practical assessment of historic cities' disaster response and learning processes, Golden Horn, İstanbul in this paper. The earlier chapters determined the necessary steps to decrease risk in heritage cities, based on this research the following chapters will examine Istanbul's historical implementation of

239 UNDRR (2015), Priority 3, p. 17.
240 Kemalettin Kuzucu, "Széchenyi Paşa ve Osmanlı İtfaiyesinin Modernleştirilmesi," Türk Kültürü İncelemeleri Dergisi, 14 (2006): 35–50.
241 Istanbul Fire Department Official Records, http://itfaiye.ibb.gov.tr.
242 UNESCO (2010), Managing Disaster Risks for World Heritage, Paris: UNESCO World Heritage Centre, pp. 15–18.
243 Bein (2008), pp. 911–917.
244 Orhan Pamuk, "Earthquake Angst in Istanbul," in Other Colors (New York: Knopf, 2007), 325–330.

these measures, by primarily giving a general knowledge of the city, reforms, political and urban transitions that took place, demonstrating how Istanbul's Golden Horn area evolved from the Tanzimat Era (1839) to the present through its experience with earthquakes and fires by examining the famous insurance maps as a guide to see the transformations the city has undergone.

In other words, having identified in the earlier chapters what should be done to reduce risk in heritage cities, we now examine how Istanbul has implemented (or failed to implement) such measures over time.

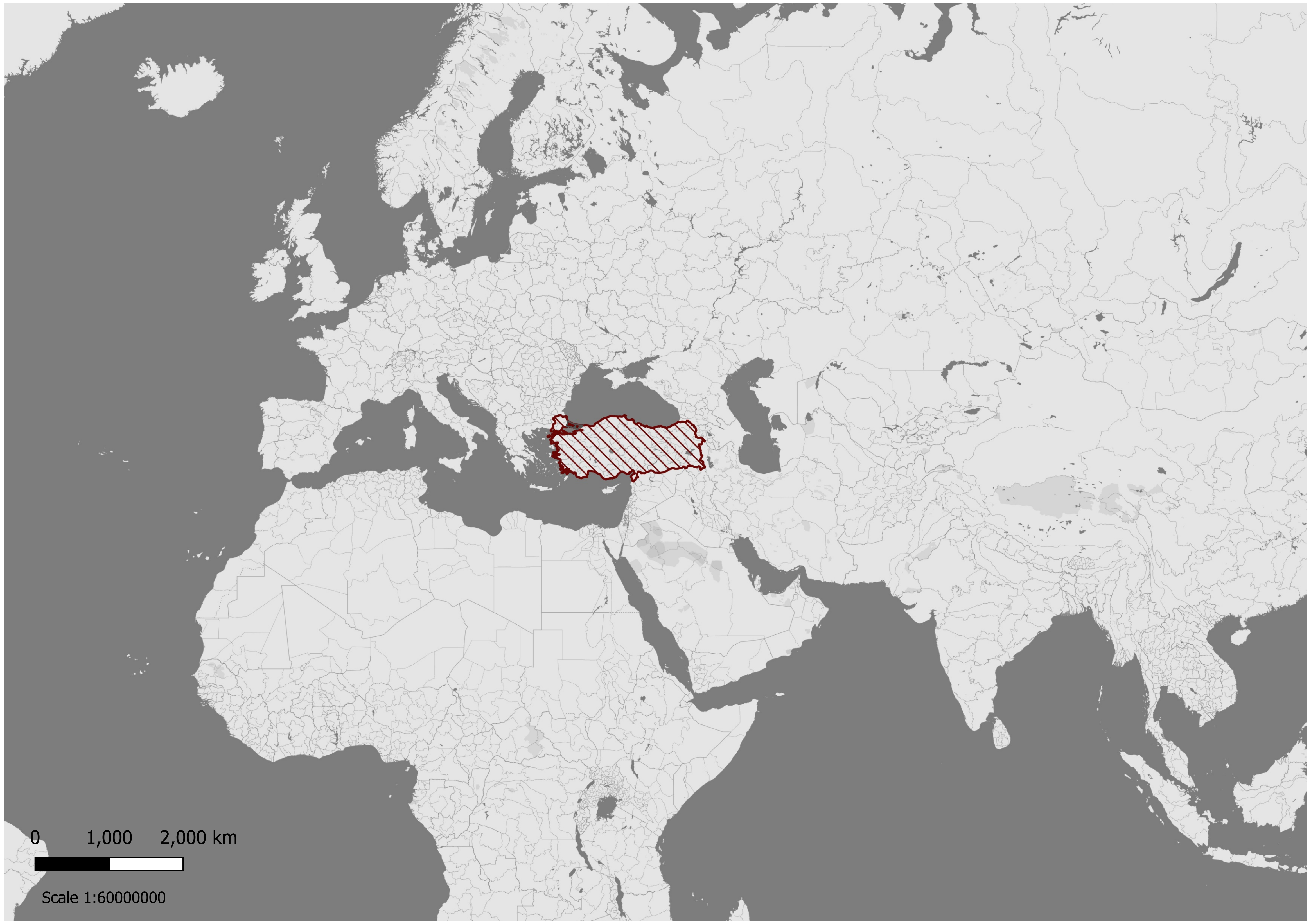
The Golden Horn area of Istanbul demonstrates how historic cities are affected by and experience multiple hazards throughout history while developing their strategies against it. The Tanzimat reforms led to post-1999 initiatives which established principles that match contemporary DRR approaches by using scientific methods for risk identification, mapping and developing better governance systems, regulations & building resilient infrastructure and preparing communities for disasters. The following chapters (4 and onward) will study each of the five parameters through historical documents and maps and disaster statistics and local testimonies and modern evaluation methods. The evaluation of Istanbul's disaster risk management achievements and current obstacles will focus on its heritage sites throughout the Golden Horn area. The research investigates how Istanbul's heritage preservation efforts relate to worldwide urban cultural protection initiatives that need to minimize disaster risks.

## 4.1 Overview of Istanbul and the Golden Horn in a Hazard Context

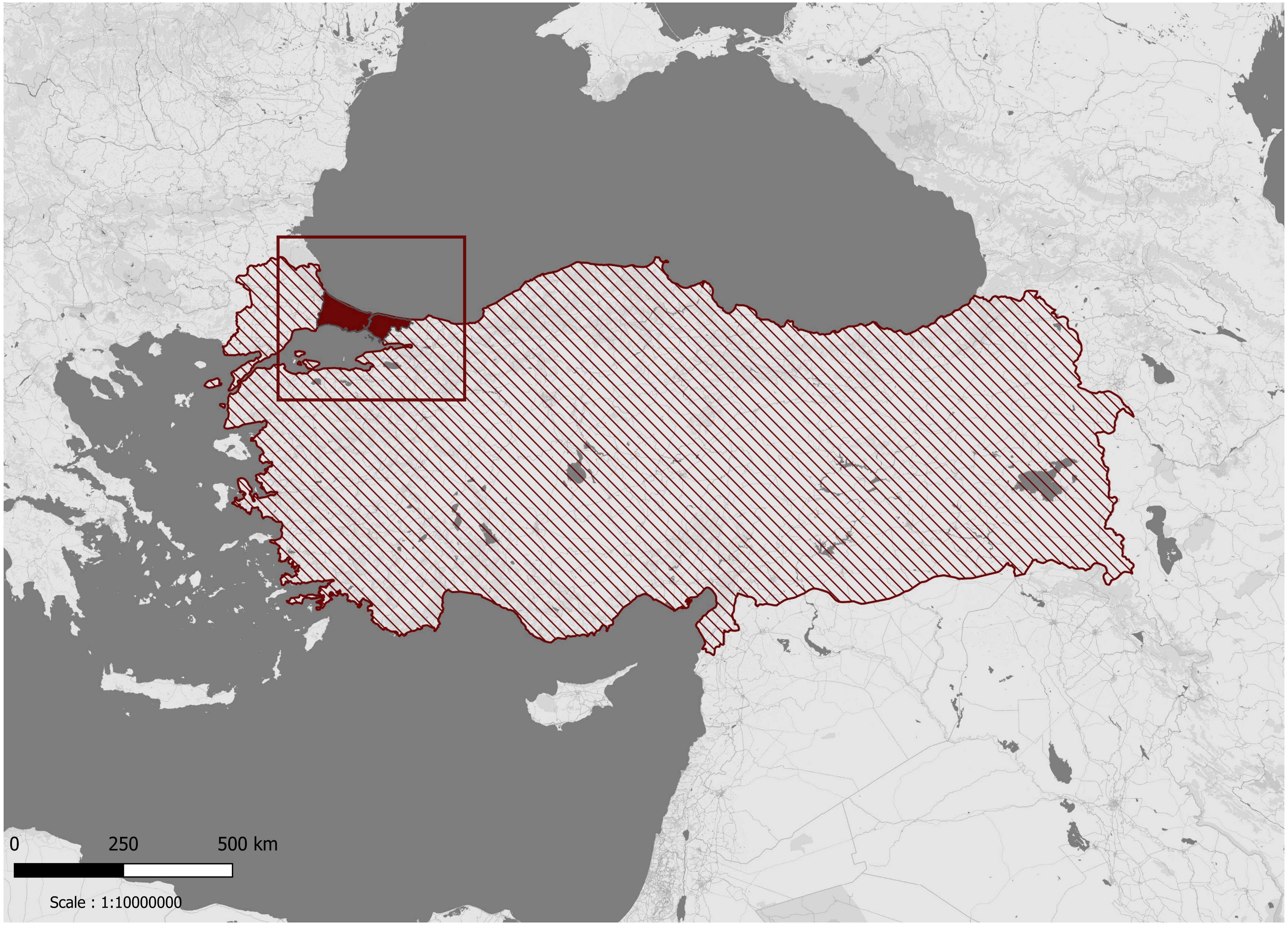
### 4.1.1 A Historical Introduction to Istanbul

The city of Istanbul exists as a worldwide influential urban center which connects Europe and Asia through its transcontinental location for more than 2000 years. The city of Byzantium emerged during the 7th century BCE before Constantine transformed it into Constantinople which later became the Ottoman Empire's capital. The city has maintained its position as a political, commercial and cultural hub since its establishment.[245] The city's position on the Bosphorus Strait allowed it to dominate essential maritime trade paths between the Black Sea and the Mediterranean which led to its development and its rising position as a major political center throughout history.[246]

245 Mango, Cyril. Byzantium: The Empire of New Rome (London: Phoenix Press, 1998).
246 Fleet, Kate. European and Islamic Trade in the Early Ottoman State (Cambridge: Cambridge University Press, 1999).




***Map 2:*** *Geographic location of Turkey within Europe, the Mediterranean basin, and the Middle East. Scale: 1.60000000. Produced by the author.*[247]




***Map 3:*** *Territorial extent of Turkey and location of Istanbul within the Marmara. Scale: 1.10000000. Produced by the author.*[248]

248 The map was produced by the author using QGIS software. Base geographic data were derived from OpenStreetMap (OSM) vector datasets and styled in grayscale to emphasize national boundaries and territorial extent. The highlighted area identifies Turkey, with a locator inset indicating the position of Istanbul. Graphic scale and representative fraction (1:10,000,000) are shown in the map.

The urban structure of Istanbul shows the cumulative effects which different civilizations have left on the city throughout history. The historic peninsula which extends from the Golden Horn to the Bosphorus and Sea of Marmara developed into a tightly packed urban center which featured important religious buildings, military structures and civic buildings.[249] The city grew outward from its original center to reach Galata and other areas while uniting various social groups and commercial areas and waterfront infrastructure which maintained its status as a worldwide economic hub. The city of Istanbul developed through time because environmental disasters including fires and earthquakes and floods continuously transformed its physical structure and social organization.[250] The built environment suffered damage from these hazards which led to multiple rounds of construction work and new urban planning regulations and citywide development changes. The historical connection between development and disaster events has established the basis for understanding present-day disaster risks in the city which needs evaluation through a disaster risk reduction framework for the Golden Horn area.

#### 4.1.2 Historical Disaster Memory in Istanbul

Istanbul's traditional urban fabric has historically been highly fire-prone. For centuries, most of the city's buildings were made of timber and tightly packed along narrow streets – conditions ripe for conflagrations. Ottoman Istanbul experienced fires with alarming frequency; as one 19th-century observer noted, "fires are so frequent that few months pass without them, and they are generally so furious, that whole districts are laid in ashes"[251]

Traditional wooden buildings combined with crowded urban layouts in Istanbul made the city highly susceptible to urban fires throughout its history. The Ottoman period of Istanbul experienced fires at such a high rate that observers from the 19th century stated that fires occurred almost every month.[252] The frequent and destructive fires became so widespread that Istanbul residents began calling them "kıyâmet-i suğrâ" or "little apocalypses" which reflected the shared suffering and sense of destiny related to fire disasters.[253] A common saying developed in public perception which linked Istanbul to fires and Anatolia to epidemics to demonstrate their widespread occurrence: "the fires of Istanbul, the epidemics of Anatolia". The Golden Horn district together with Istanbul has faced numerous hazards because of its dense historic environment which requires effective management of fires earthquakes floods and other crises.

249 Kuban, Doğan. Istanbul: An Urban History (Istanbul: Yapı Kredi Yayınları, 2010).
250 Ergin, Nina. "Disasters and Urbanism in Ottoman Istanbul," Middle Eastern Studies 45, no. 3 (2009).
251 James Dallaway, quoted in Kenan Yıldız, "Istanbul Fires During the Ottoman Period and Their Effect on the City's Topography," A History of Istanbul, Istanbul Tarihi website, accessed January 14, 2026, https://istanbultarihi.ist/393-istanbul-fires-during-the-ottoman-period-and-their-effect-on-the-citys-topography
252 Kenan Yıldız, "Istanbul Fires During the Ottoman Period and Their Effect on the City's Topography," A History of Istanbul, Istanbul Tarihi website, summarized from nineteenth-century observer accounts.
253 Ibid.

The Byzantine Church commemorated major earthquakes in Constantinople, holding public processions and mass on each anniversary. People in the affected areas responded to earthquakes by praying and performing penance because they saw these disasters as political and military occurrences. The combination of earthquake destruction with plague and famine possibly led to population decline and changes in settlement patterns.[254]

Agathias, a contemporary chronicler and eyewitness, described the latter: “Towards midnight when all the citizens were sleeping peacefully in their beds disaster suddenly struck and every structure was instantly shaken to its foundations....large numbers of ordinary people perished in the disaster.”[255] Another author of a Byzantine chronicle from the 13th century stated that "earthquakes are sent by God to teach human beings the fear of God, even though the scientists think that they are caused by the movement of air in underground caverns." [256]

***Figure 14 A and B :*** *Historical visual representations of Istanbul before and after the 1509 Marmara Sea earthquake ("Little Doomsday") :*
*(a) Engraving depicting pre-earthquake Istanbul;*
*(b) Woodcut illustrating urban destruction following the 1509 earthquake.*
*Sources: (a) Angell (n.d.); (b) Ambraseys and Finkel (1995), reproduced in The New York Times (2010).*[257]

254 As cited in “Nükhet Adıyeke Bakır, Bizans’ta Doğal Afetler ve Toplumsal Tepkiler (Istanbul: [Publisher], 2002), summarized in Angell, n.d.”

255 Agathias, quoted in Nükhet Adıyeke Bakır, Bizans’ta Doğal Afetler ve Toplumsal Tepkiler (Istanbul: [publisher], 2002), 39–41, as cited in Angell, n.d.

256 Byzantine chronicle, quoted in Nükhet Adıyeke Bakır, Bizans’ta Doğal Afetler ve Toplumsal Tepkiler (Istanbul: [publisher], 2002), 108, as cited in Angell, n.d.

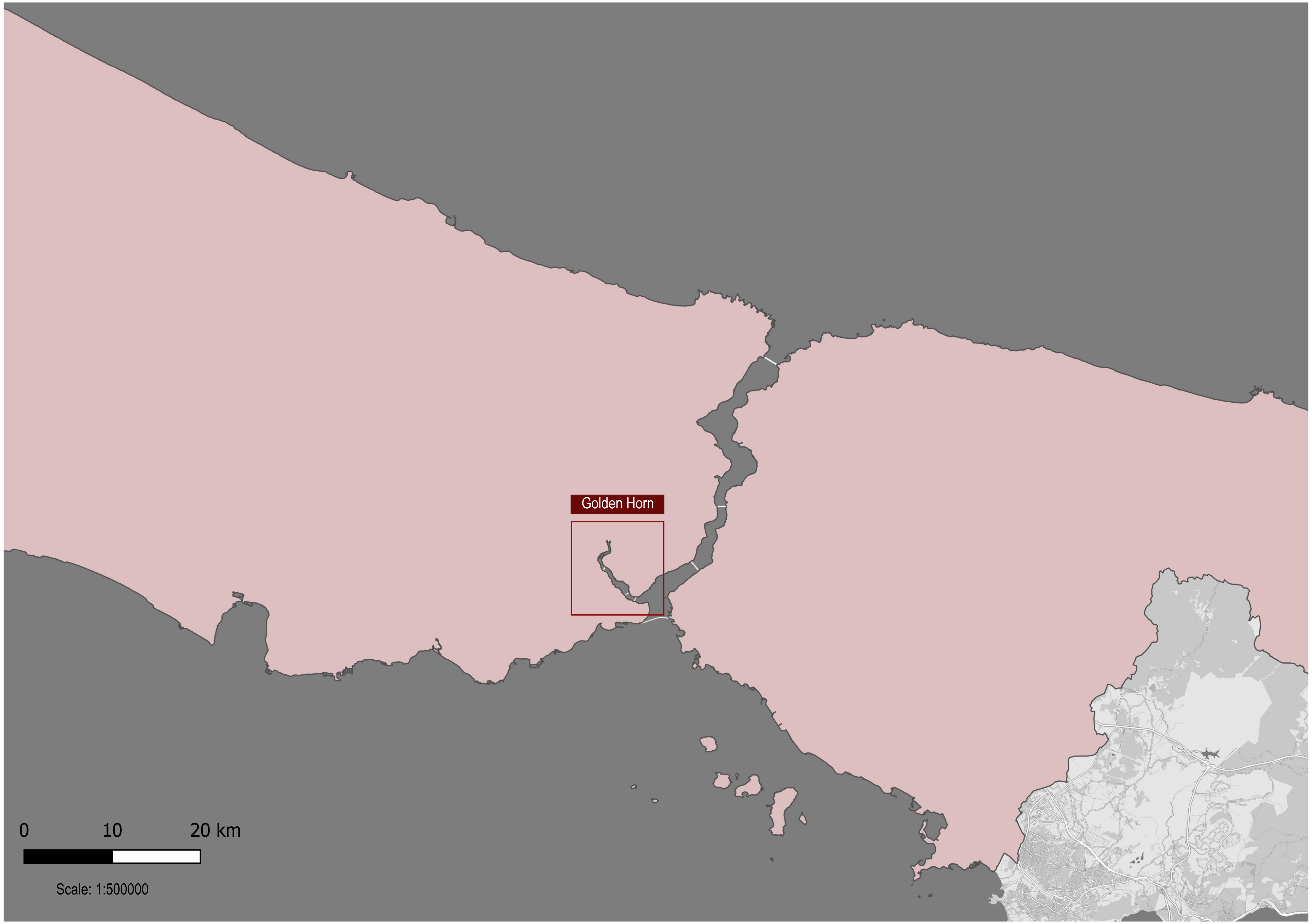
257 Figure (a) is an engraving depicting the 1509 Istanbul earthquake, commonly referred to as the "Little Doomsday," reproduced from Angell (n.d.), Istanbul Tarihi. Figure (b) is a historical woodcut illustrating destruction caused by the 1509 Marmara Sea earthquake, originally published in Ambraseys and Finkel (1995) and reproduced in The New York Times

### 4.1.3. Golden Horn and It’s Historical Significance

Istanbul is a transcontinental metropolis bridging Europe and Asia, and for over 2,500 years it has been one of the world’s most strategically important and populous cities. The Golden Horn (Turkish: Haliç), a horn-shaped inlet dividing the historic old city (the peninsula of “Stamboul”) from the newer quarters of Galata/Beyoğlu, lies at the heart of Istanbul’s geography.

The map (See Map 4) shows Istanbul's complete geography by showing its official borders and how the Golden Horn fits into the city layout. The research focuses on the Golden Horn area which serves as the main study zone because it connects the Fatih historic peninsula to Beyoğlu districts. The map establishes the spatial boundaries which will guide the creation of detailed maps that show Golden Horn hazard zones and heritage sites and urban development patterns.

This sheltered harbor was the commercial and naval lifeline of imperial Istanbul and remains a defining feature of the city’s landscape. The area around the Golden Horn encompasses some of Istanbul’s oldest neighborhoods – from Eminönü and Fatih on the historic peninsula to Karaköy (Galata), Fener-Balat, and Eyüp along its shores – many of which are rich in architectural heritage and dense urban fabric.




***Map 4:*** *General View of Istanbul Highlighting the Golden Horn (Haliç). Produced and mapped by the author using QGIS 3.34 with OpenStreetMap basemap. Coordinate reference system: EPSG:4326 (WGS 84); map scale 1:60,000.*[258]

258 The map was produced by the author using QGIS 3.34. Base geographic data were derived from OpenStreetMap (OSM). The coordinate reference system is EPSG:4326 (WGS 84). The map is presented at a scale of 1:60,000.j

The Golden Horn is a prominent urban canal and the main entry of the Bosphorus in Istanbul, Turkey. The waters of the Golden Horn, a natural estuary that connects with the Bosphorus Strait at the point where the strait meets the Sea of Marmara, help define the northern boundary of the peninsula that makes up "Old Istanbul" (ancient Byzantium and Constantinople), the tip of which is the promontory of Sarayburnu, or Seraglio Point. This estuarial inlet geographically separates Istanbul's historic core from the remainder of the city, forming a horn-shaped, sheltered port that has safeguarded Greek, Roman, Byzantine, Ottoman, and other marine trade vessels over thousands of years. Throughout its history, the Golden Horn has witnessed many turbulent historical events and has been portrayed in various works of art.


***Map 5:*** *Steel plate engraving map of Istanbul, dating to 1841 by the Society for the Diffusion of Useful Knowledge, S.D.U.K. It represents the Constantinople (Stambool), today known as Istanbul and once known as Byzantium. Exhibits the Golden Horn with neighbouring Ghalatah, and Constantinople's Asian part 'Üskudar'. Depicts the city in considerable detail down to individual streets, markets, mosques, buildings and palaces. Published for the Society for the Diffusion of Useful Knowledge Atlas by Charles Knight of 22 Ludgate Street, London, 1841. Source: Society for the Diffusion of Useful Knowledge. (1840). Map of Constantinople (Istanbul, Turkey)*

Under Ottoman control, the Golden Horn still influenced Istanbul's growth. The Ottoman navy built the Imperial Arsenal (Tersane-i Amire) along the Horn's higher areas. The inlet's banks held shipyards (tersane), docks along with storage areas that aided imperial military actions plus trade[259] By the 1600s and 1700s, the Golden Horn's edge became an early area for production. Historical documents besides current studies present places like plants and metal-casting locations at this site. A cannon foundry also a chain forge worked in the 1700s.[260]

In the nineteenth century, industrial development intensified further: one of the first Ottoman textile factories, the Feshane, was established along the Golden Horn in the 1830s, followed by the city's earliest gasworks and electric power facilities toward the end of the century. These industrial installations transformed the Golden Horn into a focal point of Ottoman industrialization, closely aligned with the empire's broader modernization agenda. As historian Edhem Eldem describes it, the Golden Horn functioned as a "mirror of modernization,"[261] where factories and shipyards reflected wider economic and institutional transformations within the Ottoman state during the nineteenth century.

The Golden Horn possesses economic, symbolic along with environmental importance. It formed the boundary of the historic peninsula, separating old Istanbul on its north side. So it often represented a separation between the administrative center at Sarayburnu plus the cosmopolitan trade hub of Galata, situated across the water.

By the 1800s connecting both sides became a stated urban development goal. In the 19th century, the initial bridges across the Golden Horn appeared. It started with a pontoon – floating bridge in 1836, then the Galata Bridge in 1845, to connect the historic city with Galata and Beyoğlu. Improved circulation assisted the change in Istanbul's commercial center. The traditional market district around the Grand Bazaar gradually lost prominence to the Galata waterfront. It happened once bridges and new roads permitted easy transfer of goods plus people. Historians consider this a turning point in Istanbul's urban evolution. The Golden Horn permitted the city to expand and integrate across its banks. This encouraged the rise of new business districts, such as banks and modern offices in Galata. Older quarters experienced some loss as a result.

259 Çelik, Remaking of Istanbul, 78–83.
260 Goodwin, History of Ottoman Architecture, 361–363.
261 Eldem, "Istanbul," 721–724.


***Figure 15:*** *The Golden Horn and the Historical Peninsula from Galata Tower, 1875.*
*The late Ottoman period photograph by Guillaume Berggren shows the Golden Horn (Haliç) and the Historic Peninsula from Galata Tower. The image shows Istanbul's first urban design before major construction projects altered the waterfront area of Golden Horn during the nineteenth century.* [262]

262 Note. The image originates from Guillaume Berggren who took The Golden Horn and the Historical Peninsula from Galata Tower in 1875. The image can be accessed at http://www.eskiistanbul.net/3383/galata-kulesi-nden-halic-ve-tarihi-yarimada-1875-guillaume-berggren-fotograf.


***Figure 16:*** *View of the "Third Galata Bridge" (completed in 1875) and background Eminönü with New Mosque from Karaköy,Istanbul, illustrating the physical link between the historic peninsula and the modern Galata district. Image retrieved from Wikipedia under Creative Commons Attribution-ShareAlike 4.0 International License.*


***Figure 17:*** *Kara-Keui (Galata) bridge, Constantinople, Turkey. (photochrom print, c. 1890-1900). Print shows a bird's-eye view of many pedestrians and a horse-drawn carriage on the Galata Bridge, which spans the Golden Horn at Eminönü, Istanbul, Turkey, with minarets and mosques visible in the background. Image source: Kara-Keui (Galata) Bridge, Constantinople, Turkey (c. 1890–1900) [Photochrom print].*

The Golden Horn has been the lifeline of Istanbul’s urban growth: a sheltered inlet that nourished the city’s trade, shipbuilding, and industry, while also serving as a stage for its most

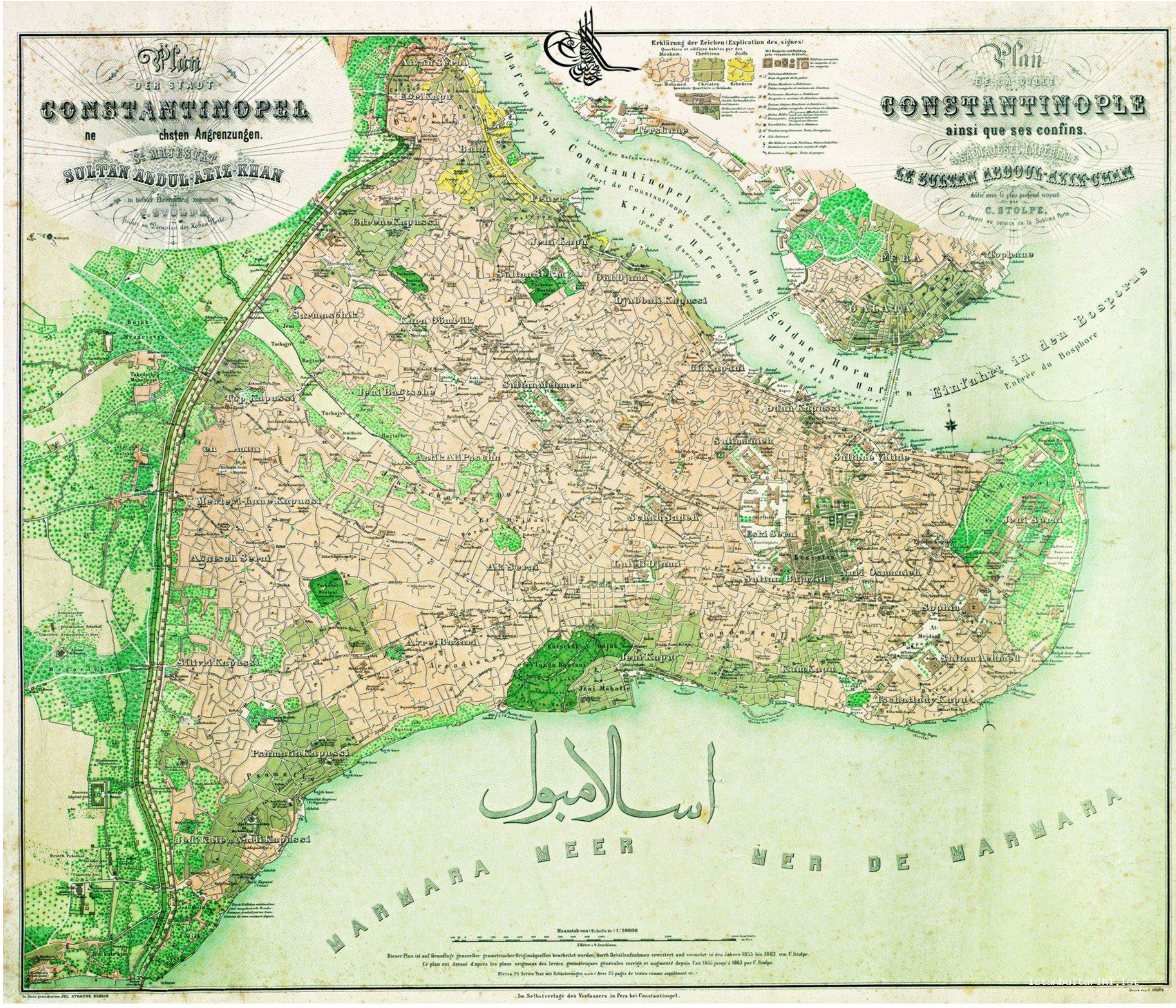
The Golden Horn has been the lifeline of Istanbul’s urban growth: a sheltered inlet that nourished the city’s trade, shipbuilding, and industry, while also serving as a stage for its most dramatic historical episodes. Any study of Istanbul’s planning must consider Golden Horn’s dual role as a physical geographic feature and a driver of socio-economic change.

Crucially, the topic of this research: the Golden Horn area as an urban core is also where the city’s exposure to natural and human-induced hazards has been most pronounced. As Britannica succinctly notes, “fire, earthquake, riot, and invasion have ravaged Istanbul many times,” with more than 60 major conflagrations and numerous destructive earthquakes recorded in its history.[263] These disasters – especially fires and earthquakes – have recurrently punctuated Istanbul’s timeline, in many cases transforming the city’s urban form and prompting new phases of rebuilding and modernization. Today’s Istanbul, characterized by a mix of ancient monuments, traditional wooden houses, and modern infrastructure, still bears the physical and social imprints of past disasters.[264] Wide boulevards cut through old quarters where narrow alleys once stood, often the result of post-disaster reconstruction schemes, and the coexistence of wooden Ottoman-era houses with concrete high-rises speaks to cycles of destruction and rebuilding. [265]

#### 4.1.4. Pre Tanzimat Era in Istanbul’s Urban Planning – A Brief Historical Explanation

Before the mid-1800s, Istanbul's urban layout developed from gradual growth, common Ottoman habits along with reactions to calamities that happened occasionally. In the 1700s the city presented narrow, twisting roads plus houses mostly built with wood. This showed a natural development instead of a designed structure. Areas commonly developed around religious plus charitable buildings (külliye). Each area typically had a mosque, church, or synagogue that gave help to the people. Because the Ottoman capital held diverse ethnic and religious groups, Istanbul’s urban structure involved a combination of Muslim, Greek, Armenian as well as Jewish sections. Each section kept its institutions running. These groups had some independence. Islamic courts (kadı) often watched over city matters. Islamic law affected land use. For instance before the 1800s, non-Muslims had limits on building height and owning land in Muslim areas.

263 Encyclopaedia Britannica, s.v. “Istanbul.”
264 Çelik, Remaking of Istanbul, 45–52.
265 Eldem, “Istanbul,” 720–726.




***Map 6:*** *The map of Istanbul dated 1863 showing Muslim, Christian, and Jewish population densities Source: Öztürk, İ. (2023). İstanbul Tarihi.*

Regulations helped maintain social order plus stopped disagreements among groups within towns. A lack of current comprehensive planning did not mean a lack of rules in pre-Tanzimat towns. The Ottoman government created construction rules when problems, like big fires, arose. Because buildings were made of wood, big fires often happened and caused great damage. Fires resulted in government orders concerning street size, the use of materials that resist fire, and rebuilding guidelines. The regulations usually addressed particular instances and did not last long. They solved immediate problems instead of making city-wide rules that stayed in place. As an example after a large fire, the Sultan could stop the use of wood as a construction material in the damaged area, but then loosen that rule later to help people find affordable housing. This kind of action-by-action response resulted in an unclear way to control towns. No single group always made urban rules followed as well as the important Office of the Chief Architect often lacked the ability to enforce order throughout the city. Urban government in pre-Tanzimat Istanbul involved a system that was decentralized plus based on reaction, with social customs and Islamic law giving direction to development more than governmental systems that we use today.

Scholars note that this era's urban form was irregular but functional. Doğan Kuban describes the Ottoman capital's fabric as a synthesis of Byzantine infrastructure and Ottoman adaptations – with old forums repurposed as markets and a maze of alleyways reflecting incremental growth.[266] The lack of geometric order did not imply chaos; rather, the city's form served the sociopolitical system of the empire. Stefanos Yerasimos [267] emphasizes that before Tanzimat, urban interventions were driven by "natural disasters and social values". Maintaining social order was paramount, so urban regulations often reinforced the status quo – for example, keeping non-Muslim buildings visually modest and clustered separately. Comprehensive planning was absent, but Istanbul's skyline of domes and minarets and its network of markets and mahalles (quarters) was the cumulative result of centuries of imperial patronage and everyday needs. Foundational studies like Kuban's Istanbul: An Urban History and Çelik's overview of the pre-Tanzimat city provide detailed accounts of how, until the 1830s, Istanbul remained a primarily medieval city in its layout, governed by tradition and the rhythms of an aging empire.

### 4.1.5. Tanzimat Reforms and Their Impact on Urban Planning and Disaster Management

Istanbul's demographic structure, economic bodies, construction and settlement activities, power relations and the constant presence of urban risks such as natural disasters and epidemics have each played major roles in defining different periods in the city's history. The transformation phases of Istanbul's urban space have been examined in five separate periods. The first phase is the establishment of Ottoman Istanbul (1453-1520); the second is the completion of an urban framework following the implementation of comprehensive projects (1520-1617); the third is the deterioration of this framework as a result of the city's increasingly dense and complicated character (1618-1718); the fourth phase involves the search for new approaches in urban development (1718-1820s); and the last phase refers to the transformation of urban space shaped by administrative and economic changes in the 19th century.[268] In this chapter of the thesis, the 19th and 20th centuries, starting from the Tanzimat Reforms, will be discussed under the scope of urban transitions over time, with fires and earthquakes.

266 Kuban, Istanbul: An Urban History, 45–48.
267 Yerasimos, La fondation de Constantinople, 112–115.
268 Kiper, "Urban Transformation of Istanbul."


***Figure 18:*** *An engraving of Istanbul by Antoine-Ignace Melling from the beginning of the 19th century. Source: Sercan Ö. Yıldırım, Kentin Anlam Haritaları: Gravürlerde İstanbul, Istanbul: İstanbul Ticaret Odası, 2008, p. 124.*

On November 3, 1839, Sultan Abdül Mecit (r. 1839–61), with the assistance of the European ambassadors, proclaimed a decree (Hatti Serif) making the politics of opening to Western influences official and declared himself as an enlightened emperor: the so-called Tanzimat period of reforms and approximation to the West had started. One of the first acts by the grand 'vezir' Mustafa Resit Pasa was to charge the German Helmut von Moltke with outlining a renovation scheme for the whole city.[269]

The Tanzimat reforms of the mid-19th century set in motion a profound transformation of Istanbul's urban form. The legal and administrative changes led to physical modifications in the city's spatial arrangement and architectural design. Zeynep Çelik notes that the institutional reforms from the Tanzimat Charter declaration led to physical changes in urban fabric development.[270] The traditional Ottoman/Islamic urban design of Istanbul underwent a transformation into a cosmopolitan urban space that incorporated Western architectural elements. The traditional Ottoman/Islamic urban fabric, which featured narrow organic streets and wooden buildings, evolved into a new urban design pattern that adopted European concepts of order and progress.

269 Bankoff, Lübken, and Sand, Flammable Cities, 89–91.
270 Çelik, Remaking of Istanbul, 49.

***Figure 19:*** *Timber houses in the vicinity of Hippodrome, 1853 Source: SALT Research Online Archives*

The urbanization process in Turkey began in the 1950s with the development of planning concepts and rapid increases in population from rural to urban. The cities that faced rapid migration initially faced with the problems of squatting, in the course of time, the period of land arrangements started to be experienced in order to meet the needs of the cities from the 1980s, the cities globally experienced a restructuring and regeneration process due to the economic restructuring and globalization. In the follow-up period, the urban regeneration period started. The implemented regeneration solutions to boost housing supply and combat illegal construction in cities proved ineffective because they lacked proper legal authorization for these practices. Addressing the regeneration with temporary solutions has led to the continuous postponement of the regeneration problem in Turkey, which is under disaster risk, and the inability to determine the building stock that needs to be regenerated.[271]

The 1950s–1970s experienced fast and uncontrolled urban growth through mass migration and the emergence of informal "gecekondu" settlements which created new risks because numerous newly constructed buildings failed to follow seismic codes and fire safety regulations. Istanbul's population grew from one million in 1950 to at least ten million by the end of the twentieth century, thanks to rapid urbanization and labor migration, which brought in waves of new residents. Many of them resided in unplanned and often unlawful impoverished settlements known as gecekondu, which sprang up on the city's outskirts to accommodate the growing demand for housing. During this time, multistory concrete apartment complexes replaced wooden or brick dwellings, transforming the urban fabric of the city center. Legal criteria for earthquake-resistant design were established in 1944 and modified in 1953, 1968, 1975, and 1998, however their application and enforcement varied

271 Çelik, Remaking of Istanbul, 150–158.

significantly.[272] Corruption and cost-cutting meant that many new structures, including those with official licenses, were planned with insufficient structural reinforcement or built with poor materials. As a result, many middle-class neighborhoods were just as vulnerable as gecekondu areas, if not more so, because to the presence of taller multistory apartment buildings.

## 4.2. Historical Development through Hazards as Urban Change Initiators

This chapter explores the historical and spatial changes of the Golden Horn area in Istanbul after Tanzimat reforms by analyzing the relationship between urban planning and environmental hazards and collective memory by examining the fires and earthquakes and their impacts under the five parameters that are taken from the Sendai Framework briefly, mentioning which type of DRR Measures were taken , how urban memory was formed after each hazard and their impacts , involving local chronicles and sources of some individuals' memories of the disasters that the city – Golden Horn area has undergone.

The main analysis focuses on the post-1839 period when the Ottoman Empire launched extensive modernization initiatives which transformed both the physical cityscape and administrative control of the city. The Golden Horn functions as the main study area to analyze how recurring natural disasters affected urban planning decisions and neighborhood development patterns. The analysis uses historical maps together with insurance plans and local chronicles to provide a detailed hazard assessment of the Golden Horn area which demonstrates how state-led actions and community responses shaped Istanbul's urban memory of disaster and resilience.

## 4.3. Earthquakes after 1839 (Tanzimat Era)

Before modern disaster management frameworks, societies interpreted disasters through spiritual/cultural lenses. The 1755 Lisbon earthquake marked a turning point, demonstrating early scientific approaches to risk mitigation through Pombaline architecture's seismic adaptations. In Ottoman Istanbul, earthquakes were often perceived as divine warnings, with rebuilding efforts focusing on religious structures rather than systemic urban planning.

Geographically, Istanbul exists in a high-risk area. The city's location in one of the world's most seismically active regions has made it vulnerable to earthquakes since the beginning of urban settlement. [273] The Marmara Sea region, is one of the most seismically active regions of the continent as manifested by the number of large earthquakes ($M \geq 6.0$) that occurred during 1509- 1999.[274]

272 Angell, "Urbanization and Disaster Risk in Istanbul."
273 Angell, "A City View: Earthquakes in Istanbul's History."
274 Kalkan et al., "Seismic Hazard in the Marmara Region."

It faces constant earthquake danger because it is located near the North Anatolian Fault Line, which stands as one of the world's most seismically active region and where at least 34 earthquakes of magnitude ~7 or above have struck in the last two millennia. That is why, it has always survived countless earthquakes throughout its history and continue to face them. Hundreds of smaller earthquakes happen on the Marmara Fault system every year, and it is not uncommon for residents of Istanbul to feel one or two of these small earthquakes in any given year—a regular reminder of the region's seismicity. Damaging earthquakes are less frequent, but still occur often enough to persist in public memory as well as historical records.[275]

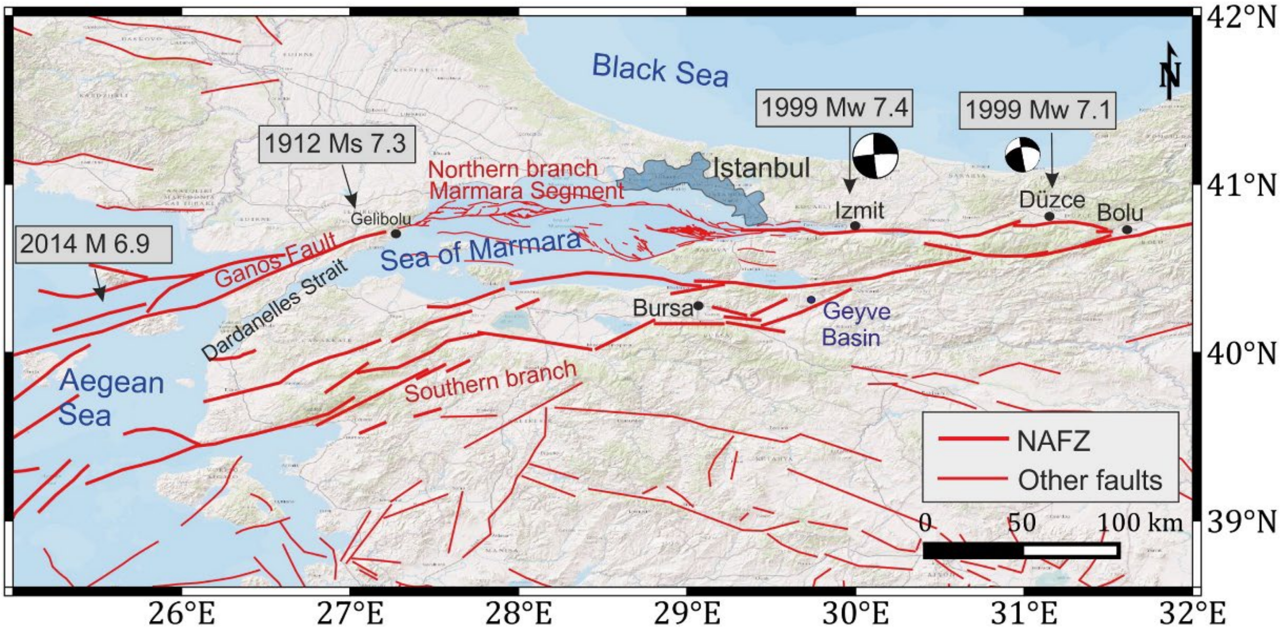
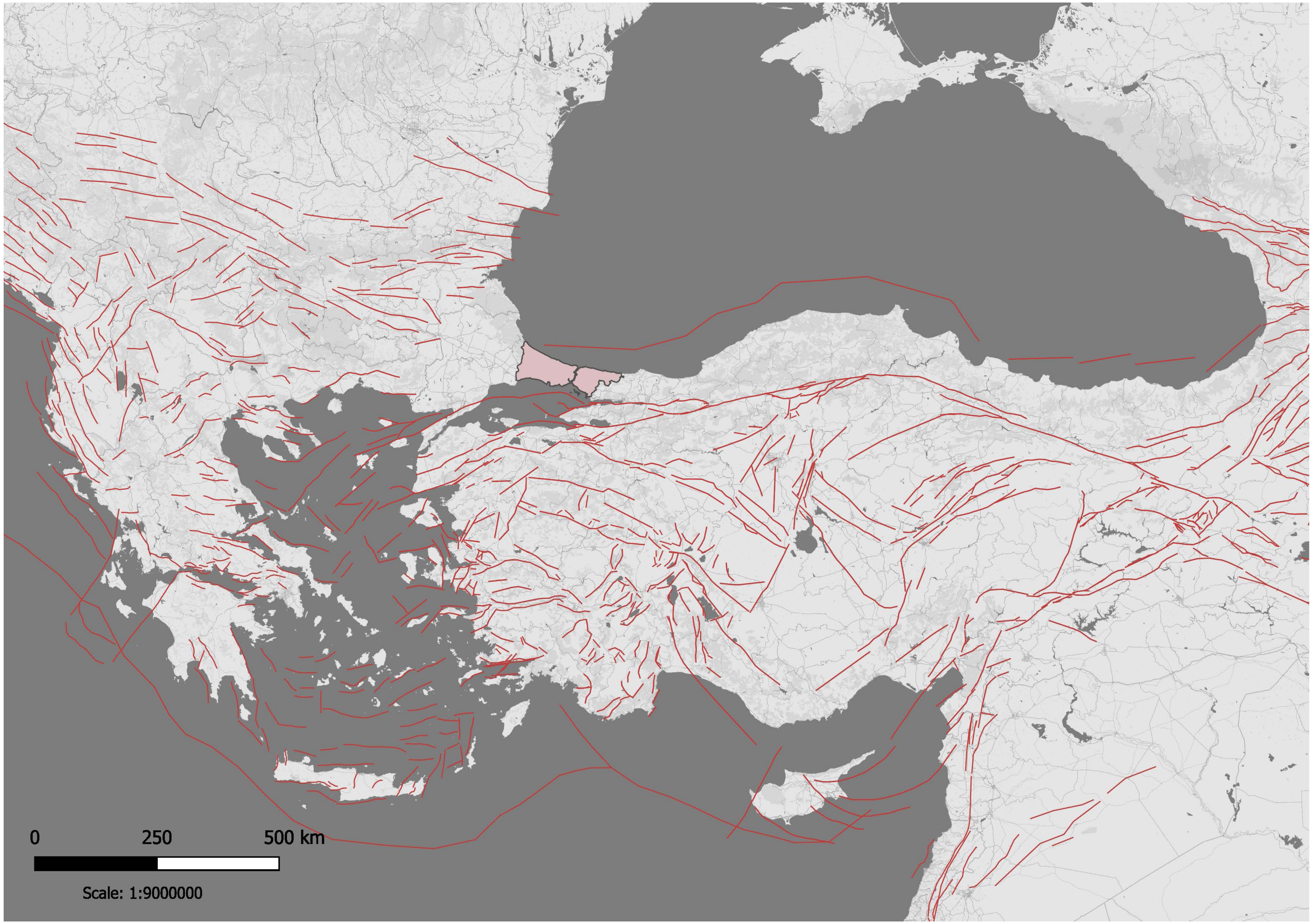



***Figure 20:*** *Map of the western part of the North Anatolian Fault Line "Maximum earthquake magnitudes along different sections of the North Anatolian fault zone"*

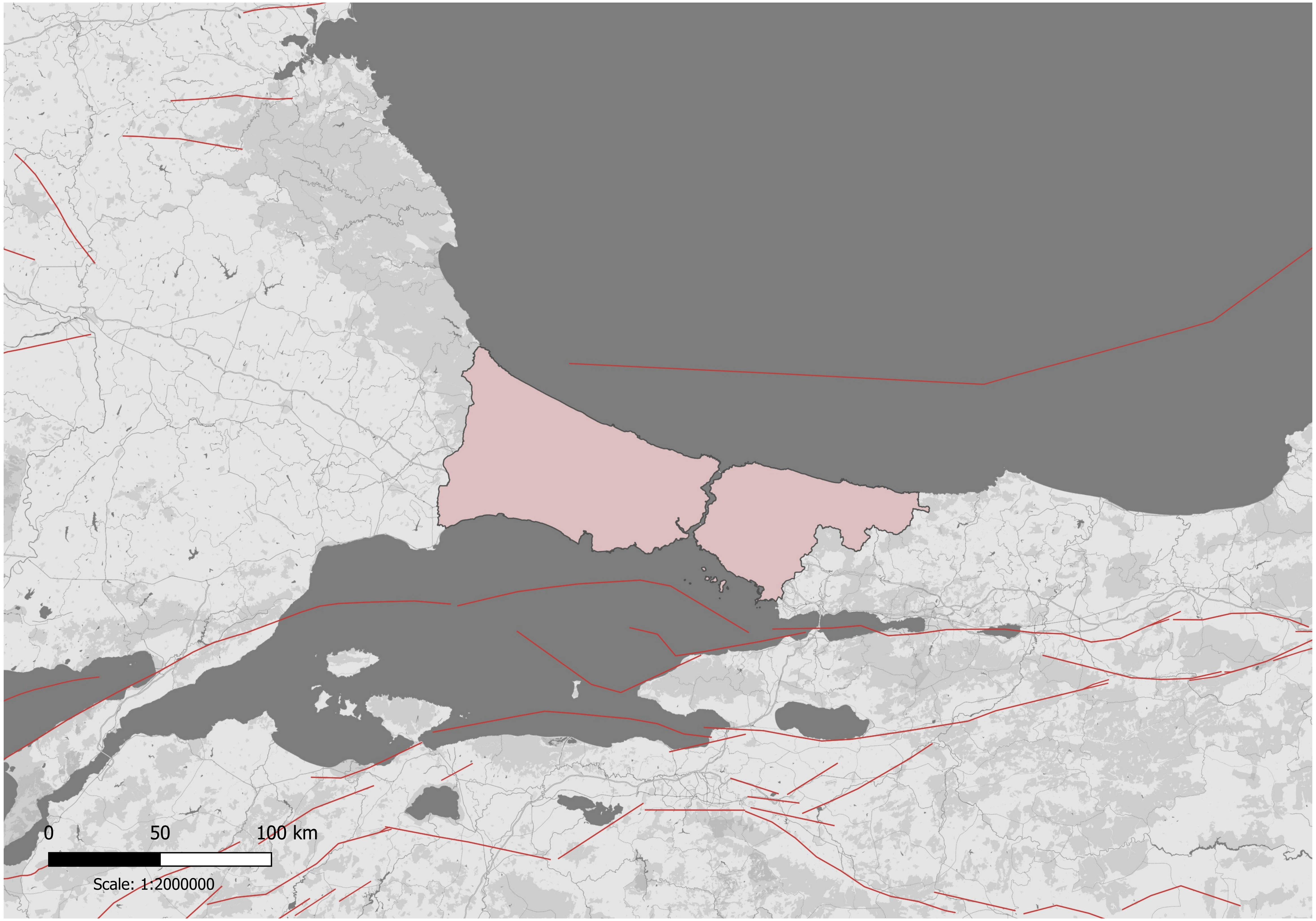
The map in Figure 20 shows how earthquake danger spreads throughout Istanbul because of its distance from the North Anatolian Fault (NAF) and its geological characteristics. The map shows hazard intensity through three categories which stem from seismic data normalization. The southern districts of Istanbul receive the highest hazard ratings between 0.8 and 2.4 because they lie near the active fault zone and contain soft alluvial soils which increase ground motion. The northern parts of the city along with its elevated areas demonstrate lower risk levels. The map demonstrates how Istanbul faces different levels of earthquake danger which requires specific risk reduction measures and urban development strategies for its most dangerous southern area

275 Angell, "A City View: Earthquakes in Istanbul's History."



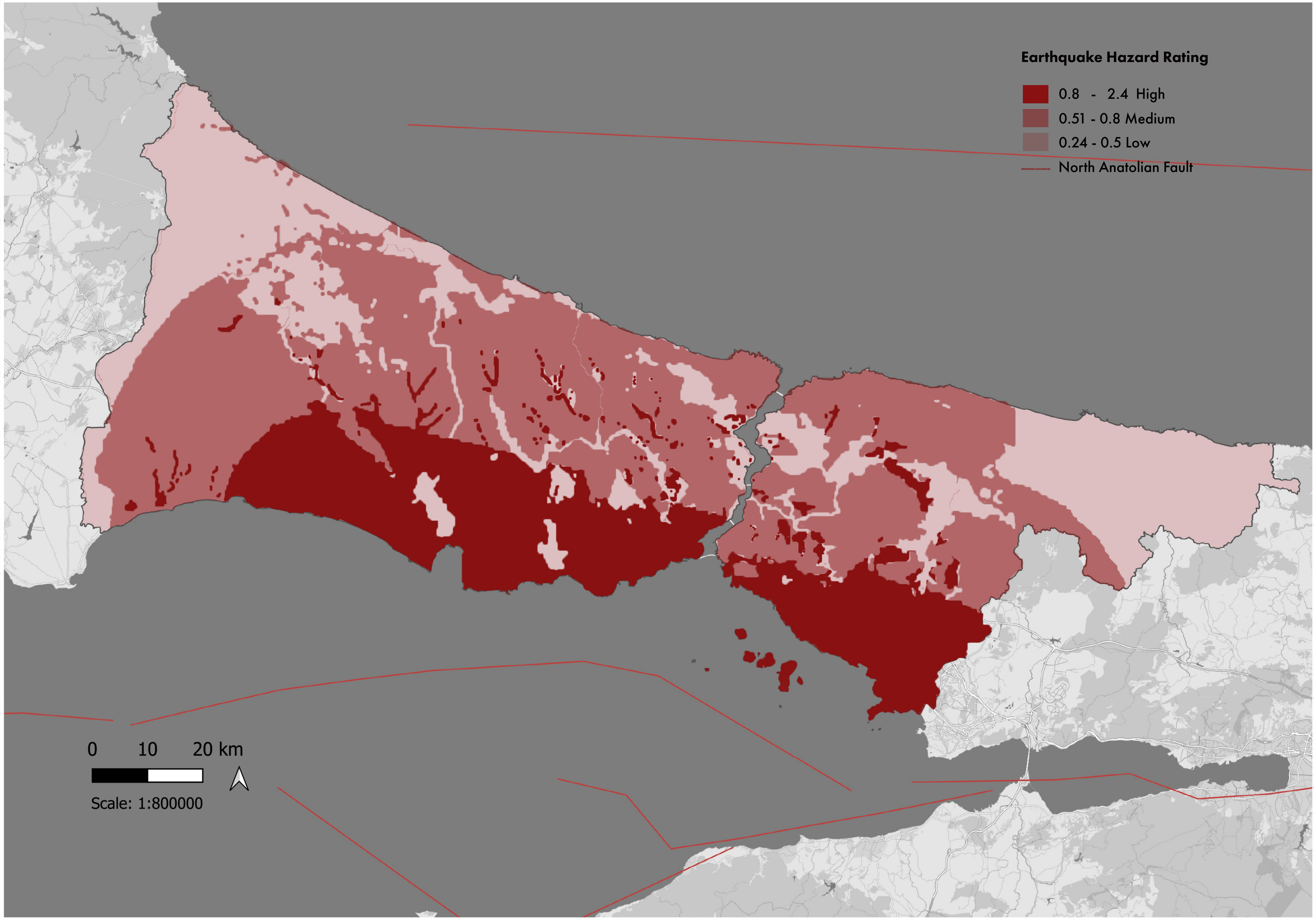

***Map 7:*** *Major seismotectonic structures of Turkey, highlighting the regional fault systems influencing seismic activity.*[276]

276 The map was produced by the author using QGIS software. Major fault systems across Turkey were compiled from published seismotectonic datasets and overlaid on OpenStreetMap (OSM) base data. The map provides a national-scale overview of tectonic structures relevant to seismic hazard assessment. Scale as shown.




***Map 8:*** *Active Fault Systems around Marmara Region which are highly related with the earthquakes of Istanbul, including segments of the North Anatolian Fault (NAF). Scale : 2000000. Produced by the author.*[277]

277 The map was produced by the author using QGIS software. Active fault segments, including the North Anatolian Fault, are shown in relation to the Marmara region to illustrate the tectonic context of Istanbul's seismic risk. Base geographic data were derived from OpenStreetMap (OSM). Scale as shown.




***Map 9:*** *Earthquake Hazard Rating Map produced by the author. Scale: 800000. Providing a visual representation of Istanbul's differentiated seismic hazard zones, illustrating how risk levels vary spatially across the metropolitan area. It serves as a contextual layer for understanding the city's exposure patterns and supports the spatial analysis of historical disasters and vulnerability mapping conducted in this study.* [278]

278 The map was prepared by the author using QGIS 3.34 with OpenStreetMap as the basemap. Earthquake hazard data were obtained from AFAD and the U.S. Geological Survey (USGS). The dataset was imported as a .csv file containing magnitude and coordinates, georeferenced in EPSG:4326 (WGS 84), and symbolized according to normalized hazard values.

The Marmara segment of this fault has produced numerous significant earthquakes with the magnitudes 7.0 and above, throughout the past two millennia according to historical records and geological studies at a rate of about one major quake every 60 years. The Golden Horn area located inland from the Marmara Sea has also experienced earthquakes including those in 1766, 1894, 1912 and 1999 which damaged structures throughout the region.

In order to analyze the affect of earthquakes in Istanbul , the history of the earthquakes will be researched as a primary step. As the city has grown, from Byzantium to Constantinople to Istanbul, its material and social structures have been shaken by earthquakes over and over again, leaving physical as well as historical traces. Today, Istanbul's growth into a global megacity of some 15 million people has further magnified the risk posed by seismic activity.[279] In such a setting, "earthquakes are quintessentially urban disasters" since their impact depends as much on building vulnerability as on natural force. This vulnerability was evident throughout the Ottoman period. In the century before the Tanzimat, quakes in 1776, 1790, 1806 and 1837 (the last on the eve of the Tanzimat reforms) repeatedly "caused property damage but not casualties" in Istanbul.

Earthquakes during the Ottoman period occurred during quick urban expansion. After the Tanzimat started in 1839, a clear policy change took place in construction. Traditional timber buildings were replaced by kârgir stone-and-brick buildings to reduce fire danger. While helpful for fires, this had unexpected seismic implications. Masonry constructions are less flexible than wood, making them brittle during heavy shaking. According to a historian, the 1894 earthquake struck a city that was technologically advanced but still frail. Table 1 summarizes the series of major earthquakes that occurred throughout the Tanzimat and later period. Notable quakes after 1839 include an 1837 shock (documented in Ottoman chronicles, causing modest damage), the devastating 1894 Marmara quake mentioned above, and several lesser events in the twentieth century (e.g., early 1910s) that affected the historic neighborhoods. In each case, structural collapse and secondary consequences (such as broken water lines and tsunamis) exacerbated the hazard.

279 Angell, "A City View: Earthquakes in Istanbul's History."


***Figure 20:*** *A scene from one of the sides of the little han in the Earthquake of July 10, 1894 (Istanbul Metropolitan Municipality, Atatürk Library) Source: Angell, E. (n.d.). A seismic cityscape: Earthquakes in Istanbul's history. A History of Istanbul. https://istanbultarihi.ist/396-a-seismic-cityscape-earthquakes-in-istanbuls-history*

***Figure 21:*** *A destroyed section of Great Market (Büyükçarşı) in the Earthquake of July 10, 1894 (Istanbul Metropolitan Municipality, Atatürk Library) Source: Angell, E. (n.d.). A seismic cityscape: Earthquakes in Istanbul's history.*

***Figure 22:*** *The street of jewelry stores in Great Market (Büyükçarşı) in the Earthquake of July 10, 1894 (Istanbul Metropolitan Municipality, Atatürk Library) Source: Angell, E. (n.d.). A seismic cityscape: Earthquakes in Istanbul's history.*

The 1894 earthquake served as a major impetus for the development of seismological research in the Ottoman Empire. Sultan Abdülhamid II commissioned Demetrius Eginitis, the director of the Greek National Observatory, to come to Istanbul and produce a report on the causes of the earthquake, which Eginitis completed in August. Ottoman ambassadors in Europe were ordered to write reports about the state of seismological research and instrumentation in the countries where they were posted, and a committee in Istanbul drew on this information to plan the creation of a local seismological service. [280]

While 1894 did not result in the kind of sweeping physical re-planning that fires did (See fires), it became a catalyst in other ways. Notably, the 1894 disaster "served as a major impetus for the development of seismological research in the Ottoman Empire" [281]

Shortly thereafter, the government authorized funding for the foundation of Istanbul's first seismological observatory, in Maçka, and hired the prominent Italian seismologist Giovanni Agamenonne to be its director. Agamenonne's successor, Salih Zeki Bey, and the group of researchers they trained became the founding scholars of seismology in the Ottoman Empire and the Turkish Republic. The seismic observatory was eventually relocated to Kandilli after the founding of the Republic, and is now the Kandilli Observatory and Earthquake Research Institute.

In this sense, the late Ottoman response to earthquakes was more intellectual and regulatory – improving knowledge and awareness – whereas fires prompted immediate physical rebuilding plans. (See fires) Nonetheless, earthquake risk was gradually being recognized as part of the urban agenda. For example, engineers assessing post-1894 damage suggested strengthening techniques for bridges and historical structures, and there were calls (echoing the fire domain) for stricter enforcement of masonry construction to replace rickety wooden houses that might not withstand the next quake.

Istanbul's seismic history in the Tanzimat period is well documented. Table 1 (below) summarizes the recorded earthquakes affecting the Golden Horn region. Among these, the most significant was the July 1894 Marmara event, as detailed above. Other noteworthy quakes include a series of moderate shocks: for example, a notable tremor in 1837 (just before the formal start of Tanzimat) caused widespread but non-fatal damage to city walls and buildings.[282] Similarly, the city was shaken by the 1855 Marmara quake (which damaged portions of the peninsula and the Horn's banks) and by aftershocks in the late 19th century. Earthquake reports from Ottoman archives often record broken minarets, collapsed chimneys, and cracked masonry. In the Golden Horn districts, even minor quakes caused panic: after the 1894 disaster, people famously fled across the Horn's bridges into parks and squares. Importantly, the shift to stone construction after 1839 had a double-edge: while these kârgir houses survived fire far better, their rigidity made them prone to collapse in strong shaking. Thus Ottoman engineers lamented that by the 1894 quake "the city was more [technologically] developed than ever before, but just as fragile".[283] The Moniteur Oriental

280 Bein, "The Istanbul Earthquake of 1894", s. 920.
281 Angell, "A City View: Earthquakes in Istanbul's History."
282 Ibid.
283 Ibid.

even noted that after the 1894 earthquake "not even just one shop was open in Galata or Pera".[284]

On balance, the patterns in Table 1 show that earthquakes were episodic but severe hazards. The historical seismic record underscores that the Golden Horn – with its soft alluvial soil and dense buildings – was and remains vulnerable to the North Anatolian Fault system.[285]

Istanbul's urban development has been significantly impacted by the many devastating earthquakes that have struck the city, which is situated on the seismically active North Anatolian Fault. In addition to drawing attention to the city's vulnerability, these seismic events have led to significant urban changes, particularly in areas such as urban renewal and disaster mitigation plans. Istanbul's Golden Horn region exemplifies why earthquakes and urban fires dominate local hazard planning. The city lies astride the highly active North Anatolian Fault, which has produced dozens of magnitude-7+ earthquakes over the past two millennia (roughly one every 60 years) and carries a 60–70% probability of another major quake in the coming decades.[286]

During the 20th century, the North Anatolian Fault saw an east–west sequence of major earthquakes, from Erzincan in 1939 to İzmit in 1999, a pattern that some seismologists interpret as evidence of progressive stress building along the fault line and triggering one earthquake after another, like a set of falling dominoes.[287]

The modern earthquake crisis in Istanbul began in 1999 when the 1999 Marmara Earthquake (7.4 Mw) was a pivotal moment for Istanbul, causing widespread destruction and over 17,000 fatalities.[288] The 1999 quake was a watershed moment. It revealed the widespread construction weaknesses in Istanbul – many collapsed buildings were modern apartments that had flouted code – and it spurred public outrage and demands for reform.[289] After the 1999 Marmara Earthquake, the Ministry of Environment and Urbanization stated that there are approximately 19 million building stocks in Turkey and that 35% of these buildings should be considered risky for life and property safety.[290]

In its aftermath, the city initiated comprehensive urban transformation efforts to mitigate future seismic risks. The Earthquake Master Plan for Istanbul (2003), developed by leading Turkish universities, introduced scenario-based risk assessments and prioritized the retrofitting of vulnerable buildings.[291] This plan marked a shift from reactive disaster response to proactive risk mitigation, emphasizing the upgrading of infrastructure and the creation of open spaces.

The earthquake's social and political ramifications were far-reaching, especially three months later, when another catastrophic earthquake devastated Düzce. The 1999 earthquake sparked

284 Moniteur Oriental, 1894, cited in Türkoğlu, n.d., SALT Research Archives, Istanbul.
285 Angell, "A City View: Earthquakes in Istanbul's History."
286 Ibid.
287 Aykut Barka and Ali Er, Depremini Bekleyen Şehir: İstanbul. Istanbul: Epsilon, 2006.
288 A. Özerdem, "The 1999 Marmara Earthquake in Turkey: An Overview of Damage, Emergency Response and Short-term Recovery," Disasters 23, no. 3 (1999): 207.
289 Angell, "A City View: Earthquakes in Istanbul's History."
290 Tunc, Sezgin, and Yomralioglu, DPRA, 2150.
291 C. Scawthorn et al., "Earthquake Risk in Istanbul: Analysis and Mitigation," Earthquake Spectra 22, Suppl. 2 (2006): S524.

popular outrage, both because of the Turkish government's delayed and incompetent response to the disaster and because of anger at the systemic issues that had allowed so many unsafe buildings to be built. The earthquake also triggered an unprecedented mobilization of civil society, with volunteers and nonprofit organizations taking the lead in organizing grassroots rescue and relief activities. The İzmit earthquake caused worry among Istanbul residents about future earthquakes.

One of the latest and most devastating earthquakes Turkey faced is the earthquakes of February 6, 2023, which affected 11 provinces in southeastern Türkiye, underscoring Istanbul's seismic vulnerability.[292] Despite the fact that the epicenter was outside of Istanbul, the tremors gave urban transformation initiatives a fresh sense of urgency. Authorities identified over 1.2 million buildings in Istanbul as requiring renovation or demolition due to their vulnerability to earthquakes.[293]

Collaborative projects between the Ministry of Environment, Urbanization, and Climate Change, district municipalities, and the private sector have focused on replacing old, unstable buildings with modern, earthquake-resistant structures. These efforts also include upgrading utilities such as water, electricity, and natural gas systems to ensure they can withstand seismic events.[294]

Istanbul's urban transformation initiatives are increasingly incorporating sustainability principles. The city is part of the EU Mission for 100 Climate-Neutral and Smart Cities, which aims to align seismic resilience with environmental sustainability. New constructions are designed to be energy-efficient and environmentally friendly, reducing their carbon footprint while enhancing resilience.[295] Community engagement has also become a key component of urban transformation projects. By involving local communities in the planning process, authorities aim to ensure that new developments meet the needs of residents while preserving cultural heritage.[296]

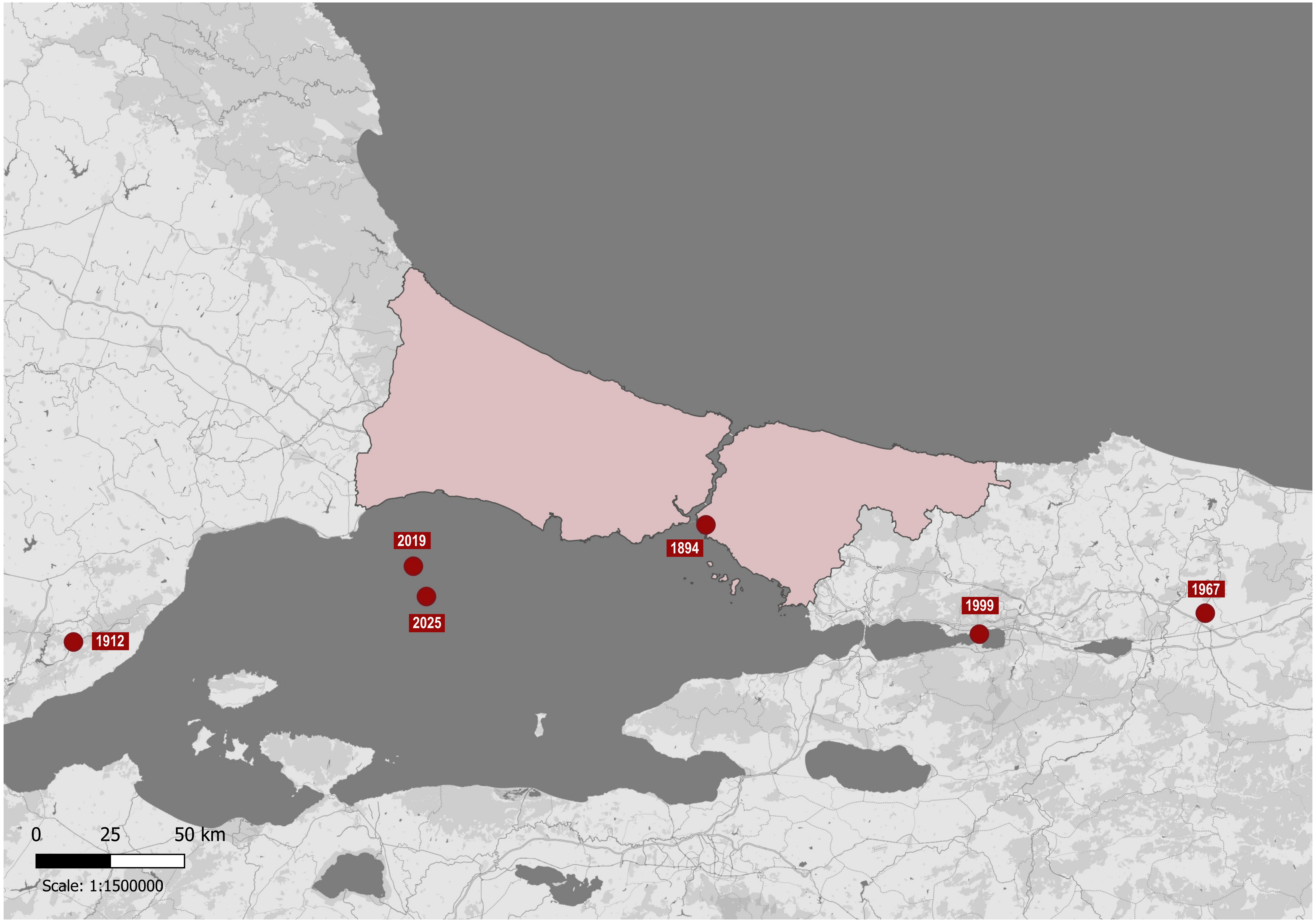
The following table shows the main earthquakes that hit Istanbul through time from 1800 until present while showing their sources and impact zones and resulting urban damage. The earthquakes are categorized in ratings from 1 to 3 which show 1 for restricted damage in specific areas and 2 for moderate damage that causes partial urban disruptions and 3 for major destruction that leads to substantial urban changes. The classification system helps to understand seismic intensity patterns throughout different time periods while showing how Istanbul developed its disaster management systems and building designs and urban resistance capabilities. The table demonstrates that earthquakes with high intensity levels such as 1894 and 1999 caused permanent changes to the Golden Horn area and its historic neighborhoods which led to multiple construction projects and new building standards and different material choices.

292 Z. M. Enlil, "The Neoliberal Transformation of Istanbul's Urban Fabric," International Planning Studies 16, no. 1 (2011): 12.
293 AFAD, Kahramanmaraş Earthquakes Situation Report (Ankara: AFAD, 2023).
294 İstanbul Valiliği, "İstanbul'da Deprem Riski Altındaki Binaların Tespiti," Press Release, March 2023.
295 European Commission, EU Mission: 100 Climate-Neutral and Smart Cities by 2030 (Brussels: European Commission, 2022), 5.
296 S. S. Turk, "Urban Regeneration in Turkey," 145.

| Date | Location | Cause / Origin | Impacted Areas | Outcomes (Damage & Urban Changes) | Impact Scale |
|---|---|---|---|---|---|
| **1894 July 10** | *(M~7.3) "Istanbul Earthquake"* | North Anatolian Fault rupture (Marmara Sea) | City-wide; worst in the Historic Peninsula – Fatih, Edirnekapı, Topkapı, and neighborhoods along the Golden Horn. Princes' Islands also hit. | Officially "several hundred" killed, but likely **1,000+** fatalities ; ~10,000 buildings damaged. Many masonry structures (mosques, schools, markets) collapsed. Highlighted the trade-off of masonry (fire-safe but quake-vulnerable). Spurred renewed enforcement of building codes in subsequent reconstructions. | **3** |
| **1912 August 9** | *(M~7.3) Mürefte–Tekirdağ* | West Marmara Fault quake (Ganos segment) | Lighlty affected minor damage inMarmara Ereğlisi, Silivri, İstanbul (Beyoğlu, Galata, Fatih) | **No significant transformation** in **Istanbul** or **Golden Horn** urban fabric. Estimated 300–400+ dead, several hundred injured. No national earthquake agency existed yet; disaster response was reactive, with no pre-planning. No significant building code changes followed | **1** |
| **1967 July 22** | *(M~7.2) Adapazarı –Mudurnu* | North Anatolian Fault rupture (Bolu segment) | Felt across Istanbul; one notable incident in the old city (Çemberlitaş). | Minimal structural damage citywide, but an old han (inn) in Çemberlitaş (Fatih) collapsed, killing one person. This highlighted the fragility of some aging structures even in moderate quakes. | **1** |
| **1999 August 17** | *(M7.4) İzmit (Kocaeli) Earthquake* | North Anatolian Fault main rupture (Marmara east) | Entire Istanbul province; strongest effects in Marmara coastal districts (Avcılar) rather than Haliç. Golden Horn area felt strong shaking. | >17,000 killed in region; ~1,000 deaths in Istanbul. Haliç's historic quarters saw some building cracks and minor collapses, but the worst devastation hit suburbs on soft soil (e.g. Avcılar). The disaster prompted a city-wide overhaul of building codes and emergency planning, ushering in modern DRM practices. | **3** |
| **2019 September 26** | *(M5.7) Offshore Marmara Ereglisi* | Western segment of the North Anatolian Fault (NAF) beneath the Marmara Sea - right-lateral strike-slip motion | Avcılar, Bakırköy, Silivri, Beylikdüzü, **Fatih, Beyoğlu, Şişli** | **Damage to 473 buildings**, many evacuated. Walls cracked in **Fatih**, Zeytinburnu, Avcılar, and historic school buildings. **Exposed structural vulnerability of older masonry buildings. Triggered inspections and closure of unsafe public buildings. Led to mobile communication collapse — revealed infrastructure weaknesses** | **2** |
| **2025 April 23** | *(M6.2) Offshore southeast of Marmara Ereğlisi, closer to Silivri* | Expected rupture of a segment of the Central Marmara Fault Zone | **Fatih, Eminönü, Beyoğlu, Şişli,** Silivri, Büyükçekmece, Avcılar | non-structural damage (falling plaster, cracked walls) May serve as a wake-up call:<br>Urban renewal policies could intensify<br>**Risk zoning** and retrofit mandates likely to accelerate<br>**Post-quake mapping** and **heritage vulnerability assessments** may increase | **1** |
| **Present** | *Seismic Risk Ongoing* | North Anatolian Fault (Seismic Gap under Marmara) | | No fatal quake since 1999, but risk is high. Scientists estimate a 65–70% chance of an M7+ quake by 2040. Golden Horn's soft sediments could amplify shaking 2–3 times, threatening its vulnerable historic buildings. Intensive retrofitting and disaster preparedness efforts are underway city-wide. | **N/A** |

***Table 8:*** *List of major recorded earthquakes affecting the Golden Hrn area from 1839 to the present. Table produced by the author based on historical and seismological sources (AFAD, n.d.; Ambraseys, 2002; Erdik, 2013; Şengör et al., 2014; U.S. Geological Survey [USGS], n.d.).*

Map 10 below shows the exact epicentral locations of the major earthquakes that struck Istanbul and the wider Marmara region between our indicated time frame for this research, between 1894 and now, 2025, corresponding to the quakes listed in the table above. The spatial distribution of these seismic events highlights the influence of the North Anatolian Fault Line




***Map 10:*** *Epicentral Locations of Major Earthquakes Affecting Istanbul with the highlighted city area (1894–2025). Produced by the author. The map shows the major earthquake epicenters which struck Istanbul and the Marmara region during the period from 1894 to 2025. The map shows each major seismic event through points while displaying Istanbul city limits to demonstrate its location near the North Anatolian Fault zone.*[297]

297 Compiled and mapped by the author using QGIS 3.34 with OpenStreetMap basemap (© OpenStreetMap contributors, 2025). Earthquake epicenter data obtained from AFAD (n.d.) and the U.S. Geological Survey [USGS] (n.d.) databases, exported as a .csv file containing latitude, longitude, magnitude, and event year. Data were georeferenced using EPSG:4326 (WGS 84); map scale 1:1,500,000.

In the figure below shows the same epicentral points of the earthquakes which had the most impact on Istanbul and the Golden Horn region , with Istanbul's city borders and proper placement in the Marmara region.

In the years that followed, state and local disaster management institutions were reorganized and expanded, and the Istanbul Metropolitan Municipality created an Earthquake Master Plan, which outlined a road map for seismic risk assessment, risk mitigation, and disaster preparedness projects that are still ongoing today. Over the last decade, historical monuments, public buildings, and infrastructure including bridges and viaducts have been repaired, and many residents have taken steps to strengthen their own structures. Nonetheless, most of Istanbul's built environment remains vulnerable to future earthquakes.[298]

## 4.4. Fires after 1839 (Tanzimat Era)

Urban fires were equally chronic and devastating in İstanbul considering the fact that many more fires occurred compared to earthquakes. Ottoman chronicles repeatedly liken the city to "a flame" – between 1563 and 1600, for example, Selânikî records 17 fires in just 37 years.[299] Disastrous fires had long been a fact of life in Istanbul, a city of timber architecture, but the 19th century marked a turning point in how the city responded to conflagrations. According to contemporary accounts, Istanbul suffered hundreds of fires – between 1633 and 1839 alone, at least 109 large fires were recorded, and the pace only accelerated in the late 19th century as the city grew denser. In the 19th century, hundreds of conflagrations swept through Istanbul (see Table 9). Eyewitnesses described the collective dread these blazes inspired; as one Italian traveler noted, *"the cry 'Yangın var!' [Fire!]… is charged with a dread meaning, terrible, fateful, carrying dismay… as at the announcement of a scourge from God"*.[300]

Before the mid-1800s, even after catastrophic fires, Istanbul's pattern was simply to rebuild the same crooked streets and wooden houses as before – essentially restoring the status quo ante. Çelik explains that "before the 1840s, the continuous rebuilding necessitated by [fires] was carried out according to previously established patterns… [the destroyed areas] were rebuilt according to what had existed before the fires".[301] There was overriding concern to find radical solutions for fire prevention after 1840, under the influence of Tanzimat reforms, paired with the fervor for modernization, resulted in a new appreciation of urban design. Every burned-down area became a stage for formal urban change.[302]

In the Tanzimat era and beyond, Istanbul's historic quarters suffered repeated, catastrophic fires that reshaped the city. Scholars emphasize that by the mid-19th century, "Istanbul had been struggling with fires rather than social, economic, and political events".[303] Wooden construction, narrow alleys, and scarce water made conflagrations nearly inevitable.[304]

298 Angell, "A City View: Earthquakes in Istanbul's History."
299 Yıldız, "Osmanlı Döneminde İstanbul Yangınları."
300 Edmondo De Amicis quoted in Çelik, Remaking of Istanbul, 53.
301 Çelik, Remaking of Istanbul, 53.
302 Ibid.
303 İ. Sunar and M. Ceylanlı, "The Fires of Istanbul: Spatial Characteristics of the Urban Disasters of the 19th Century," METU Journal of the Faculty of Architecture 29, no. 2 (2012): 1.
304 Ibid., 1–3.

According to Sunar and Ceylanlı, on average "every district in Istanbul experienced fires," and by the end of the century, "approximately 1/50 part of Istanbul was burnt" by recurrent blazes.[305] These major fires often cleared centuries-old urban fabric, enabling new urban reforms.[306] Authorities typically responded by widening streets and enforcing stone construction, reflecting the reality that "with every fire, changes in the topographical structure of the city appeared."[307]

***Figure 23:*** *"Typical Wooden houses in the Stamboul district of Istanbul." (LMA CLC/B/192/019/31522/259, p. 121. Reproduced by permission of RSA Insurance Group PLC and London Metropolitan Archives, City of London Corporation.) Source: Bankoff, Lübken, & Sand (2012, p. 89).*

305 Ibid., 1–2.
306 Ibid., 3.
307 Zeynep Çelik, "Fires," in History of Istanbul, accessed July 15, 2025, https://istanbultarihi.ist/644-fires.

Stamboul district of Istanbul with all wooden houses, showing how vulnerable the city was to fires. (See Figure 23). Bankoff, Lubken and Sand states that: "Woods makes observations about the firefighting techniques of the Ottomans: the dry or demolition extinguishing technique of the Turks, which chiefly entailed pulling down houses and only to a secondary extent the use of relatively ineffective small portable water syringes, seemed to him backward and inefficient, and he urged the managers to establish a company fire brigade that relied more on water hoses."[308]

The fires between 1831 and 1923 ranged from local blazes to city-spanning catastrophes. Early Tanzimat Istanbul experienced especially devastating fires as the one in 1838–39 a "Great Fire" ravaged the Tepebaşı/Pera district, destroying much of modern-day Beyoğlu. Later examples include an 1856 fire in the Aksaray quarter and the great 1865 conflagration in Galata-Hocapaşa. By some accounts the 1865 fire "brought well-being to Istanbul" by clearing space for a new road network – indeed it led directly to the creation of the Islahat-ı Tarik (Road Reform) Commission for planned reconstruction. [309]

The greatest fire in Istanbul's history, the Hocapaşa Fire, also called the Great Fire, burned the city "from sea to sea" (from the Golden Horn to the Sea of Marmara). The government was rocked by the size of the fire and the fact that it occurred in a prominent part of Istanbul.[310]

In subsequent decades the city continued to burn: among many others, the fires of 1870 (Pera), 1908 (Çırçır/Küçükpazar), 1911 (Babıâli and Uzunçarşı), 1912 (İshakpaşa) and 1918 (Yavuz Selim) all "caused great destruction".[311] Each conflagration destroyed whole streets of wooden shops and residences. For perspective, Table 9 (below) catalogues the major fires of this era, many of which struck the Golden Horn vicinity (e.g. Yemişvân/Kadımehmetpaşa, Unkapanı, Odunkapısı, Fener, Balat). These recurring fires prompted continuous rebuilding: for instance, after the 1856 Aksaray fire the authorities reorganized and widened the surrounding streets while after 1865 the Galata-Hocapaşa area was reconstructed with orderly new avenues like Divanyolu, Gedikpaşa, and more.

308 Bankoff, Lübken, and Sand, Flammable Cities, 89–91.
309 Yıldız, "Osmanlı Döneminde İstanbul Yangınları."
310 Zeynep Çelik, The Remaking of Istanbul: The Ottoman Capital in the Nineteenth Century (Istanbul: Economic and Social History Foundation of Turkey, 1998), pp. 44–45; for the boundaries of the area destroyed in the fire, see p. 56, fig. 27.
311 Yıldız, "Osmanlı Döneminde İstanbul Yangınları."

***Figure 24:*** *L'Illustration October 28, 1865 dated 1183 Numbered in the issue On page 277 Hocapasa of the fire an engraving.*

***Figure 25:*** *1863 Kasımpaşa Fire & 1866 Balat Fire Source: Harper's Weekly. (1865, Oct. 28). The Late Great Fire in Constantinople [Engraving]. p. 684. New York, NY.*

The newspapers and periodicals of Istanbul delivered disaster reports as events unfolded in real time. For instance, This Day in History reports that the 1870 fire engulfed a square mile of Pera and left “9,000 homes…destroyed and 2,000 people…dead” . Ottoman and foreign-language presses – Rûznâme-i Cerîde-i Havâdis, İkdam, Saadet etc., and French Moniteur Oriental[312] – covered fires and quakes in detail. Scholars demonstrate that historians use newspapers as their main source for studying urban memory. The period reports show both relief operations (e.g. government aid commissions after the 1870 fire ) and public responses.[313] The press reports from different linguistic communities during that time period maintained records of how common people experienced and managed disasters. a German resident’s 1870 letter from Pera vividly describes the panic of the Beyoğlu fire:

*“On Sunday morning, at 3 o'clock, the fire broke out in an outlying quarter, far away from the German Church. We caught the first flicker of the flames from the roof of the Prussian clergyman's house, and believing ourselves then to be quite safe, looked on calmly, as one is apt to do at the misfortunes of people unknown to us. Besides, the losses here in such cases are not so great as in other European countries, the houses being all small and built of wood…Anxiety, terror, and despair were depicted on every face. The air grew dark and thick clouds of smoke rose up to the skies…From the church steps we watched the fire as it advanced with rapid strides, the wind carrying splinters of burning wood in all directions, and wherever they fell fresh flames burst out. A new rush of fugitives told us that the English Embassy was in flames, and that the fire was already making its way in our direction…I could not get rid of the sound in my ears of the roaring of the wind, the falling houses, the crackling of the flames…The number of dead is said to be over a thousand. Even such a fire, however, could only spread in a country like Turkey, where there is no well-organized fire-brigade, nor a people willing to help their neighbors out of sympathy alone.”* [314]

312 Monsieur, “The Great Fire of Pera (1870)

313 Yıldız, “Şehir Topografyasına Etkisi Bakımından Osmanlı Dönemi İstanbul Yangınları,” 486–487.

314 “Great Fire at Constantinople,” Mercury (Hobart), 1870.

of Ossar's Camp. The programme was well suited for the special purpose of combining a mere parade review and a sham fight of some extent within the space of a summer evening, since the battle ground was close to and, indeed, included that on which the troops first formed for inspection, while the canal close by, with the low hills and swamps near it, afforded sufficient obstacles to justify the detention of even a superior force for some time by an enterprising and vigilant enemy.

At a little before five on Saturday afternoon the troops were formed up on a flat near the canal and on the south side of Cove Common, waiting for Her Majesty's arrival. On the right front was General Carey, C.B., with a division of infantry (General Maxwell's and Colonel Glyn's brigades), and on the left front General Lysons, C.B., with his infantry division (Colonels Elrington and Sankey acting as brigadiers), and these divisions formed the first and second lines. A third was composed of the cavalry, formed for the day into a division, under General White, C.B., with Colonels Baker and Oakes at the head of his light and heavy brigades respectively. The Royal Horse Artillery, Field Batteries, and Pontoon Train made a further line, under Colonel Smyth, C.B. The whole faced southwards towards the canal, which at this part is higher than the plain, and so is hidden from it by its own embankment and some rising ground near covered with bushes.

Arriving from the Pavilion and crossing the canal by a stone bridge close by, Her Majesty suddenly appeared in front of the troops in an opening left for the Royal carriage among the large crowd which thronged the rising ground just spoken of. The Royal salute was given in due form by 10,000 men, following Sir J. Scarlett's word.

trains having filled Aldershott to overflowing. It was said that Her Majesty expressed her great personal gratification, which was doubtless not the less so from the circumstance that the Prince of Wales marched past both times at the head of the splendid regiment of the 10th Hussars, of which he is Colonel. The Queen on this occasion took only luncheon at the Pavilion, and the Prince shared the mess-tent of his regiment. Before 8 Her Majesty was on her way to the Isle of Wight.—*Times.*

GREAT FIRE AT CONSTANTINOPLE.

(From a German Lady's letter.)

THERAPIA, June 8.

On Sunday morning, at 3 o'clock, the fire broke out in an outlying quarter, far away from the German Church. We caught the first flicker of the flames from the roof of the Prussian clergyman's house, and believing ourselves then to be quite safe, looked on calmly, as one is apt to do at the misfortunes of people unknown to us. Besides, the losses here in such cases are not so great as in other European countries, the houses being all small and built of wood. We soon saw that the wind was driving the flames towards the richest and most popular quarter of Pera, but still, not apprehending any danger on our own account, I went out with Miss B. at a quarter to 5. She was going home and I back to Therapia. There was great excitement in the street, and when I had got half way to Galata, a sudden panic seized me and I turned to go back. I had hardly regained the principal street, when I was met by the people flying for safety. Anxiety, terror, and despair were depicted on every face. The air grew dark and thick clouds of smoke rose up to the skies. Not far from our house the Sisters of Charity were coming from the German

that they had no time to save themselves, or fled to the cellars, there to be suffocated. In the hospital 17 patients and one of the Sisters are said to have been burnt, several Germans among them, and one man (the father of seven children), who tried to save the patients; and are already buried. Nothing but cries and lamentations are to be heard, for one meets none who have not directly or indirectly some one to mourn. Over 3,000 families have suffered in this calamity, and three-quarters of Pera are destroyed.

We find in the *Builder* the following account of the origin of the fire:—A poor woman in Constantinople, the other day, was about to go to the upper floor of her living place to bring down the *mangal*, or pan of lighted charcoal, for cooking; but, feeling lazy—the day was warm—sent her child for it. The child let the pan fall on the stairs, near a window curtain; and the result of the woman's change of mind was that terrible fire we have all heard of, which has reduced 30,000 persons to destitution, utterly destroying many hundreds of them and some thousands of houses.

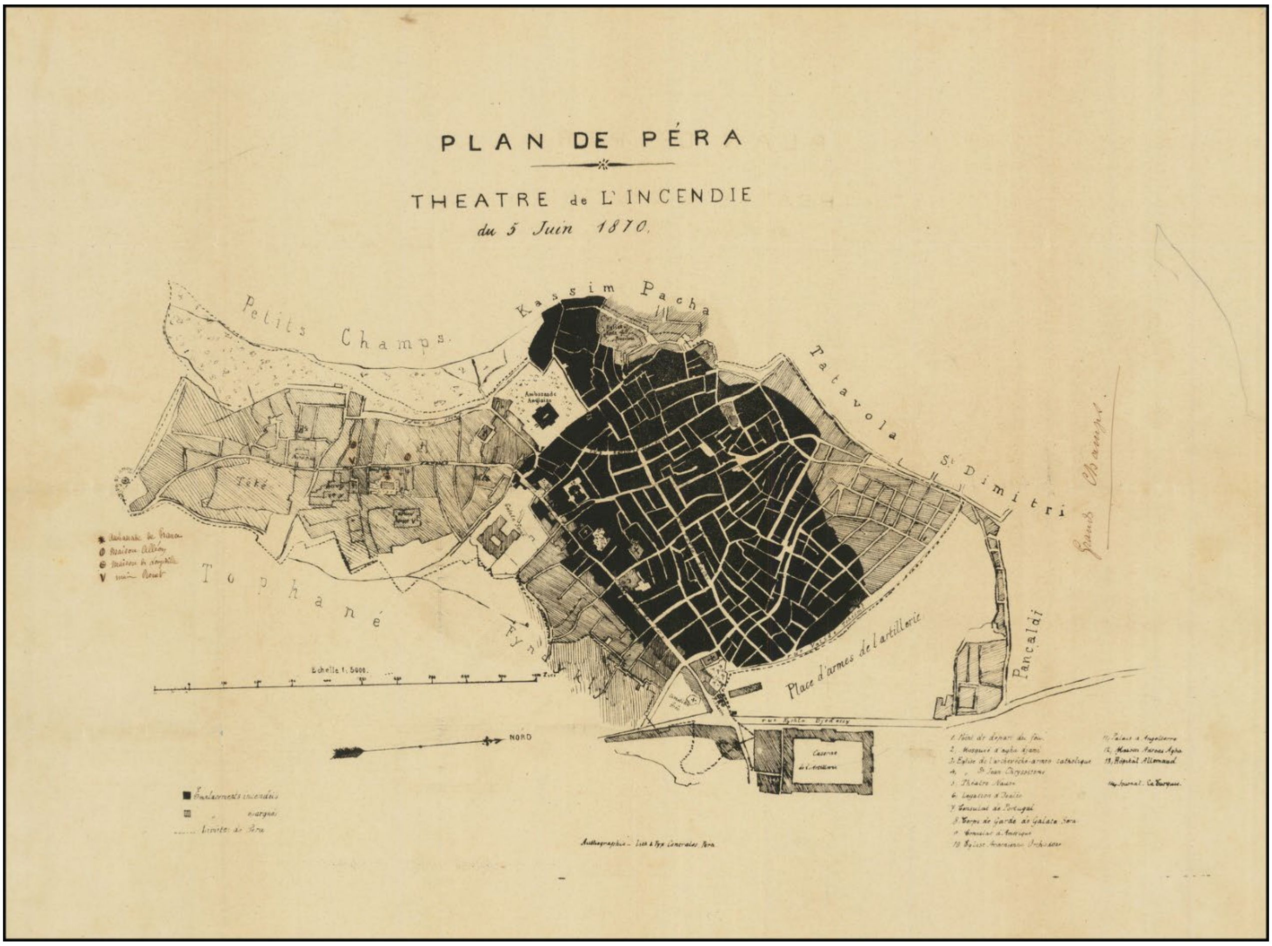
TARIFF OF THE UNITED KINGDOM

No export duties are levied in the United Kingdom. The tariff of import duties, corrected by the Board of Trade to 1st of May, 1870, shows that such duties are levied on cocoa, coffee, chicory, dried fruits, sugar, tea, tobacco, and wine. There are also import duties on beer, malt, and vinegar, to countervail the Excise duty upon British malt; there are duties on spirits, chloroform, collodion, ether, naphtha or methylic alcohol, and varnish, to countervail Excise duty on British spirits; and lastly, the duties on plate and playing cards, to countervail stamp duties



***Figure 26:*** *[Great Fire in Constantinople, A German Lady's Letter, on The Mercury Newspaper.*
*Source: The Mercury (Hobart, Tas.: 1860-1954)*

The account shows that wooden construction throughout Istanbul made the city highly vulnerable to fires because flames could rapidly spread through densely populated residential areas. The lack of a formal fire brigade together with minimal public involvement in firefighting operations demonstrated major weaknesses in urban fire management and disaster preparedness during this time. The combination of these factors made the 1870 Great Fire and other similar events much more destructive and deadly.




***Map 10:*** *[Istanbul Fire of 1870] Plan de Pera - Theatre de L'Incendie du 5 Jun 1870, map illustrating the Great Fire of Pera (Beyoğlu, Istanbul), in June 1870. Source: Autographie, lithographie & typographie Centrales, Plan de Péra: Théâtre de l'incendie du 5 juin 1870, Paris, 1870. Courtesy of Barry Lawrence Ruderman Antique Maps.* [315]

The black area on Map 10 indicates the area destroyed by fire in the heart of the European section of Istanbul, which is now known as Beyoğlu. Notable landmarks shown include the Naum Theater, the Mosque of Agha Djami, Church of St. Chrysostom, Church of the Armenian-Catholic Archdiocese, as well as diplomatic buildings such as the French Embassy, Legation of Italy, Consulates of Portugal and America, and the Galata Sera guardhouse.

Edmondo de Amicis, in his book Constantinople (published 1877), talks about fires (1870 Beyoglu- Pera fire to be exact) and disasters from his own observations and memories:

"It had been burning six hours, and in that time two-thirds of Pera were reduced to ashes, nine thousand houses destroyed, and two thousand lives lost… Whole quarters had disappeared as completely as though they had been Bedouin encampments swept away by a cyclone… thousands of the homeless wandered up and down, ragged and dishevelled, imploring aid…"[316]

315 Plan de Péra: Théâtre de l'incendie du 5 juin 1870, Autographie, lithographie & typographie Centrales (Paris, 1870), Barry Lawrence Ruderman Antique Maps Inc., accessed July 17, 2025, https://www.raremaps.com/gallery/detail/79543.

316 De Amicis, Constantinople, 1896, 275–276.

De Amicis describes the fire's destruction in dramatic detail: entire neighborhoods wiped out, people carrying bits of furniture or personal belongings to nearby cemeteries for safety, and the aftermath of smoldering ruins and desperate crowds. He also says the 1870 fire was the worst disaster the city had faced since the famous fire of 1756:

*"Next to the famous fire of 1756… no such disaster as this has ever visited the city."*[317]

De Amicis doesn't just report facts. He adds the emotional and social impact, noting the shock of Constantinople's population, the interreligious solidarity (Muslims, Christians, Jews all helping each other), and the charitable efforts to house and feed the thousands left homeless.


***Figure 27:*** *Women's Market after the Çırçır Fire, Istanbul, 1908, Originally published in Toplum ve Bilim (Aykut, 2016), as reproduced on SALT Online (2016). Source: Aykut (2016, as cited in SALT Online, 2016).*

317 Ibid.

During World War I, Istanbul escaped any direct battle but suffered industrial accidents and at least one notable fire (the 1917 Cibali fire). In 1918, just at the end of WWI, a massive conflagration swept through the Fatih and Cibali districts along the Golden Horn, reportedly destroying around 7,000 buildings. (Angell, 2020). This tragic event ironically arrived when modern urban planning ideas were maturing – and it became the last great fire to fundamentally reshape the old city's map. The burnt zones of the 1918 fire were used to drive new grid-pattern roads through the historic neighborhood. Notably, the wide Fevzi Paşa Boulevard in Fatih was laid out through the heart of the fire area in the early 1920s, creating a permanent firebreak and traffic artery where dense wooden housing once stood (Angell, 2020). This approach of using a fire-scarred area for urban renewal prefigured the urban planning ethos of the Republican era.

***Figure 28:*** *The view of the area reflects the traces of the İshakpaşa fire of 1912. Source: Source: Kuban (n.d.). https://istanbultarihi.ist/393-istanbul-fires-during-the-ottoman-period-and-their-effect-on-the-citys-topography*

***Figure 29:*** *Another corner in the vicinity of the Erkân-1 Harbiye-i Umumiye office and the places that were heavily destroyed by the fire in Uzunçarsi fire. Source : Cezar, M. (1963). Osmanlı devrinde İstanbul yapılarında tahribat yapan yangınlar ve tabii afetler. İstanbul Güzel Sanatlar Akademisi Türk Sanatı Tarihi Enstitüsü Yayınları: 1. Mimar Sinan Güzel Sanatlar Üniversitesi. https://acikerisim.msgsu.edu.tr/xmlui/handle/20.500.14124/9644*

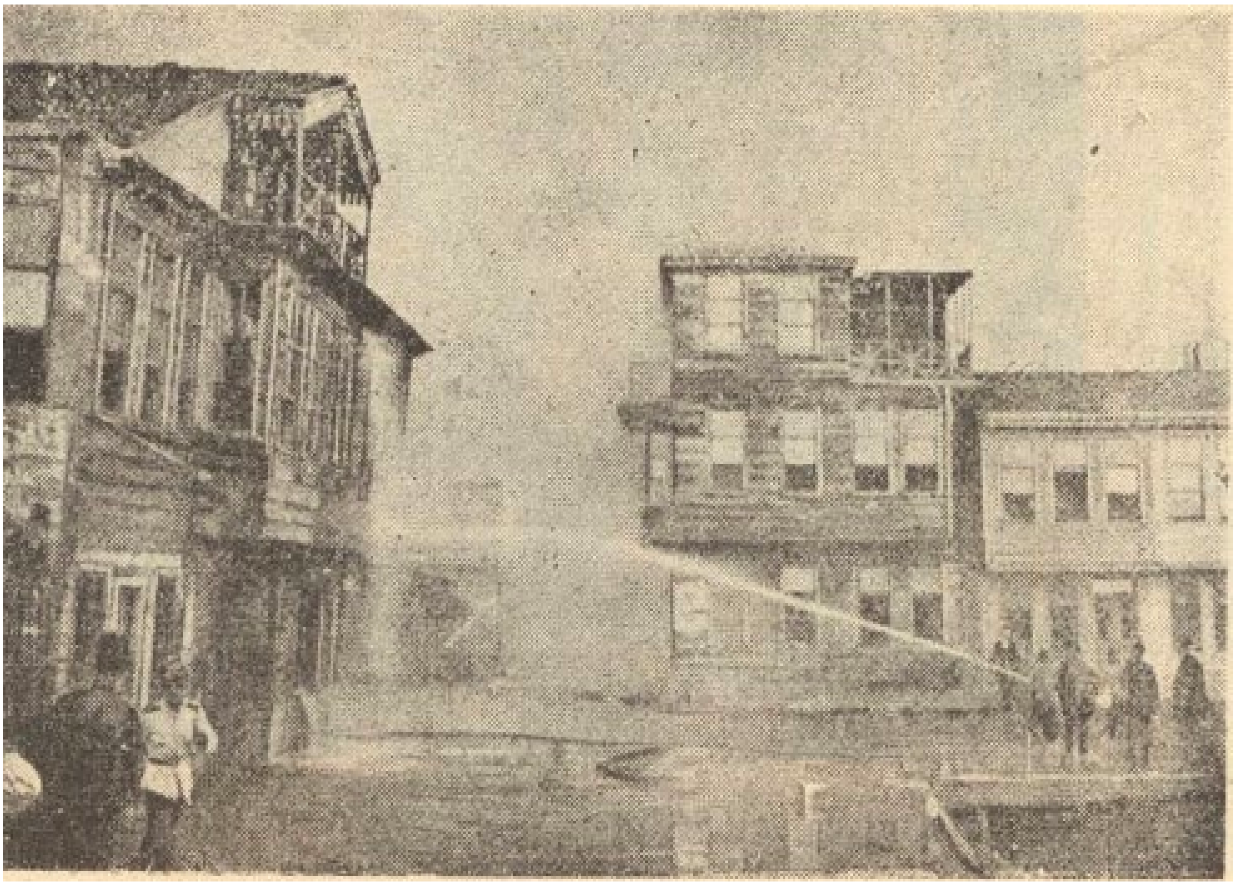


***Figure 30:*** *On July 24, 1911, extinguishing activities in the Balat fir. Source : Cezar, M. (1963). Osmanlı devrinde İstanbul yapılarında tahribat yapan yangınlar ve tabii afetler. İstanbul Güzel Sanatlar Akademisi Türk Sanatı Tarihi Enstitüsü Yayınları: 1. Mimar Sinan Güzel Sanatlar Üniversitesi. https://acikerisim.msgsu.edu.tr/xmlui/handle/20.500.14124/9644*

Table 2 below provides a chronological list of major recorded urban fires affecting the Golden Horn area from 1839 to the present, including their causes, impacted zones, and its effects on urban areas while demonstrating how repeated fires shaped Istanbul's architectural development and urban planning regulations. The impact scale (1–3) evaluates each fire based on its destructive power and its effects on buildings and subsequent changes in urban planning and regulatory frameworks. The combined data shows that timber-based urban structures in Istanbul face ongoing risks which have driven architectural development in the city.

| Date | Location | Cause / Origin | Impacted Areas | Outcomes (Damage & Urban Changes) | Impact Scale |
|---|---|---|---|---|---|
| 1839 (Aug) | *Sublime Porte (Babıali)* | Accidental (unknown ignition) | **Ottoman government quarter near Sarayburnu(entrance of Golden Horn)** | *Ottoman central offices burned down; rebuilt by 1843 in stone/masonry to prevent future fire loss* | 2 |
| 1852 28 May | *Yemiş and Unkapanı* | Accidental (unknown ignition) | **Unkapanı and Yemiş docks area (southern shore of Golden Horn)** | *500 shops and stores burned down.* | 3 |
| 1855 26 June | *Fire- Laleli - Aksaray* | Accidental (urban fire) | **Laleli & Aksaray districts (south of Golden Horn)** | *748 buildings destroyed ; area streets later reorganized to improve layout* | 3 |
| 1860 June | *Unkapanı* | Accidental (urban fire) | **Unkapanı docks area (southern shore of Golden Horn)** | *600 buildings burned; highlighted need for better fire prevention in port warehouses.* | 3 |
| 1861 | *Fener* | Accidental (urban fire) | **South shore of Golden Horn, east of Balat (Fener)** | *1100 buildings burned down.* | 3 |
| 1862 | *Küçükmustafapaşa* | Accidental (urban fire) | **South of Golden Horn, between Yedikule and Samatya. Spread likely contained within older wooden housing clusters.** | *242 buildings burned down.* | 2 |
| 1862 | *Ayvansaray* | Accidental (urban fire) | **Coastal district along the mid-south shore of the Golden Horn, adjacent to the city walls and Eyüp slope.** | *219 buildings burned down.* | 2 |
| 1863 July | *Kasımpaşa* | Accidental (urban fire) | **North shore of the Golden Horn; fire was in the naval arsenal / shipyard quarter (Tersane).** | *526 buildings lostin naval arsenal/shipyard quarter; prompted improvements in local firefighting.* | 3 |
| 1864 | *Ayvansaray* | Accidental (urban fire) | **Same district as above: possibly further west toward Eyup side. Small-scale destruction.** | *76 builduings were burned.* | 1 |
| 1864 | *Mahmutpaşa* | Accidental (urban fire) | **Located inland from Eminönü, close to the Bazaar zone, south of Golden Horn (within historic peninsula walls).** | *57 builduings were burned.* | 1 |
| 1865 19 September | *Hocapaşa "Great Fire"* | Accidental (spark in market area) | **South shore of Golden Horn: Hocapaşa and Sirkeci areas near the Eminönü port and waterfront. Fire consumed ~⅓ of old city.** | *3010 buildings destroyed ( 1/3 of the old city). Led to Islahat-ı Turuk (Road Improvement Commission) which rebuilt the burnt zone with widened, straight streets. State relief provided to fire victims. Marked a turning point in urban pplanning for fire safety.* | 3 |
| 1865 | *Edirnekapı* | Accidental (urban fire) | **Western end of the Golden Horn's southern shore, near the land walls. Fire likely spread through dense wooden housing inside the walls.** | *170 builduings were burned.* | 2 |
| 1865 August | *Galata* | Accidental (urban fire) | **Galata waterfront (north shore, Golden Horn entrance)** | *Major conflagration in warehouses and shops; simultaneous with Hocapaşa fire. State provided aid for those affected. Reinforced the push for masonry construction in commercial areas.* | 3 |

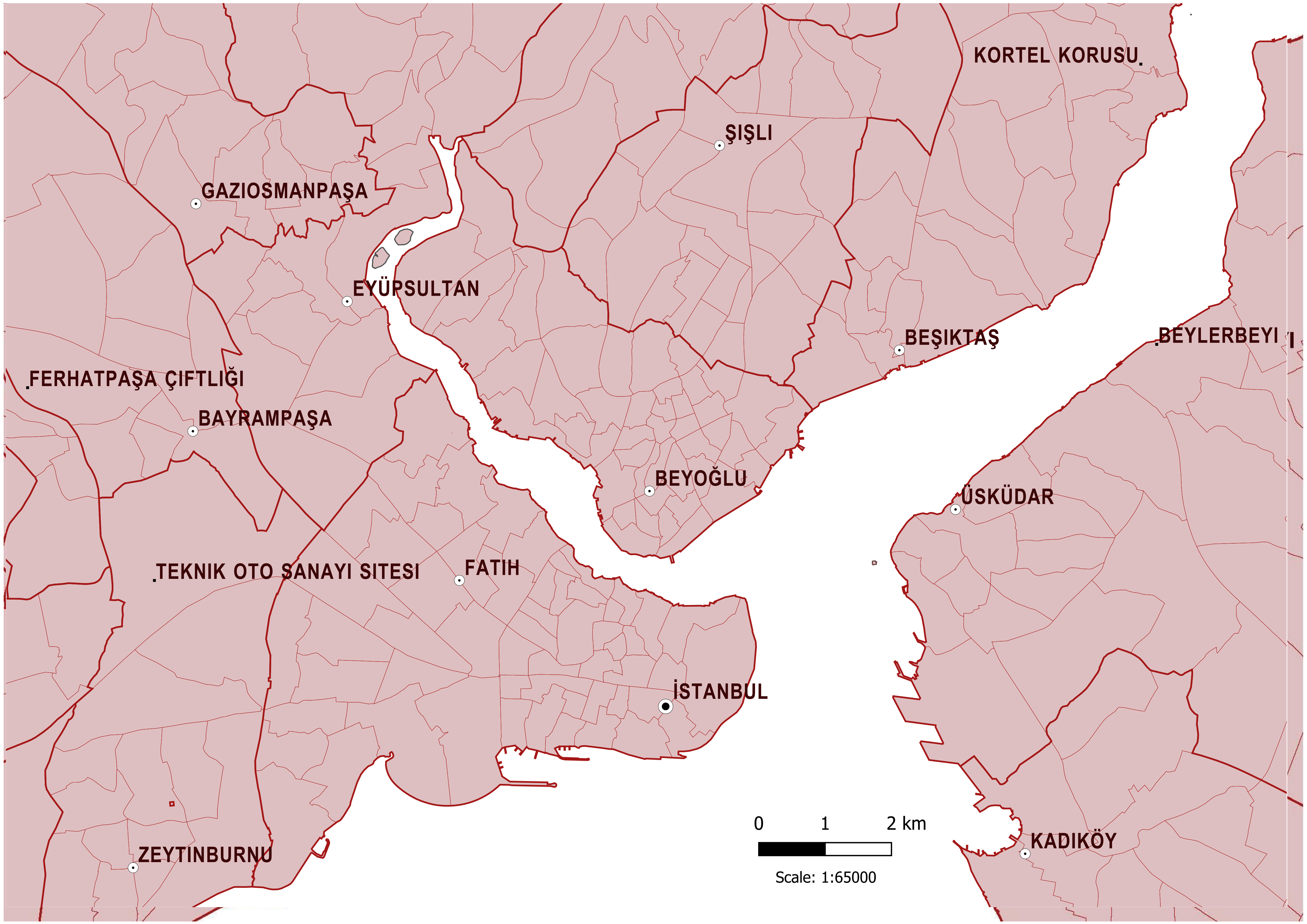
| Date | Location | Cause / Origin | Impacted Areas | Outcomes (Damage & Urban Changes) | Impact Scale |
|---|---|---|---|---|---|
| **1866 July** | ***Balat*** | Accidental (urban fire) | **Balat quarter (south shore of mid-Golden Horn)** | *500 buildings burned in this dense residential area (largely wooden houses). Many homes rebuilt in brick, though the traditional street pattern persisted.* | **3** |
| **1868** | ***Balat*** | General Urban Fires from dense wooden housing, narrow streets, and open flames or chimneys igniting nearby structures | **South shore of Golden Horn, historically dense residential zone near Jewish quarter** | *118 builduings were burned.* | **2** |
| **1868** | ***Uzunçarşı*** | **General Urban Fires** from dense wooden housing, narrow streets, and open flames or chimneys igniting nearby structures | **Commercial area just inside Eminönü; narrow wooden streets near the Grand Bazaar** | *220 builduings were burned.* | **2** |
| **1870 June 5** | ***Beyoğlu (Pera)*** | Accidental (started in a bakery) | **Beyoğlu (Pera) district (north of Golden Horn), started among wood buildings and proceeded to Macar, Tarlabaşı, Taksim and to İstiklal Street** | *3010 buildings destroyed ( 1/3 of the old city). Led to Islahat-ı Turuk (Road Improvement Commission) which rebuilt the burnt zone with widened, straight streets. State relief provided to fire victims. Marked a turning point in urban planning for fire safety.* | **3** |
| **1872** | ***Edirnekapı*** | No specific documented cause exists | **South shore near city walls, gateway district of the Old City** | *305 buildings burned.* | **2** |
| **1873** | ***Beyoğlu (Pera)*** | No specific documented cause exists | **Upper Pera slope, near Taksim. Fire likely limited to side streets near İstiklal** | *60 buildings burned.* | **1** |
| **1874** | ***Galata*** | No specific documented cause exists | **Commercial warehouses around Karaköy port and hill slope** | *120 buildings burned.* | **2** |
| **1877** | ***Fener, Balat*** | No specific documented cause exists | **Along the southern shore of the Golden Horn, between Fener and Balat districts** | *67 builduings burned.* | **1** |
| **1878 23 May** | ***Babıali*** | Accidental (urban fire) | **Ottoman government quarter near Sarayburnu(entrance of Golden Horn). Started on the upper floor of the central part of the Sublime Porte building,** | *Continued for six hours. The fire spread from the State Office to the Ahkam-ı Adliye and the offices of the Ministries of Interior and Foreign Affairs below it and burned a large part of these offices. Many documents were lost in the fire.* | **1** |
| **1881** | ***Edirnekapı*** | No specific documented cause exists | **Close to land walls, western end of Golden Horn's southern edge** | *59 buildings burned.* | **1** |
| **1885** | ***Hasköy*** | Typical **urban conflagrations** initiated by fireplaces, lamps, or limited sparks in entire wooden residential quarters | **Northern bank of Golden Horn, uphill from the shoreline, near Jewish quarter** | *297 buildings burned.* | **2** |
| **1885** | ***Unkapanı*** | Accidental (urban fire) | **Port area on the southern shore of the Golden Horn, near Atatürk Bridge entrance** | *140 buildings burned.* | **2** |
| **1885** | ***Fener, Balat*** | No specific documented cause exists | **Fener–Balat coastline, small residential zone near historic churches and synagogues** | *51 buildings burned.* | **1** |

| Date | Location | Cause / Origin | Impacted Areas | Outcomes (Damage & Urban Changes) | Impact Scale |
|---|---|---|---|---|---|
| **1885** | ***Mahmutpaşa*** | Likely accidental (urban fire, residential zone) | **Mahmutpaşa market district near Eminönü (south of Golden Horn)** | *92 buildings burned.* | **1** |
| **1892** | ***Balat*** | Accidental (urban fire) | **Balat (south shore of Golden Horn, Jewish quarter)** | *60 buildings burned.* | **1** |
| **1895** | ***Halıcıoğlu*** | Accidental ignition (likely stove or lantern in dense timber housing) | **Haliçioğlu (along west bank of Golden Horn, near Okmeydanı)** | *105 buildings burned.* | **2** |
| **1898** | ***Hacıkadın*** | Accidental ignition | **Haskadın (western Fatih, near city** | *110 buildings burned.* | **2** |
| **1901** | ***Eğrikapı*** | Urban fire typical of inner Fatih | **Eğrikapı (Fatih, along land walls)** | *90 buildings burned.* | **1** |
| **1908 July 10** | ***Çırçır*** | Accidental (urban fire) | **Çırçır district (Fatih, near Golden Horn)** | *One of the last great fires of Ottoman era; "great destruction" in a residential zone. Underscored that fires still plagued even outlying quarters in the 20th century.* | **2** |
| **1911** | ***Balat*** | Accidental (urban fire) | **Balat (Fener-Balat historic residential zone)** | *334 buildings burned.* | **2** |
| **1911** | ***Beyazıt*** | Accidental (urban fire) | **Beyazıt (near Grand Bazaar, inland from Golden Horn)** | *111 buildings burned.* | **2** |
| **1912 3 June** | ***Ayasofya, İshakpaşa*** | Accidental (urban fire) the fires the teapot are blown around by the wind through the open window. | **İshakpaşa quarter (Sultanahmet area, near Sarayburnu)** | *Spread through historic wooden mansions near Topkapı; significant damage to Ottoman heritage buildings. . Prompted further calls for fireproof materials in historic sites.* | **2** |
| **1913** | ***Ayasofya*** | Two fires; likely stove/lamplight | **Ayasofya slope (around Topkapı Palace complex)** | *2 different fires . 50 in the first one and 120 buildings in the second one burned.* | **2** |
| **1913** | ***Halıcıoğlu*** | Accidental residential fire | **Haliçioğlu (adjacent to Golden Horn's northwest edge)** | *221 buildings burned.* | **2** |
| **1916** | ***Hasköy*** | Accidental urban fire (common in timber districts) | **Hasköy (north shore of Golden Horn, near Jewish quarter)** | *267 buildings burned.* | **2** |
| **1918 June 18** | ***Yavuz Selim (Fatih)*** | Accidental (cause unclear; during wartime) | **Yavuz Selim–Fener–Cibali area (Fatih, along Golden Horn)** | *One of the largest fires in Istanbul's history, occurring during WWI chaos. Raged for days, consuming large parts of Fatih. Thousands left homeless (exact building toll not recorded, but "great destruction" noted. Marked the end of the era of massive urban fires in the old city.* | **3** |

| Date | Location | Cause / Origin | Impacted Areas | Outcomes (Damage & Urban Changes) | Impact Scale |
|---|---|---|---|---|---|
| **1918** | ***Vefa Street*** | Accidental ignition in densely built residential zone | **Vefa (south of Süleymaniye Mosque, near Golden Horn ridge)** | *500 buildings burned.* | **3** |
| **1919** | ***Kasımpaşa*** | Accidental ignition from daily use (stove/ lantern) | **Kasımpaşa (north shore of Golden Horn, naval quarter)** | *381 buildings burned.* | **2** |
| **1919** | ***Edirnekapı*** | Typical urban conflagration (unknown precise cause) | **Edirnekapı (along land walls, western Fatih near Golden Horn's edge)** | *570 buildings burned.* | **3** |
| **1923 September** | ***Karagümrük*** | Accidental (urban fire) | **Karagümrük (northwest end of Golden Horn, inside old city walls)** | *First major fire of the Republic: destroyed many wooden houses. Reconstruction was slow due to post-war economic strain, with some neighborhoods permanently thinned out.* | **2** |
| **1929 January 13** | ***Tatavla (Kurtuluş)*** | Accidental (rumored arson) | **Tatavla quarter (north of Golden Horn, near Pera)** | *A predominantly Greek neighborhood burned down; ~2070 houses lost (outside immediate Haliç banks but significant for urban demographics). Led to stricter oversight of firefighting services in non-Muslim districts.* | **3** |
| **1941 November** | ***Fenerkapı*** | Accidental (urban fire) | **Fener–Balat area (south shore of Golden Horn)** | *Mid-20th century blaze in the old wooden waterfront houses; numerous historic homes destroyed. Accelerated the ongoing exodus of residents from old wooden homes to newer areas.* | **2** |
| **1943 November 20** | ***Grand Bazaar*** | Accidental (unknown ignition) | **Kapalıçarşı and vicinity (Eminönü, near Golden Horn)** | *A blaze severely damaged the covered Grand Bazaar and surrounding markets. Prompted restoration of the Bazaar with modern fire precautions.* | **2** |
| **1943 July 13** | ***Sütlüce Factory*** | Industrial accident (gunpowder explosion) | **Sütlüce (north shore of Golden Horn)** | *Nuri Paşa Factory explosion caused a massive fire;10 killed, 40 injured. Led to stricter regulation of industrial plants and relocation of some industries away from Haliç.* | **2** |
| **1954 November 25** | ***Grand Bazaar*** | Electrical short-circuit | **Kapalıçarşı (Eminönü)** | *Catastrophic fire engulfed the Bazaar again: 1,394 shops burned. This disaster finally spurred installation of modern electrical systems and fire alarms in the market.* | **3** |
| **1959 6 January** | ***Sirkeci (Explosion)*** | Industrial accident (chemical explosion) | **Sirkeci (Eminönü, at Golden Horn mouth)** | *Explosion in a warehouse ignited a fire, causing multiple deaths. Marked one of the last large-scale fires in central Istanbul. Authorities thereafter enforced stricter storage codes for combustibles.* | **3** |

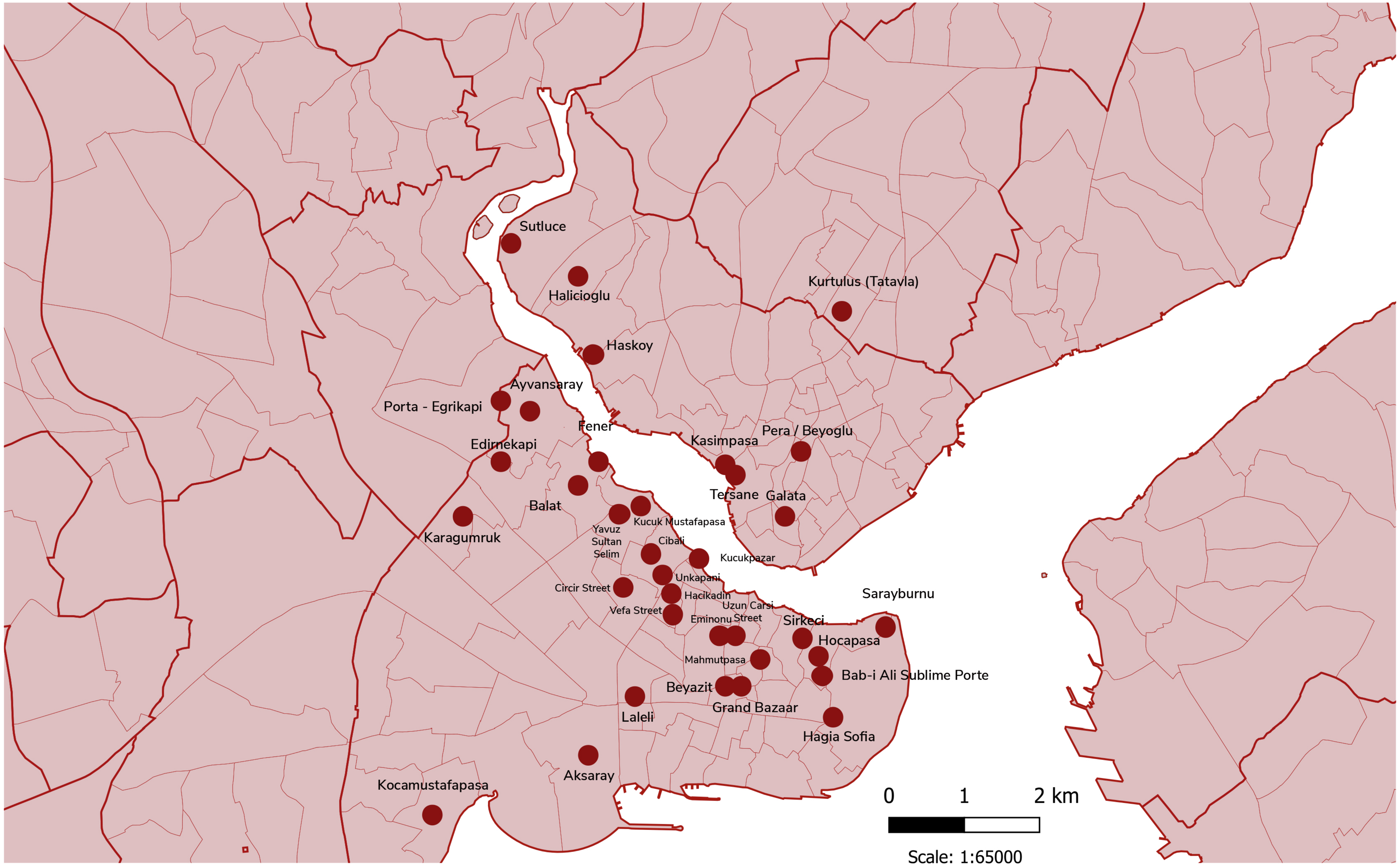
***Table 9:*** *Major Fires Affecting Istanbul and the Golden Horn Region (1839–1959).Table produced by the author using data from the İstanbul Büyükşehir Belediyesi [İBB] (n.d.) historical fire records, supplemented by Ottoman archives and secondary literature (Çelik, 1986; Ergin, 1995; Kuban, 1996; Şenyurt, 2019; Ünlü, 2021).*

To bring everything all together in a visual context through maps which demonstrate primarily, the spatial relationships between the Golden Horn neighborhoods and the historical fire zones which had the biggest impacts. The maps first show the urban boundaries and administrative districts surrounding Golden Horn, providing a geographic framework to help understanding the study area. The maps show the locations of major fires to identify which districts experienced the most frequent damage during the period from the nineteenth century to the mid-twentieth century.



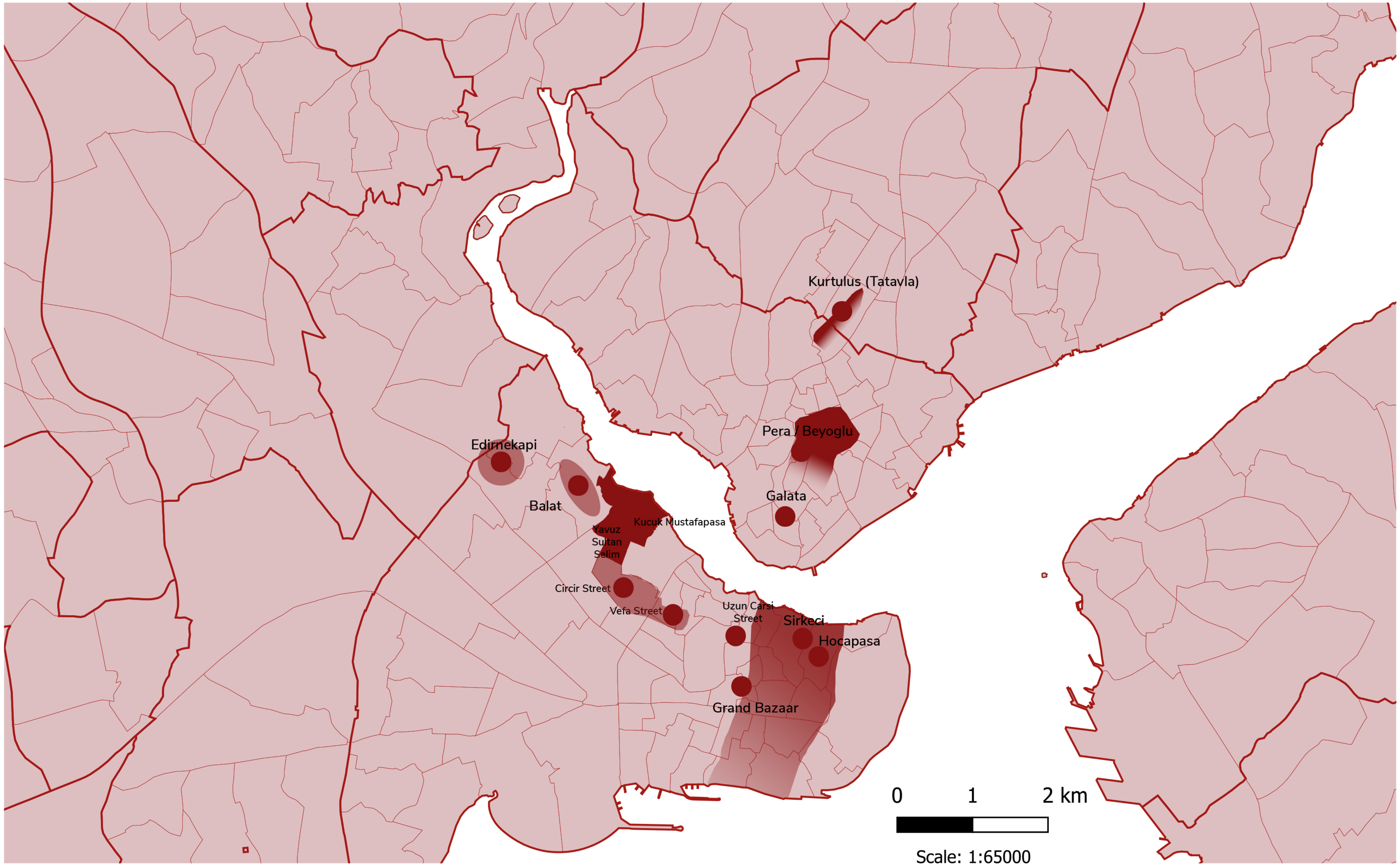

***Map 11:*** *Administrative Districts Surrounding the Golden Horn (Haliç). Produced and mapped by the author author using QGIS 3.34 with OpenStreetMap basemap. Coordinate reference system: EPSG:4326 (WGS 84); map scale 1:60,000.*

The map shows the central Istanbul districts which surround the Golden Horn including Fatih and Beyoğlu and Eyüpsultan as the main research area. The map shows how the Golden Horn waterfront maintains continuous urban development through its district borders which connect the historic peninsula to the northern shore. The defined spatial boundaries will serve as the base for studying Golden Horn region vulnerability to hazards and industrial heritage preservation and urban development changes.



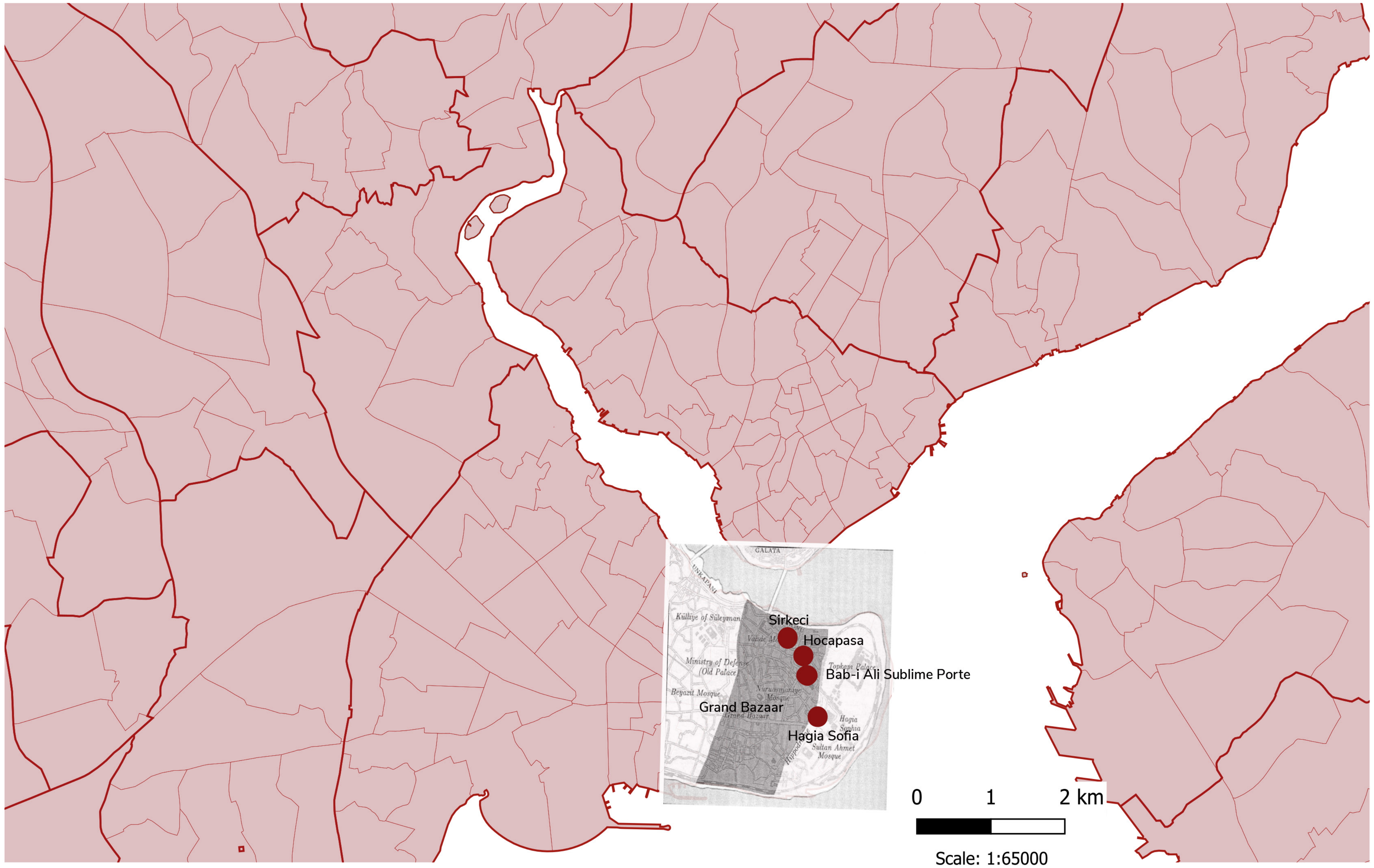

***Map 12:*** *Geographic distribution of the Golden Horn's major urban fires from 1839 to 1959. Produced and mapped by the author using QGIS 3.34 with OpenStreetMap. Fire locations were georeferenced from historical sources, including İstanbul Büyükşehir Belediyesi [İBB] (n.d.), Ergin (1995), and Şenyurt (2019). Coordinate reference system: EPSG:4326 (WGS 84); map scale 1:65,000.*

The map displays the locations of significant historical fires that occurred in the historic peninsula regions and Golden Horn between the middle of the 19th and mid-20th centuries. The map points show known fire locations that were gathered by researchers from municipal archives and historical documents. Due to the presence of dense timber buildings and industrial facilities in the districts of Balat, Fener, Ayvansaray, Unkapanı, and Galata, the Golden Horn shoreline has a high rate of fire occurrence. By illustrating how fires concentrated in particular locations, resulting in the development of Istanbul's central district, the map visualization validates the historical data in the table




***Map 13:*** *The Golden Horn's Principal Fire Zones and Highest Impact Areas (1839–1959). Produced and mapped by the author using QGIS 3.34 with OpenStreetMap. Fire locations were georeferenced from historical sources, including İstanbul Büyükşehir Belediyesi [İBB] (n.d.), Ergin (1995), and Şenyurt (2019). Coordinate reference system: EPSG:4326 (WGS 84); map scale 1:65,000.*

The map above shows the highest impact areas after major urban fires. Each circle indicates the approximate spot where a fire started, and the shaded area around it shows the estimated zone of impact based on the amount of damage that has been documented. The destruction is more widespread and more intense in areas like Hocapasa, Beyoglu (Pera), Balat and Fener, which are known for their mixed residential-commercial use, narrow street patterns and dense wooden buildings.




***Map 14:*** *The Map of Impact Area of the 1865 Hocapasa Fire, Map produced by the author, The overlayed historical base map was sourced from Zeynep Çelik, The Remaking of Istanbul: Portrait of an Ottoman City in the Nineteenth Century (Seattle: University of Washington Press, 1986), p. 56, fig. 27, "Extent of the 1865 Hocapaşa Fire." The current map was compiled by the author using QGIS 3.34 with OpenStreetMap basemap and georeferenced to overlay the historical fire extent onto contemporary district boundaries. Coordinate reference system: EPSG:4326 (WGS 84); map scale 1:65,000. Overlayed on QGIS OpenMap*

To provide a historical spatial reference, this map was overlayed with a nineteenth-century topographic base from the Library of Congress collection. The integration of modern administrative boundaries with the historical cartography helps visualize the fire's extent within the Ottoman urban structure and illustrates how the Hocapaşa area's dense wooden fabric and proximity to key state buildings contributed to the disaster's severity.


**Map 15:** *The 1870 Pera (Beyoğlu) Fire Overlayed on the Historical "Plan de Péra" Map.*
*The historical base map from Plan de Péra: Théâtre de l'Incendie du 5 Juin 1870 (Paris: Lemercier & Cie, ca. 1870) comes from the Bibliothèque nationale de France (Gallica Digital Library) through ark:/12148/btv1b8443967p. The author used QGIS 3.34 to merge the historical map with present-day administrative boundaries through OpenStreetMap basemap data (2025) from OpenStreetMap contributors. The map uses WGS 84 coordinate reference system (EPSG: 4326) at 1:65,000 scale.*

The map shows the full extent of the 1870 Pera (Beyoğlu) Fire which became one of the deadliest urban fires throughout nineteenth-century Istanbul. The historical map titled "Plan de Péra: Théâtre de l'Incendie du 5 Juin 1870" from Lemercier & Cie (Paris ca. 1870) received a scanned version which the author used to create an overlay with modern administrative limits to show the fire zone and its position relative to Galata and the Golden Horn's northern shoreline. The visualization shows the disaster's location in relation to present-day Istanbul while demonstrating how urban density and street patterns of streets and risk levels appeared during the disaster.

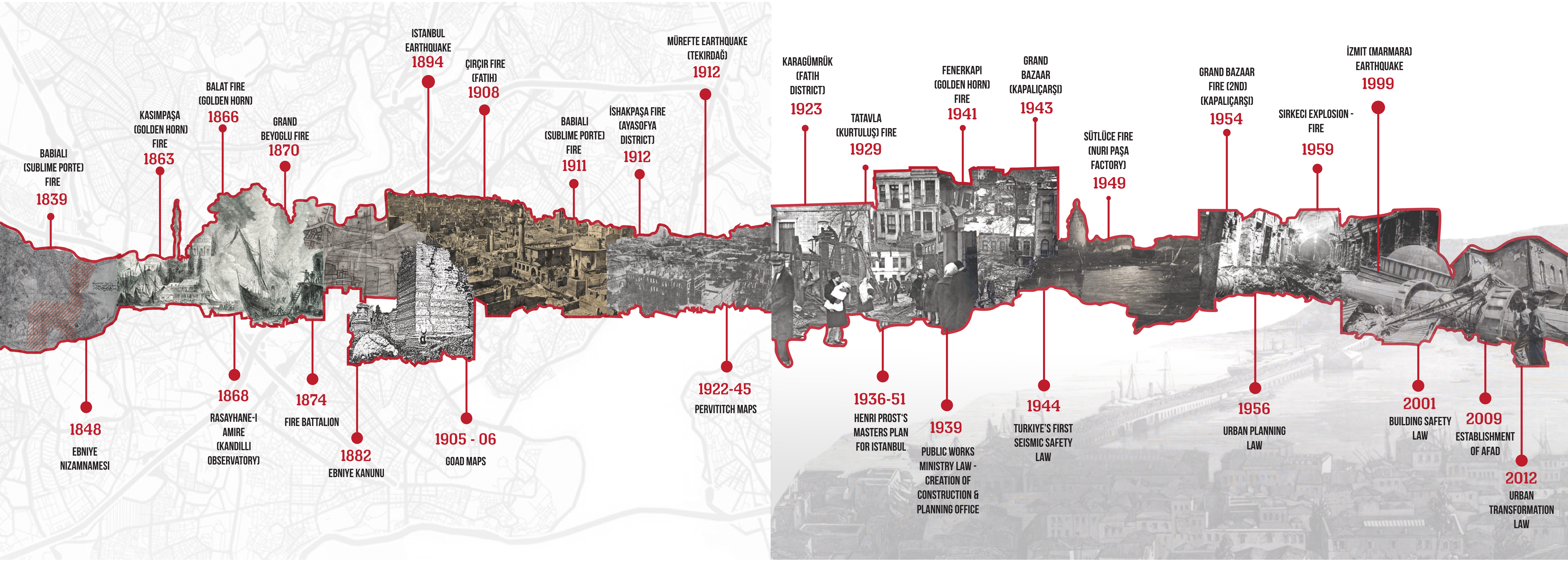



***Figure 31:*** *Collage of Major Fires, Earthquakes, Planning Interventions, and Regulatory Turning Points in Istanbul's Urban History*[318]

318 Compiled and produced by the author. The collage brings together historical photographs of major fires and earthquakes in Istanbul, fire insurance plans (including Goad and Pervititch maps), references to early urban planning initiatives (notably Henri Prost's first master plan), and key regulatory milestones affecting urban development and disaster risk. Visual materials are drawn from Ottoman and Republican-era archival sources, municipal records, and secondary literature, and are used illustratively to convey the historical layering of disaster events, planning responses, and urban transformation.

The city of Istanbul has learned valuable lessons about survival from its extensive historical background. The city has survived numerous disasters while developing its protective measures through repeated reconstruction efforts. The Golden Horn area functions as a small-scale representation of Istanbul's historical hazard experiences because it stands as the central urban core. The high concentration of cultural heritage sites including mosques, churches, markets and wooden mansions in the Golden Horn area requires disaster risk reduction (DRR) efforts that protect both human lives and economic stability and priceless cultural heritage. The dual requirement of heritage protection and risk management establishes the framework for our research study. The following sections explain how Istanbul adapted after past disasters which created foundations for contemporary resilience initiatives. The city underwent urban transformations through fire and earthquake events which triggered new regulations and urban plans and community initiatives that transformed Istanbul from reactive rebuilding to proactive risk management.

## 4.5 Fire Insurance Maps as Early Instruments of Urban Risk Awareness

Fire insurance maps are detailed city plans that insurers use to determine fire rates and premiums for buildings in crowded areas. Created in the 19th century, these maps provide written descriptions of buildings' construction and materials, use, and height, as well as their proximity to water or fire-fighting infrastructure.[319] They have evolved from city surveys conducted by the Phoenix Assurance Company of late-18th-century London, which saw the need for accurate building plan. [320]

Significantly, the UK was the first market to embrace the practice of insuring properties against fire. The first fire insurance companies were established in the 1700s, when several mutual and joint stock insurers were set up in London following the Great Fire of 1666. While there had been previous attempts to provide financial relief after a major fire, the first commercial insurance schemes were started in the decades following the Great Fire. These included the Fire Office, formed in 1696 by property developer Nicholas Barbon and other investors, which is generally thought to be the first joint-stock insurer ever established. Over the subsequent two decades other insurers were founded that would survive in name until modern times – including the Sun Fire Office, the Union Fire Office, the Royal Exchange Assurance and the London Assurance.[321]

The expansion of insurance underwriting during the 1700s led companies to understand that they needed precise information about the insured buildings. During the late 18th century London insurers started ordering extensive maps of urban regions to evaluate fire hazards.

Thomas Leverton is credited with having produced a map of central London for the Phoenix Assurance Company, Ltd., around 1785 but the Phoenix Company, which is still in business, has no record of such a map having been prepared. Between 1792 and 1799, it is know that Richard Horwood compiled for Phoenix a map of London at the scale of 26 inches to a mile. A copy of it is in the Library of Congress collections. This large-scale detailed map, which is on

319 Library of Congress, "Fire Insurance Maps."
320 Sanborn Map Company, Sanborn Fire Insurance Maps: Their History and Use (New York: Sanborn Map Company, n.d.); Library of Congress, "Fire Insurance Maps."
321 Swiss Re, Sigma 2/2013.

thirty-two sheets, identifies by street number every dwelling and commercial structure then standing. Horwood dedicated his map "to the Trustees and Directors of the Phoenix Fire Office."[322]

The Phoenix company conducted surveys of foreign cities at this period while the first surviving fire insurance map emerged as a 1790 Charleston South Carolina plan for the Phoenix company. The systematic mapping of urban layouts and building materials and water sources by insurers during the early 19th century marked the beginning of a new practice. Phoenix Assurance established itself as the first insurance company to implement fire insurance mapping in 1782 and thus created the standard practice for the industry. The early 1800s saw limited production of such maps because they were mainly created for internal purposes. Insurers depended mainly on written surveys and the first Ordnance Survey maps for general information yet these sources proved insufficient for accurate fire-risk evaluation.[323]

During the 19th century industrial revolution Britain experienced rapid urban growth that led to higher city densities which made urban fires more likely to occur. Insuring industrializing cities during the middle of the 19th century demanded more advanced methods of risk assessment. The British model led to parallel developments in other countries where Dakin and Sanborn started creating fire insurance atlases across North America during the 1850s–1860s. Fire insurance mapping achieved its peak in the late 19th century when specialist mapmakers entered the UK market. Charles E. Goad established himself as a key figure in fire insurance plan creation after starting his work in Canada during the 1870s. Goad understood that standardized maps which get updated frequently held great value for underwriting purposes. In 1885 Goad returned to Britain to launch a comprehensive fire insurance mapping initiative for British towns and cities.

The Goad FIPs (Fire Insurance Maps) were first produced for centers within the British Isles in 1886. Within ten years the central parts of the major towns and cities were covered and by 1970, fifty-three centers had been surveyed by Goad. Goad's areas of particular interest for his FIP productions included the central business districts of the major urban areas, major commercial regions and industrial districts.[324] Goad did not create the first fire-risk maps in Britain but his company established itself as the leading provider of such maps.

Goad’s Insurance Plan series established a new benchmark by presenting urban areas at 1:480 scale through atlases which included building footprint details along with construction material information and floor counts and occupancy data and critical fire infrastructure such as hydrants and alarm boxes.

Each building material is additionally color coded with pink representing buildings made of brick, stone or concrete; yellow representing wooden buildings and blue representing skylights, (see Figure 31) to show their fire resistance which resulted in maps that combined high information value with unique visual appeal.

322 Library of Congress, “Horwood’s Map of London (1792–1799).
323 Ibid.
324 Rowley, “Charles E. Goad and Fire Insurance Plans.”


***Map 16:*** *Insurance Plan of City of London Vol. I: sheet 22, 1886, Charles E. Goad Limited 1: 480. (Source: OldMapsOnline. (n.d.). 1886 map of London.*

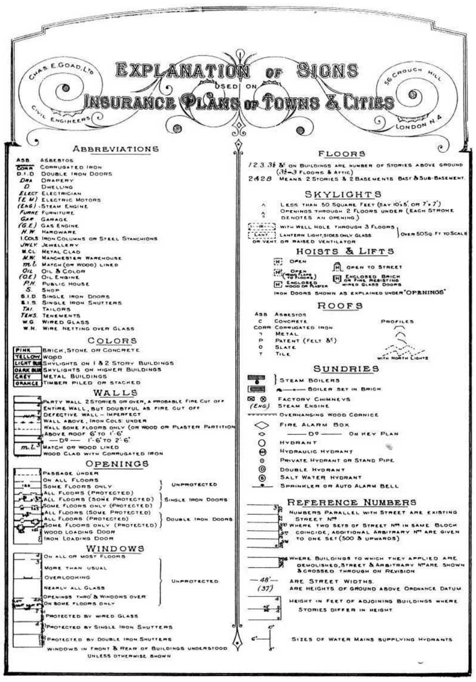



***Figure 31:*** *The Legend of Goad Maps (Source: Local Local History. (2011, June 28). The Goad fire insurance maps.*

### 4.5.1. First Insurance Plans of Istanbul by : Charles E. Goad

The map collection of the Institut Français d'Etudes Anatoliennes (IFEA) in Istanbul includes two series of fire insurance maps that are particularly relevant to the social and economic history of the East Mediterranean. One comes from the beginning of the twentieth century, while the other from 1920 to 1945.[325]

Because of the abundance of information they hold, they are both highly sought-after and frequently referenced as fascinating sources of reference. This is due to the fact that their goal was to map out the fire risk for the insurance companies that hired them by giving them as much information as they could on the characteristics of buildings and the sources of vulnerability. In view of property, fire insurance rates were influenced by various risk factors: the quality of water supply in a particular city area, the location of the building, the type of construction, street width, fire protection, etc. The premium was thus determined in accordance with the estimated risk running factors.[326]

As a result, the Goad plans have a scale of 1/600th (and 1/3600th for the world plans); the Pervititch maps, on the other hand, are much finer, ranging from 1/250th to 1/1000th (except from a few Anatolian bank plates and the index and global plates). The development of an insurance sector at the end of the Ottoman Empire, which was a manifestation of the influence of Western and European interests in the area, was closely linked to the creation of these maps. Because of this, the zones that Goad and Pervititch (to a lesser extent) represent are extremely focused and meticulously chosen in response to requests that only come from specific milieus. As a result, the perception of metropolitan areas that these papers provide is rather incomplete, though still valuable [327]

Goad's Turkish fire insurance plans are in any case listed between 1904 and 1906. However, it is noteworthy that some of the plans were reprinted in 1914, albeit partially without updating. The Ch. E. Goad series includes four lots of unequal dimensions: 3 “volumes” covering Constantinople; and one for Izmir (Smyrna). The Istanbul volumes are divided as follows: 20 plates for “Stamboul”, the term used in the early 20th century to describe the historical peninsula (or the Byzantine-Ottoman city); 18 plates for “Pera-Galata, that is to say the quarters situated on the other bank of the Golden Horn; and 14 plates for Kadıköy, the former Chalcedon, on the Anatolian bank of the Bosporus.[328]

Volume I, Stamboul (Istanbul) , was published in September 1904, Volume II, Pera & Galata, was published in December 1905 and Volume III, Kadi-Keui ( Kadıköy ), was published in April 1906. The view underlying these depictions is highly selective. It is extroverted in the sense that it privileges areas inhabited by bidders, potential or existing policyholders, i.e. companies with close ties to European or foreign capital. In the “Stamboul” volume, for example, there is a clear distinction between the “Turkish neighborhoods”, which are not described in detail, and

325 Bibliothèque nationale de France, “Plans d’assurance-incendie (Pervititch et Goad).
326 Sabancıoğlu, “Fire Insurance and Urban Risk,” 45–48.
327 BnF, “Plans d’assurance-incendie.”
328 Dağdelen, “Goad Sigorta Planları ve İstanbul.”

the coastal strips where western profits are concentrated. In this respect, we can say that Goad's plans were formed within a tripartite polarization: the liminal polarization, the foreign polarization and the “non-Muslim” polarization.

These different types of plans therefore offer a partial view of the city as it was in the past. Goad's maps tell us that Istanbul and Kadikoy; these maps paint a picture of a wooden yet low-rise city. The precision of the information provided by the insurance company allows for a reasonably accurate description of the urban fabric and landscape of the period. Stone has been reduced to public, commercial, or religious buildings in some still-developing neighborhoods, especially in Teşvikiye and Nişantaşı. The Foundation Inns in Eminönü, part of the “1st National Architecture” movement, have not yet been built, and the warehouses on the Golden Horn shore are entirely wooden.[329]

The maps also reveal a city that was built with very low density, particularly in Istanbul and Kadıköy. The gaps in the center of the urban fabric, made up of gardens and orchards, are many: they are not just the remnants of fire. Moreover, although the plans were drawn before the great fires of 1918, the city - and of course the engineer insisted on this information - is marked by numerous traces of more recent fires. In 1900 alone, many neighborhoods in the Fatih district, from the Marmara Sea to the Golden Horn, from Yedikule to Eğrikapı, were scarred by disasters that caused radical transformations in the urban fabric.[330]

Finally, Goad gives us a picture of a city under construction, and in some respects even in the process of being completely rebuilt. From Haydarpaşa to Taksim, the number of public buildings under construction in Istanbul is surprising, including schools, ministries and especially hospitals. Architects and urbanists, Ottoman and foreign, were hard at work everywhere, from the organization of spaces to the construction of buildings that resembled the “art nouveau” style of Beyoğlu. The contrast between the prevalence of wood and stone in the urban fabric forms the cornerstone of the new urban landscape of Istanbul at the time.[331]

Throughout the 19th century, maps of Istanbul were produced in different scales. However, these maps are small-scale and constitute the first products of the transition from city descriptions to scale maps. In the 19th century, after the fires in Istanbul, large-scale fire maps of the city were produced. However, these maps only show the places of fire. Until the early 20th century, no map as detailed as Goad's was prepared for Istanbul. Considering the technical possibilities of the period, in the case of Istanbul, these sheets are two-dimensional scale cadastral maps created by assuming zero as the starting point. Since they are for insurance purposes and not used in zoning and project studies, floor heights and other elevation differences are given with legend explanations.[332] The plan index maps produced by Charles E.

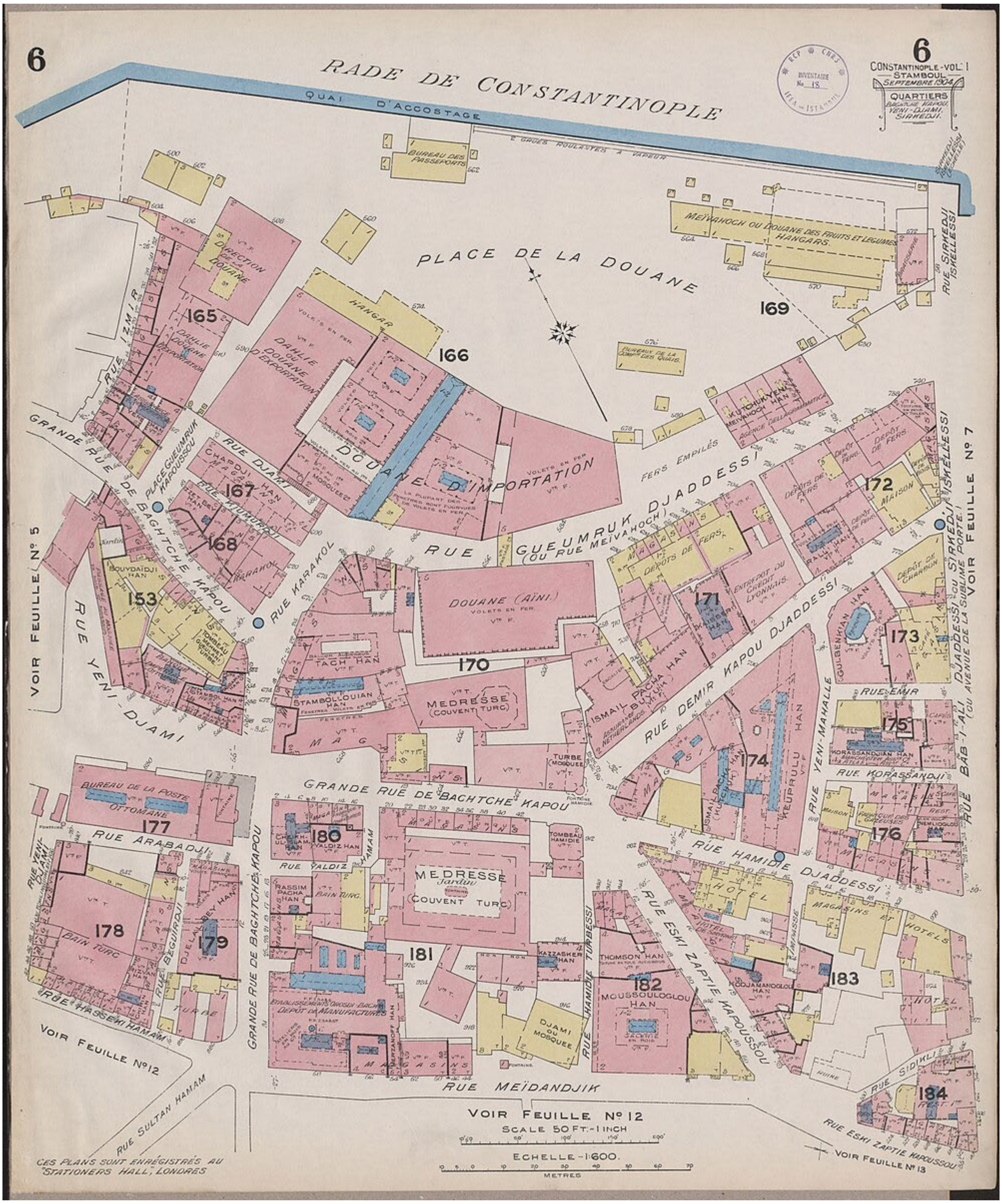
329 Dağdelen, “Goad Sigorta Planları ve İstanbul.”
330 Yerasimos, Constantinople, 214–218; Kuzucu, İstanbul Yangınları, 96–102.
331 Dağdelen, “Goad Sigorta Planları ve İstanbul.”
332 Ibid.

Goad function as a systematic framework for organizing the fire insurance survey of Constantinople. These index sheets divide the city into clearly defined neighborhoods and coastal sectors, each assigned a numerical identifier corresponding to an individual insurance sheet. The survey uses a numbering system to connect directly between the index map and detailed large-scale plates which enables exact location identification. The index plans serve as essential tools for this research because they help determine which specific Goad sheet numbers to use and they maintain sheet selection consistency while ensuring proper spatial coverage and enabling future comparisons with fire insurance maps from later periods. These Plan Index sheets function as the spatial key to Charles E. Goad's fire insurance survey of Constantinople, indicating the subdivision of the city into numbered plates and clarifying the relationship between individual detailed sheets and the wider urban structure. The index maps show a large-scale view of coverage areas and coastline positions and neighborhood boundaries which run through the Golden Horn and Pera–Galata corridor.

The index maps function as verification tools which enable users to verify sheet continuity and coastal area coverage and the correct spatial relationship between Goad's 1900s survey and Pervititch's insurance maps from a subsequent time period for precise georeferencing inside specified urban limits.


***Map 17:*** *Plan Index of Pera and Galata Fire Insurance Maps, Showing Sheet Coverage and Coastal Segmentation (1905). This plan index illustrates the spatial organization of Charles E. Goad's Plan d'Assurance de Constantinople, Vol. II: Pera & Galata, indicating the numbered insurance sheets along the northern shore of the Golden Horn. The index clarifies sheet boundaries, coastal alignment, and neighborhood divisions used to structure the detailed fire insurance survey.*


***Map 18:*** *Plan Index of Southern Golden Horn Fire Insurance Maps (Stamboul), Indicating Sheet Distribution and Urban Coverage (1904). This plan index presents the organization of Goad's Plan d'Assurance de Constantinople, Vol. I: Stamboul, covering the southern shore of the Golden Horn. The map outlines the numbered sheets used to document dense residential and commercial districts, providing a reference framework for understanding the spatial limits of Goad's insurance mapping.*




***Map 19:*** *The 1904 fire insurance plan of Stamboul (Constantinople Vol. I, Sheet 6) by Charles E. Goad shows the Yeni Cami (New Mosque) and its surrounding customs and bazaar and harbor areas along the Golden Horn. The map (scale 1:600) shows brick/stone buildings in pink and wooden structures in yellow with each building marked by a number or letter code for its use or occupant. The Place de la Douane (Customs Square) and the waterfront ("Rade de Constantinople") with piers are notable features. The plans were produced in French (the language of the insurance trade at the time) and printed in London, showing Western involvement in Ottoman insurance mapping. These detailed maps enabled insurers to determine risk concentrations and asset locations relative to water supply and fire brigade access. (Source: Dağdelen, İ. (Ed.). (n.d.). Charles Edouard Goad'ın İstanbul sigorta haritaları. İstanbul Büyükşehir Belediyesi, Kütüphane ve Müzeler Müdürlüğü.)*

***Map 20:*** *Correspondence of GOAD sheets with the present day survey sheets in Galata District and showing the deformation caused by the difference in slope. (Source: Dağdelen, İ. (Ed.). (n.d.). Charles Edouard Goad'ın İstanbul sigorta haritaları. İstanbul Büyükşehir Belediyesi, Kütüphane ve Müzeler Müdürlüğü.)*

The numerous fires which occurred in Ottoman Istanbul led to the total destruction of timber house neighborhoods through fire. The wooden buildings situated along the Golden Horn shoreline became highly vulnerable to fires because of their compact design pattern combined with the strong waterborne winds. The two major fires which burned across the Golden Horn in 1865 destroyed most of Galata and the Eminönü waterfront around Sirkeci. The government delivered reconstruction assistance after thousands of official buildings and market structures burned during the fires. The 1865 fires initiated the first phase of modernization through which builders created broader streets in the burned zones and established masonry buildings in designated districts instead of wood structures. The Great Fire of Pera (Beyoğlu) which burned the opposite ridge above Galata in 1870 did not damage the Golden Horn area but its educational value shaped the citywide fire safety approach.

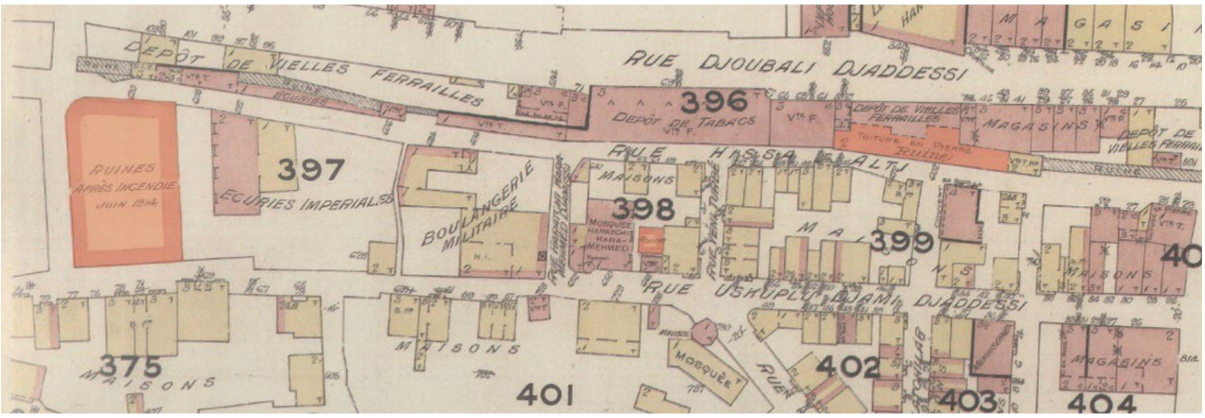
Reform implementation failed to eliminate fires during the twentieth century. The Çırçır fire of 1908 spread across the Cibali–Yavuz Selim area of Stamboul and destroyed 1,500 homes. A severe fire at Balat Gate (Balatkapı) in 1911 destroyed 334 houses in the Balat Gate area. The June 1918 "Great Fatih Fire" devastated thousands of buildings which spanned from Küçükmustafapaşa to Samatya in the peninsula's southern section. The fires resulted in both population changes and urban transformation since displaced families avoided returning and multiple burned-out buildings stood vacant for extended periods. The Galata side witnessed fewer major fires after 1865 because stone construction started becoming more common in this area. The 1905 Goad maps demonstrate that wooden buildings persisted in Galata's backstreets despite previous fires so fire dangers persisted. Multiple destructive fires within the Golden Horn districts during this time resulted in the burned sites which Goad documented.

In the Golden Horn districts of Stamboul (historic peninsula) and Galata, the Goad maps identify several sites as "burnt" or fire-damaged. Below we examine key examples:

**Istanbul Side – Eminönü, Fener, Balat**

The Stamboul side (south of the Golden Horn) of Goad's Volume I maps includes Eminönü and the waterfront areas which extend from Fener to Balat. The 1865 Hocapaşa fire zone in Eminönü received new modern buildings with wider streets during the 1904 period so Goad's maps lack explicit "burnt" labels in this area but pink-shaded masonry dominates Bahçekapı and Yeni Cami due to post-1865 reconstruction with fire-resistant materials.

The Cibali–Fener area shows at least one recent burn site according to Goad's documentation. The index of Volume I "Ruines (Après Incendie)" – ruins after a conflagration – indicates that Bostan Hamamı Street in Fener quarter contained ruins from a fire that occurred after the conflagration. (See Map 21) The Fener quarter contained burned-out ruins during 1904 according to the index of Volume I which suggests an earlier local fire occurred in the area. An Ottoman document describes a major fire which occurred near Bostan İskelesi during the late 19th century possibly at the same location. The exact location of the burned-out site appears on Goad's Sheet No.20 as an empty lot along Bostan Hamamı Sokak labeled "Ruines". The map shows this burned-out site without any building footprint which demonstrates that some fire-damaged areas remained vacant during the Ottoman period.




***Map 21:*** *The ruines highlighted with red by the author on Goad's Istanbul Maps, Volume I, Sheet No. 20 (Source: Author)*

The Bulgarian St. Stephen Church stands as another important landmark in Balat which Goad surveyed before the fire reconstruction was finished in 1904. The wooden church at this location experienced a fire during the 1890s until the construction of an iron-clad church in 1898 became the replacement. Goad's 1904 map depicts the new "Iron Church" of Balat which he represented through masonry (pink) symbols for its iron-clad walls. The church reconstruction demonstrates how buildings transitioned from wooden structures to fireproof iron and steel materials after fires. The maps of Fener and Balat from Goad depict these areas as densely packed warren-like neighborhoods containing mostly old timber houses. The numerous yellow-colored buildings on the map demonstrate that wooden architecture continues to dominate the area. The 1911 Balat fire could spread quickly because of the wooden construction that still dominated the area. The survey by Goad shows Fener-Balat during a transitional phase when modern buildings (churches and factories) existed within a predominantly traditional and combustible urban structure. The maps of Goad show at least one unaddressed burn site at the Bostan Hamamı ruins which remained abandoned before the Ottoman Empire collapsed.

**Galata Side: Karaköy and Galata**

The Volume II maps of Goad show Galata (Karaköy) as a district which had already suffered major changes from fires by 1905. The Galata fire of 1865 destroyed many old wooden buildings so stone construction became the preferred choice for new buildings. The Galata sheets of Goad's map show that most buildings in the post-1860s core are colored pink (masonry) especially in commercial areas near Bankalar Caddesi and around Galata Tower. The map shows a few unusual remnants according to Goad's index where an "Ancienne Tour en ruine" ("old tower in ruins") exists in Galata, which probably refers to a piece of the old Genoese fortifications. The number of open burn sites in Galata during 1905 was minimal because the area experienced fast development after previous fires. Most Galata sheets lack "ruiné" labels which indicates that all buildings destroyed during 19th-century fires and the 1894 earthquake had been rebuilt before Goad conducted his survey. The late Ottoman period saw the installation of modern infrastructure such as pressurized water mains and fire brigade stations which reduced fire risk in Galata.

The widespread use of masonry does not show in Goad’s plan because wooden apartment rows continued to exist in Galata’s side streets【76†look=256,396】. The stone warehouses of the lower Karaköy harbor area and Perşembe Pazarı district contained many interior blocks that consisted of yellow wooden houses. Local residents chose wood construction for their buildings except on major streets after the major fires of the 1870s according to observers at that time. The detailed notes in Goad's map show that Galata Sheet No. 26 (see Map 22) contains yellow structures located behind pink façades in the bank quarter and commercial port area [76†look=0,396].

The combination of different building materials made Galata susceptible to fires although it would not experience another major blaze until 1909 when a fire broke out at the docks but remained small in scale. The 1905 Goad map fails to identify any building in Galata as a fire-damaged structure which suggests that no substantial vacant lots existed in Galata proper at that time. The high land values of Galata together with insurance requirements to rebuild led to the reconstruction of all previous burn sites during the intervening decades. Goad identified at least one fire-damaged lot in Fener/Balat during his survey. The Galata maps depict a quarter that experienced rebuilding following 19th-century fires yet still contains enough remaining wooden structures to maintain fire hazards.


**Map 22 :** *Goad's 1905 Galata map includes Sheet No.26 which shows the Karaköy waterfront together with a section of Galata proper. The buildings located near the shore and along major streets consist of brick or stone structures (pink) but interior structures maintain their wooden construction (yellow). The 1905 Goad's map of Galata shows no explicitly "burnt" sites which indicates that all previous fire damage from 1865 had been completely rebuilt. The urban core of Galata continues to harbor wooden buildings (yellow areas) which demonstrate the hidden fire risk in this area. ((Source: Dağdelen, İ. (Ed.). (n.d.). Charles Edouard Goad'ın İstanbul sigorta haritaları. İstanbul Büyükşehir Belediyesi, Kütüphane ve Müzeler Müdürlüğü.)*

The 1905 fire insurance map created by Charles E. Goad (Sheet 28, Galata) (See Map 28) displays building construction materials. The map uses yellow shading to represent wooden structures while pink shading indicates masonry buildings made from stone or brick. The 1865 conflagration occurred 40 years before the map was created yet Galata's inner streets still display many small yellow-colored buildings which represent the continued presence of timber houses among newer masonry structures on main roads and waterfront areas.


***Map 23:*** *Goad's 1905 Galata map , Sheet No.28 (Source: Goad, C. E. (1905). Plan d'assurance de Constantinople. Vol. II – Péra & Galata. No: 28 [Map]. Salt Research. https://archives.saltresearch.org/handle/123456789/110010)*

Goad's detailed insurance maps (Volume II, Péra & Galata, December 1905) provide clear evidence that many wooden buildings remained in the Galata district decades after the 1865 fire.
The interior of Galata contains yellow-shaded lots which are located in the back-streets off Rue de Galata and the port area. The yellow-shaded lots in the figure above indicate that Galata maintained a substantial number of timber-built traditional houses during 1905. The major civic and commercial buildings (banks, hotels, embassies, etc.) located along major streets and quays appear in solid pink because they used fire-resistant stone or brick materials for their construction.

In essence, Goad's map "depicted individual structures" and their materials and it unmistakably shows that Galata did not transform into an all-masonry quarter after the 19th-century fires. Long into the early 20th century, there were sizable areas of historic wooden homes that were either still standing or had been rebuilt in wood within Galata's urban blocks. This visual documentation supports academic findings that many fire-damaged homes were merely "redone following the traditional [wooden] construction methods in the early twentieth century,"[333] keeping the timber character of the Ottoman era.

The 1905 map of Galata includes building use labels which show that yellow structures primarily function as residential homes ("H" for habitation) but pink structures typically contain modern offices and banks and institutional facilities. The post-fire redevelopment of Galata shows uneven development through its contrasting color scheme and density because main streets like Voyvoda Caddesi (Bankers' Street) received new stone-finance houses that created a modern European appearance while traditional timber houses remained tightly packed in alleyways just a block away【53†】. (See: Goad, 1905, Sheet 28 – Galata, Istanbul 【53†】; full map set available via SALT Research【7†】.) The fire insurance maps provide direct evidence through citable documentation that wooden buildings continued to exist throughout Galata's urban area beyond the 1800s fires despite the expectation of masonry structure replacement.

### 4.5.2. Jacques Pervititch and the Evolution of Fire Insurance Cartography

Ipek A. states in her publication about early 20th century Istanbul that "the 1920s was a period of preparation for city maps, and topographic and geographic studies began with Jacques Pervititch, a French topographer, being commissioned to prepare the cadastral maps of İstanbul, and execute a task to cover three districts of the city; the historical peninsula, Beyoğlu-Pera, Beşiktaş, and Üsküdar (1926–1928)."[334]

Like the Goad maps, the insurance maps created by engineer and topographer Jacques Pervititch for the Central Office of Turkish Insurance Agents from 1922 to 1945 have different meanings now than when they were first published. Jacques Pervititch (1877–1945) was a Croatian-born Ottoman/Turkish cartographer and topographical engineer, best known for

333 Orlandi, "Reminiscences of Ottoman Vernacular in Galata."
334 İpek Akpınar, "The Rebuilding of İstanbul Revisited: Foreign Planners in the Early Republican Years," New Perspectives on Turkey, no. 50 (2014): 69-70, https://doi.org/10.1017/S0896634600006580. For further reading on the 1933 urban design competition and Henri Prost's 1937 plan, see the full article.

producing a remarkable series of fire insurance maps of Istanbul. He was employed by the Syndicate of Fire Insurance Companies Operating in Constantinople, a consortium of insurance firms formed in 1900 in the aftermath of devastating urban fires (notably the Great Beyoğlu/Pera Fire of 1870).[335]

Pervititch's maps at the time were intended to show the risk variables that insurance companies took into account in order to lessen the significant burden of large fires that occurred in Istanbul.

Istanbul underwent several notable reconstructions over a century, beginning after the great fire in 1870. This event marked an important turning point in the development of fire insurance in the city. The conversion of traditional wooden houses to more fire-resistant stone and brick buildings became a decision of government. To achieve this end, it became necessary to obtain more detailed maps of the various regions of the city than the existing general maps. This became an especially important issue after the second half of the 19th century.[336]

Today we do not have a complete collection of the Pervititch maps. Most of them are kept at the Istanbul Metropolitan Municipality Taksim Atatürk Library and the archives of Axa Oyak Insurance Group.[337]

The insurance maps made by topographer and engineer Jacques Pervititch between 1922 and 1945 for the Central Office of Turkish Insurance Agents carry different meanings today from when they were first issued. At the time, the aim of Pervititch’s maps was to illustrate the risk factors considered by insurance companies to mitigate the heavy burden of large fires occurring in Istanbul. [338]

The Pervititch maps, the first of which was dated 1922, were derived from the 1890 map of Galata and Pera region drawn by R. Huber, and the Goad maps. Pervititch’s project, however, had a much wider context and included almost the entire peninsula, Kadıköy and Üsküdar regions, several sections of Izmir, regions with major industrial plants of Bafra and Hereke and also Rodosto, namely Tekirdag˘ (a city near Istanbul).[339]

The series' final map was created in 1945. Prior to the Democratic Party's extensive reconstruction efforts in the 1950s, the Pervititch maps were utilized for insurance purposes. The insurer may quickly locate the relevant area, pinpoint the precise location of the property, and adjust the policy conditions based on the client's address.

The Pervititch maps include 243 sections.[340] The systematic approach of the Pervititch maps, which included a sectional guide for each region and large-scale drawings of the regions on the master plan, revealed how inadequate the previous mapping projects were. In view of their former counterparts, the detailed nature of the Pervititch maps may be accounted by

335 Şen, “Fire Insurance Maps of Istanbul.”
336 Ibid.
337 Sabancıoğlu, Yangın Sigorta Haritaları, 45–62.
338 Şen, “Fire Insurance Maps of Istanbul.”
339 Sabancioglu, 2003.
340 Ibid.

the fact that they were based on the 1904-1906 Goad maps, from which they have been principally drawn.
His work—which was primarily published in French with later sheets in Turkish—has grown to be a priceless tool for urban historians, providing a striking depiction of Istanbul's urban fabric in the early 20th century as well as the city's continuous battle with hazards like fire.

The mapping work of Pervititch developed from the historical pattern of disasters that occurred in Istanbul during the 19th century. The Golden Horn districts consisting of Galata, Eminönü (historical peninsula), Fener, Balat, Ayvansaray and Hasköy experienced repeated destruction from fires and earthquakes throughout the 1830s until the present day. The Pervititch maps contain indirect evidence about the city's rebuilding process following disasters and the absence of rebuilding efforts. This research investigates the reconstruction of Golden Horn districts following major fires and earthquakes through an analysis of the Pervititch maps which document these changes. The first part of this chapter explains how to read fire and earthquake risk indicators in the maps. The research examines Golden Horn district cases through a study of major events since 1830 and the resulting urban changes.

**Interpretation of Pervititich Maps**

The proper interpretation of fire risk and other hazards on Jacques Pervititch's insurance maps requires understanding their representation methods. The maps contain detailed cadastral plans that use color-coding and symbols to show construction types, building features, and risk-related information. The Pervititch map legend contains an exceptionally complex system of symbols. Exactly as the Goad maps, Pervititch uses yellow to show wood-frame structures and pink for masonry buildings of brick or stone (and later reinforced concrete). Buildings with mixed structure – for example, a stone or brick ground floor and wooden upper storeys (a common Ottoman-era pattern) – are shown with a combination of yellow and pink (often a pink outline with yellow infill).

Blue, for instance, indicates glass rooftops, pools, fountains, cisterns, wells and seas, while green stands for parks and gardens.[341]

The Pervititch maps are mostly in French. Therefore abbreviations usually stand for French names, as in Vieux Bois: Vx Bs. However, the maps made in the 1940s are in Turkish.[342] The map shows each building footprint with additional notes and letters and numbers. The annotations on Pervititch's legend use French acronyms to represent specific risk factors and architectural details. The "Vx Bs" annotation (vieux bois) indicates an extremely old wooden building which would be more susceptible to fire risks and "D.M.I." stands for a warehouse that stores flammable materials (dépôt de matières inflammables). The labels Esc. Bois indicate wooden staircases and L.R.M. marks large wooden bay windows or eaves exceeding 50 cm in width which both contribute to increased fire spread risk. The annotations enabled insurers to quickly spot properties with elevated fire risks because of their construction materials and stored contents.

341 Sabancioglu, 2003.
342 Ibid.

The maps show important features that help prevent fires and fight them. The abbreviation “FsP” (fontaine et puits) marks water sources including fountains and wells which serve as fire-fighting supply locations. The street width measurements on the maps reflect actual dimensions while broad boulevards and open squares emerge as potential firebreaks or paths for fire brigade access. Pervititch included fire stations and firefighting equipment locations on his maps whenever possible (he marked municipal fire hydrants from the early 20th century). Some sheets contain topographic contour lines as a subtle addition. The contour lines on maps served primarily for general reference but they also helped determine flood risks in coastal lowlands and revealed strategic viewpoints for fire observation. Pervititch included written notes about local dangers and protective elements on his maps. The Eminönü map no. 77 (See Map 26) shows the Golden Horn port district where Pervititch wrote that the Covered Fruit Market in Timurtaş Street presented a fire hazard because of its accumulated “bags, garbage, and pieces of paper on the floor” yet he noted the fire brigade could easily access this location because of its convenient location. The detailed observations of market tinder piles in the maps demonstrate their dual function as static records and active risk assessments. The maps unite cartographic information with the surveyor's first-hand knowledge of urban dangers. These maps clearly show that Jacques Pervititch was more than a mere topographer. His work is characterized by great professional zeal and devotion, the result of which are these magnificent plans worthy of appreciation.[343]

343 Sabancioglu, 2003.

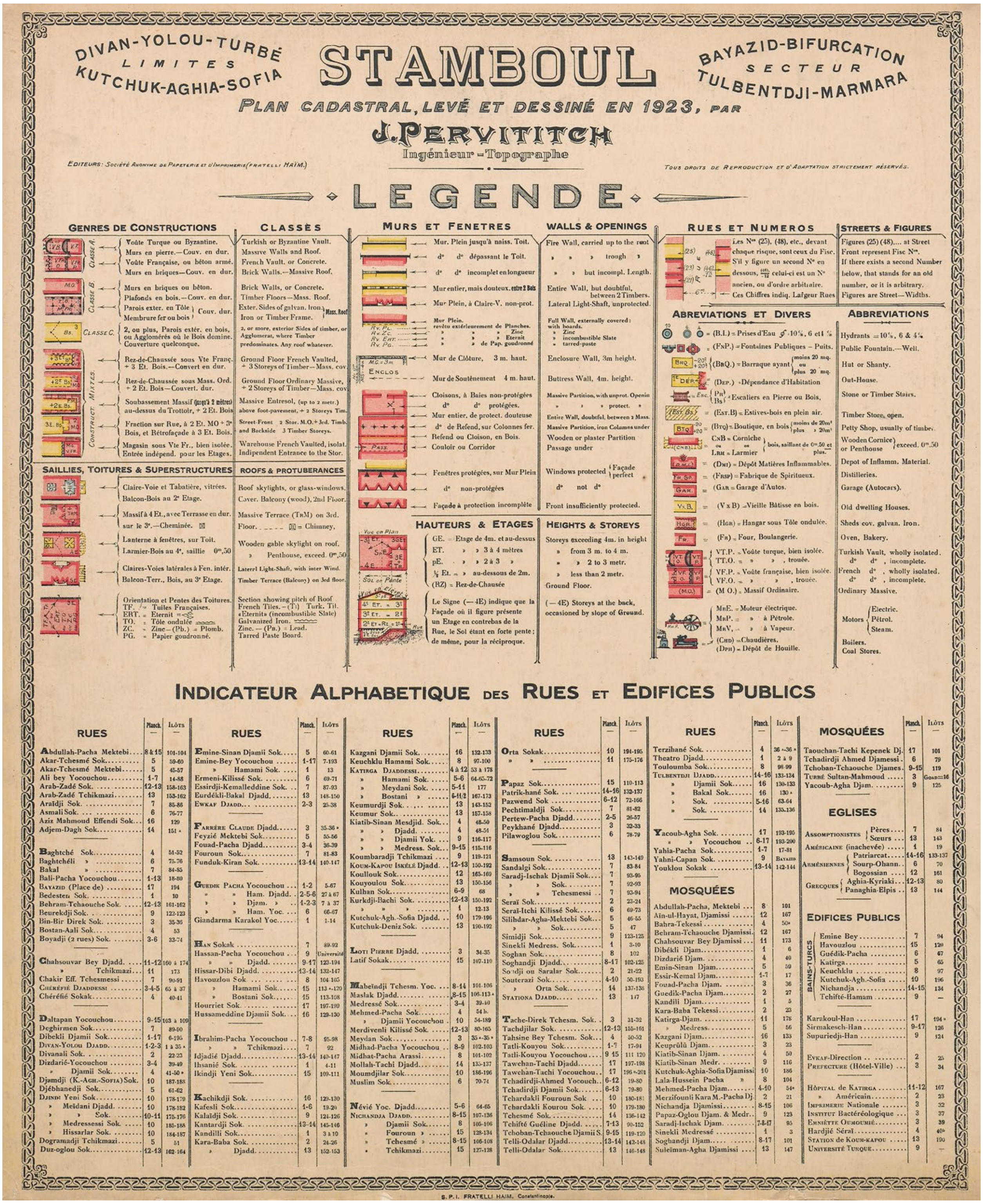



***Figure 32:*** *Legend from cadastral plan of Stamboul, drawn by Jacques Pervititch in 1923. Source: Salt Research Archives (https://archives.saltresearch.org/handle/123456789/108083)*

Pervititch has prepared several sheets of maps for Istanbul. The Golden Horn waterfront of Eminönü appears in Jacques Pervititch's fire insurance maps from the early 1940s which were designed to evaluate urban fire hazards in Istanbul. The waterfront area appears in three consecutive maps numbered 76 (with sub-sheets A, B, and C), 77, and 78 which demonstrate the transition from Zindan Kapı, Yemiş, and Rüstem Paşa commercial areas to Hallar Meydanı warehouse districts. The maps provide clear visual evidence of the port district's urban structure which combined wooden and masonry buildings with large market spaces and hangars that exposed the city to fire risks while demonstrating its economic importance along the Golden Horn.

Pervititch's Istanbul fire insurance atlas was divided into numbered sheets, each covering a small portion of the city. In dense districts like Eminönü, some sheets have sub-sheets (A, B, C, etc.) because one number could not fit the entire area at the same scale.
For example:

- Map 76 → Zindan Kapı, Yemiş, Rüstem Paşa, Ahi Çelebi neighborhoods, covering central Eminönü along the Golden Horn, divided into 76, 76A, 76B, 76C.
- Map 77 → Adjacent section, continuing eastward or inland, also near the Golden Horn (depends on the specific sheet).
- Map 78 → Western part of Eminönü near Hallar Meydanı, covering warehouses and open port areas along the Golden Horn.

The northern shore (Beyoğlu) section of Pervititch's maps (1925–1945) includes the Galata–Karaköy waterfront and the unbroken shoreline extending from Kasımpaşa to Hasköy. The early 1930s map sheets show Galata's port district which includes the banking quarter and Galata Bridge approach at Azapkapı and the adjacent Tophane area while the later sheets (numbered 16–23) concentrate on Kasımpaşa and its surrounding areas. The northern shore maps include the Ottoman naval shipyard (Tersane-i Amire) and arsenals in Kasımpaşa, the commercial Kasımpaşa fish market and docks, as well as the more industrial stretch toward Hasköy (featuring factories, gasworks or powder mills, and the historic Aynalıkavak Pavilion).

For the aim of this research, this thesis will focus on the maps around the Golden Horn which show burnt or demolished sites in order to track how the urban fabric and the city scape changed after earthquakes and fires and compare those to the modern day plan of Istanbul. For this purpose, the maps which will be required o analyze are :

**Southern Shore (Eminönü)**

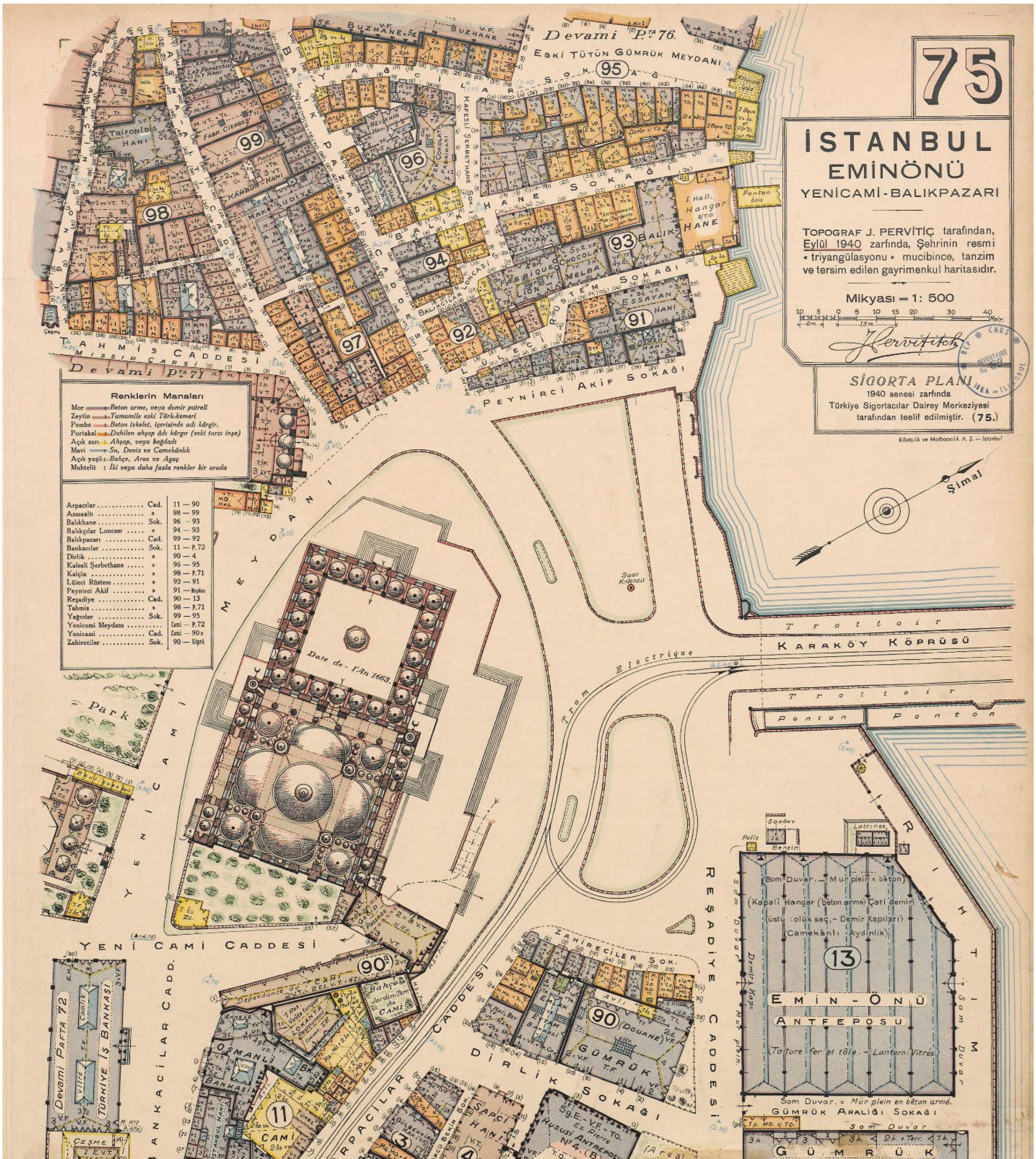
- Map 75 (1940) – Yeni Cami & Balıkpazarı
  - Covers Eminönü Square, Yeni Cami, Egyptian Bazaar, and waterfront piers.
  - Shows open areas around customs warehouses and pier edges, likely cleared for traffic and hygiene projects.
  - Small vacant plots near Balıkpazarı suggest sites cleared after fires or early demolitions for road alignment.
  - Useful for illustrating the start of urban clearance in the core port district.

- Map 76 & sub-sheets (1941–42)
  - Around Yemiş & Zindankapı: Shows vacant parcels near the old city walls, likely sites of past fires and partial demolitions for Prost's hygiene plan.
  - Rüstem Paşa/Tahtakale: Some gaps correspond to old fire sites in the 1910s–20s, linked to commercial warehouse fires.
- Map 77 (1943)
  - Küçükpazar / Unkapanı: Large empty plots along the water — partly demolished wooden warehouses, some cleared post-fire, some for Prost's road projects.
  - Visually documents urban transformation under risk/hygiene planning.
- Map 78 (1941)
  - Hallar Meydanı shows wide empty yards, some noted as "Terrain vague", likely sites cleared after fires or structural demolitions.

**Northern Shore (Beyoğlu/Kasımpaşa)**

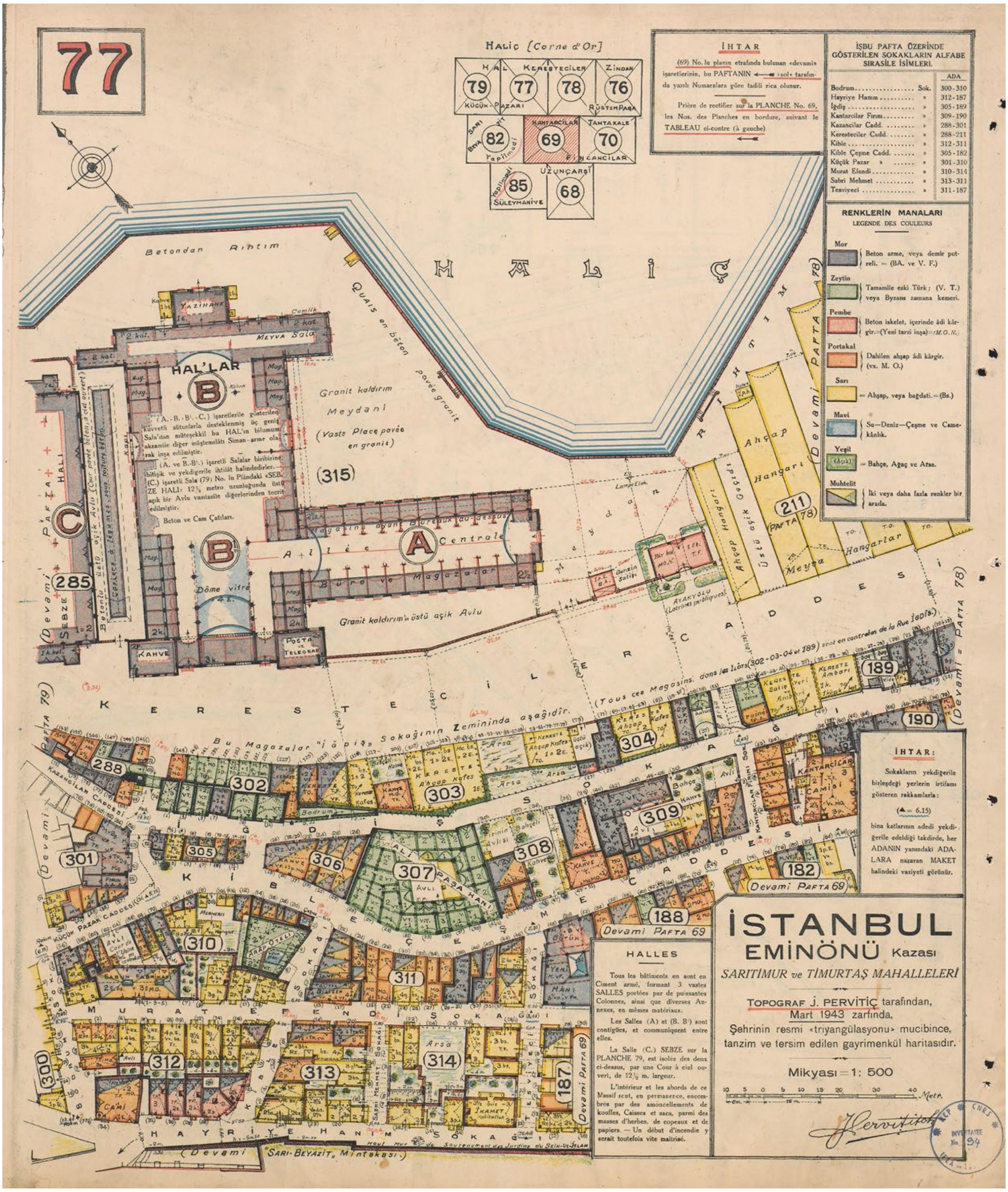
- Map 51 (Galata/Azapkapı, 1932)
  - At Azapkapı, some plots are empty or marked as ruins following late 19th–early 20th c. fires.
- Maps 19–23 (Kasımpaşa/Hasköy, 1929)
  - Show gaps in industrial/residential tissue where fires were frequent in the wooden housing areas.
  - These correlate with known Hasköy fires and industrial hazards (shipyard/arsenal risks).

Pervititch mostly used two scales to create these fire insurance maps. 1:250 scale was used for dense urban/commercial areas like Eminönü core and Galata. 1:500 scale was used for less dense or larger-scale zones like port warehouses (Map 78) or Kasımpaşa industrial areas.

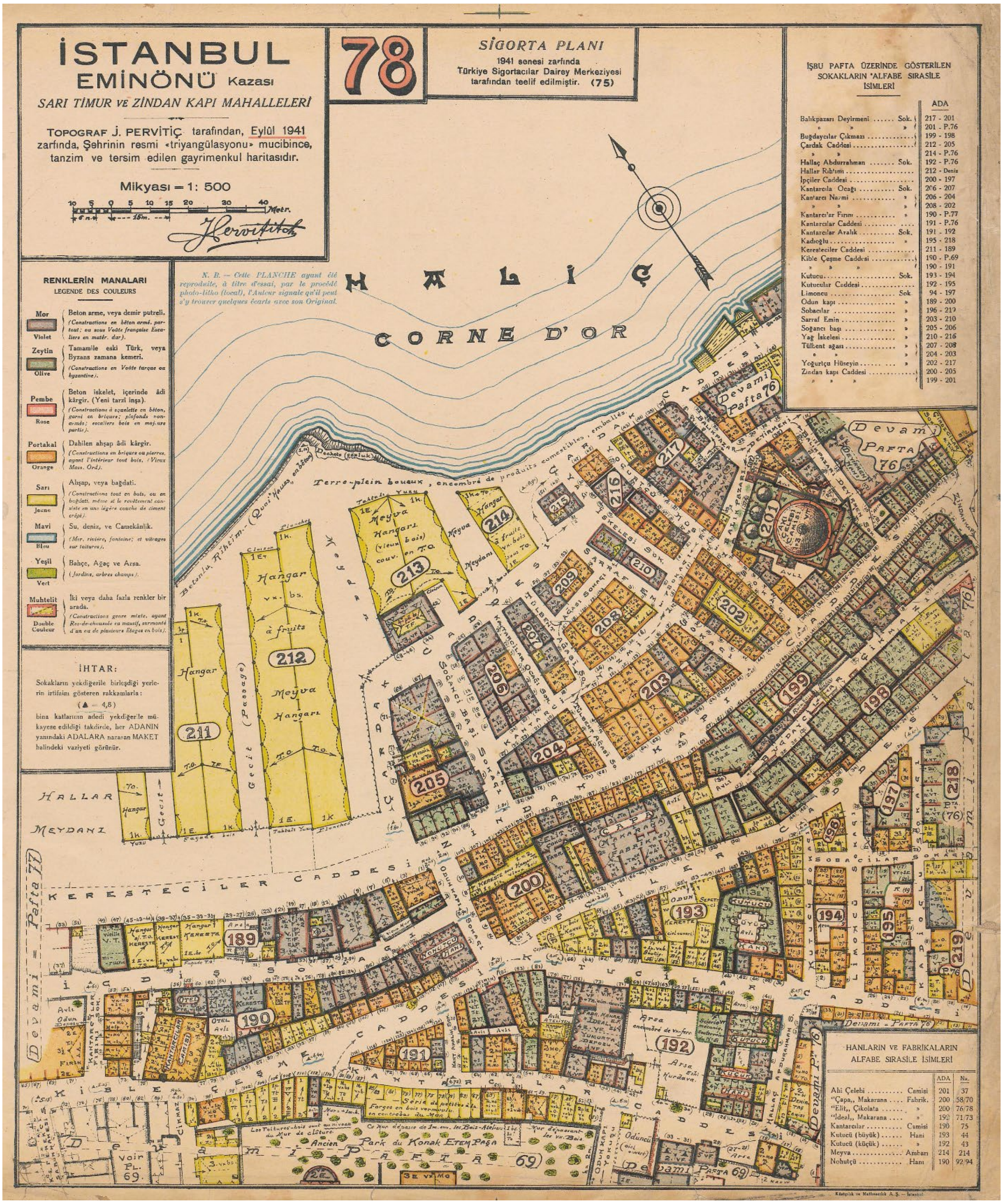



***Map 24:*** *Fire Insurance Map of Eminönü showing (Yenikami–Balıkpazarı), Pervititch Map No. 75, 1940 , map scale: 1:500, Reproduced from Salt Research Archives: https://archives.saltresearch.org/handle/123456789/124839*


*Map 25:* *Fire Insurance Map of Eminönü showing the Sarıtimur and Timurtaş neighborhoods (No. 77), map scale: 1:250, created by Jacques Pervititch in March 1943. Reproduced from Salt Research Archives: https://archives.saltresearch.org/handle/123456789/124839*




***Map 26:*** *Fire Insurance Map of Eminönü showing the Sarıtimur and Timurtaş neighborhoods (No. 77), map scale: 1:500, created by Jacques Pervititch in March 1943. Reproduced from Salt Research Archives: https://archives.saltresearch.org/handle/123456789/124839*



***Map 27:*** *Fire insurance map of Eminönü showing Sarıtimur & Zindankapı neighborhoods (No. 78), map scale: 1:500, created by Jacques Pervititch in March 1943. Reproduced from Salt Research Archives: https://archives.saltresearch.org/handle/123456789/124839*

The maps focus primarily on fire risk because this was the main concern of the time but they do not use separate symbols for earthquake risk. Istanbul lacked any method to map seismic hazard zones during the 1920s–1930s while earthquake insurance remained less developed than fire insurance. The construction information on the maps reveals seismic vulnerability through the fact that heavy masonry buildings (pink) would experience more damage from earthquakes than flexible timber structures (yellow) as shown by the 1894 Istanbul earthquake. Multiple reports from the 1894 earthquake showed that wooden houses built in the old style survived the earthquake without major structural issues but several new masonry buildings with iron tie reinforcement failed during the shaking. [344]

The development of Istanbul reveals a fundamental paradox where fire protection elements become earthquake vulnerabilities and earthquake-resistant elements become fire vulnerabilities. The early 20th century Pervititch maps show fire-resistant masonry areas built for lower fire risk but higher earthquake risk next to traditional timber house quarters which are prone to burns but relatively earthquake-resistant. Through historical analysis of the Pervititch maps one can identify both construction type distribution and the risk management choices that Istanbul residents and officials made during post-disaster reconstruction.

The research used Pervititch fire insurance maps to study the Golden Horn waterfront and its disaster-prone areas through georeferencing. The selected maps included 75, 76 and its sub-sheets 77 and 78 for Eminönü and 51 and 19–23 for Beyoğlu/Kasımpaşa which showed vacant lots and ruins and "terrain vague" parcels that represented areas affected by fires and earthquakes and subsequent demolitions. QGIS Georeferencer was used to align historical maps with modern basemaps through the identification of permanent features such as mosques and han courtyards and shoreline bends. The georeferencing technique allowed the research to combine historical and modern urban layouts which revealed areas that underwent changes and enabled visual tracking of urban development. The research shows how disasters together with early modernization projects modified the Golden Horn waterfront through this method which demonstrates the connection between risk and memory and urban redevelopment throughout time.

How Pervititch Indicates Burnt or Demolished Sites:

- Hatched or dotted plots: Often mark vacant lots after fires or lots cleared for construction.
- "R" or "Ruin" annotation: Marks ruined/damaged buildings (frequent in the Golden Horn where fire or demolition occurred).
- Open white parcels within dense blocks: Usually mean empty land — in Eminönü and Galata this often followed fires or demolitions for hygiene projects.
- Notes in French or Turkish: Sometimes say "Terrain vague," "Yıkıntı," "Boş arsa," meaning vacant/ruined land.

344 Yenihayat, Çaktı, and Şeşetyan, "1894 Istanbul Earthquake," 45–48.

### 4.5.3. Comparative Analysis of Goad and Pervititch Maps: Rebuilding, Material Change, and Risk Adaptation

The following section investigates Istanbul urban development through a study of fire insurance maps created by Charles E. Goad and Jacques Pervititch which uses spatial comparison methods. The two map series show similar details because they were made during different times spanning fifteen to twenty years for the same purposes. The maps show building outlines and construction materials and street patterns and fire damage zones with equal precision. The study benefits from its close time frame and uniform research approach which enables researchers to track urban area developments through time.

By georeferencing and overlaying Goad's early twentieth-century insurance maps with Pervititch's interwar maps for identical locations, it becomes possible to trace the physical consequences of major fires and earthquakes, as well as the subsequent rebuilding processes. The comparison enables to determine which buildings were completely destroyed or rebuilt or received additional structural support or new construction while showing how building materials changed from wood to stone structures because of improving disaster protection methods. The maps function as historical documents which show how cities developed while showing how people became aware of dangers and how government agencies responded to disasters throughout different emergency situations.

The process of uniting Goad's (1904) and Pervititch's (1940s) maps requires exact measurement and alignment because their maps differ in size and their hand-drawn appearance led to drafting errors. The two map series contain detailed information but their different nominal scales and non-matching projection systems prevent direct map alignment until georeferencing and affine transformations are applied. The process of paper deformation together with drafting errors and urban development changes results in additional mapping errors which make it impossible to achieve successful map alignment. The analysis shows that small positioning errors should be considered as mapping errors instead of actual changes in space while the overall physical and structural changes in cities can be used to study urban development.

One of the most important aspects to take into consideration when comparing the work of two cartographers documenting the same urban areas at different moments in time is the internal logic of their cartographic legends and classification systems. The fire-insurance maps created by Charles E. Goad and Jacques Pervititch share identical objectives yet their construction material representation systems show distinct differences in their level of detail and their classification systems. The 1904 maps by Goad use a basic two-color scheme which shows timber buildings in yellow and masonry buildings in pink because these colors represented the fire safety standards of that time.

Pervititch presented mid-twentieth-century maps which used a detailed material classification system to identify traditional load-bearing masonry and reinforced-concrete structures and mixed construction types and non-built areas. The structures shown in orange on Pervititch maps as “internally wooden, externally masonry (known as kârgir)” are hybrid structures with wooden internal load-bearing systems despite their stone or brick exteriors. This classification reflects the semi-stone building typology developed within the framework of fire regulations and modernization policies during the late Ottoman and early Republican periods.
Pink is reserved specifically for buildings with a concrete structural frame, with masonry used only as non-load-bearing infill.

While purple is used for buildings with a fully load-bearing masonry structural system, typically brick or stone, without reinforced concrete elements.

The two maps from Goad and Pervititch show the same areas through different color schemes because they used separate methods to represent building conditions. The change represents an advancement in construction classification systems which now distinguishes between historical masonry structures and contemporary reinforced concrete buildings because of better building technology and more precise surveying methods and updated regulatory standards.

| Color | Goad Maps | Pervititich Maps | Interpretation for comparison |
|---|---|---|---|
| **Yellow** | Timber / wooden construction | Timber / bağdadi construction | Direct correspondence; continued presence of fire-prone wooden buildings |
| **Pink** | Masonry (brick or stone) | Reinforced concrete structural frame | Apparent “change” may reflect reclassification, not rebuilding |
| **Orange** | Not used | Hybrid: timber internal structure + masonry external walls (“adi kârgir”) | Explains why former Goad “pink” areas appear orange in Pervititch |
| **Violet / Purple** | Not used | Load-bearing masonry (brick/stone), no reinforced concrete | Indicates modern, fire-resistant construction |
| **Green** | Not material specific | Gardens, courtyards, open land | Non-built or low-risk zones |
| **Blue** | Not material specific | Water, cisterns, fountains | Fire-mitigating urban elements |
| **Mixed / Patterned** | Not used | Mixed construction types | Reflects hybrid structures common in transitional periods |

***Table 10:*** *Comparison of material classification systems in Goad and Pervititch fire-insurance maps*[345]

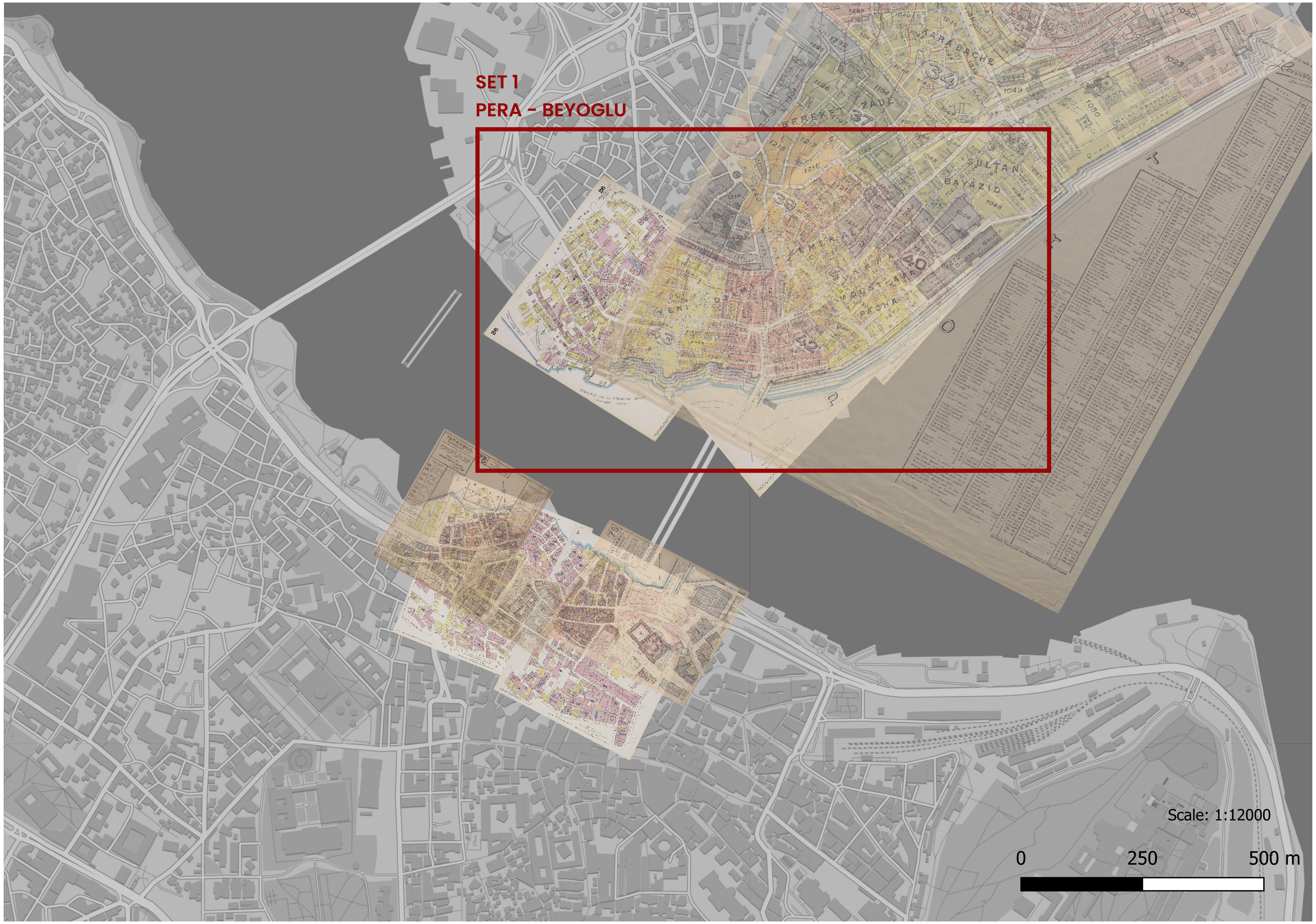
345 Compiled by the author based on Charles E. Goad, Plan d’Assurance de Constantinople (1904), and Jacques Pervititch, Sigorta Planları for Istanbul (1935–1942). Color interpretations follow the original legends of both map series and reflect differences in cartographic classification rather than direct material change.

The maps are organized into two geographic sets based on shared urban zones. Each set pairs Goad and Pervititch sheets covering the same neighborhoods, enabling a focused examination of transformation over time. The research method allows to analyze disaster impacts on communities while they observe how urban areas transform through rebuilding initiatives and regulatory systems which operate in earthquake and fire-prone areas. The section demonstrates through comparative mapping how risk adaptation practices moved from one historic district of Istanbul to another before modern planning systems gained authority

**SET 1 : BEYOGLU - PERA**

Set 1 focuses on the Galata–Karaköy area, one of the most commercially active and fire-prone districts of late Ottoman Istanbul. The area experienced multiple major fires throughout the nineteenth century before undergoing major rebuilding work during the beginning of the twentieth century. The comparative analysis is based on Goad's insurance maps of Galata and Karaköy (c. 1904–1906) and corresponding Pervititch maps produced in the 1920s. The two cartographers recorded all building materials and plot boundaries and street configurations with exactness which enables researchers to analyze post-disaster rebuilding patterns in great detail. The comparison shows how buildings underwent material changes while their density increased and urban design patterns shifted to represent new fire prevention methods and seismic safety standards and commercial development in the northern Golden Horn region.

The maps used for the first georeferencing and comparison for Galata – Pera zone are Goad Vol. II, Sheet 26, produced between 1904–1906, and Pervititich Plan d'Assurances – Beyoğlu / Galata / Karaköy, produced in December 1927.




***Map 28:*** *Georeferenced overlay of Charles E. Goad and Jacques Pervititch fire insurance maps in the Karaköy–Galata waterfront area (early 20th century)*[346]

346 The figure presents a georeferenced overlay of Charles E. Goad, Insurance Plan of Constantinople, Vol. II, Sheet 26 (1904–1906, scale 1:600) and Jacques Pervititch, Plans d'Assurances de Constantinople: Beyoğlu–Karaköy, Sheet 36 (1925–1940, scale 1:500), aligned over a grayscale Carto Light (OpenStreetMap-based) basemap.
Georeferencing was conducted in QGIS using persistent urban landmarks, including Arap Camii, Saint Benoît School, and stable street intersections within the historic Karaköy core. Differences in scale and surveying methods result in minor geometric distortions; however, shoreline geometry and institutional footprints confirm reliable spatial correspondence.
The overlay enables a comparative reading of building materials, parcel continuity, and post-fire reconstruction patterns, documenting the transition from a mixed, fire-scarred urban fabric recorded by Goad to the more regulated and material-standardized environment

The GIS environment allowed to perform spatial analysis between the Goad and Pervititch maps which were georeferenced for studying post-fire rebuilding activities and material changes and risk management strategies in Beyoğlu–Pera. The analysis used OpenStreetMap data which received Carto Light styling without labels to create a modern spatial reference system which maintained street patterns and coastal boundaries without introducing excessive visual elements.

The georeferencing process used permanent urban features which maintain their identity between historical and present-day maps. The study focused on three main control points which were firstly; Arap Camii because its layout has not changed since medieval times and secondly; Saint Benoît Lyceum as a significant institutional building that appears in both insurance maps and lastly; Galata Tower which has stayed the same throughout time. Additional secondary control points were added which they positioned at both block corners and waterfront boundaries to enhance the overall alignment of the project.

The two maps show different scales because Goad used 1:600 and Pervititch used 1:500 while historical cartography methods produced distorting effects which cause small positioning errors in outer sections of the maps. The central area of the core zone contains enough detailed information which enables researchers to conduct both qualitative and comparative studies about building materials and block consolidation and post-disaster urban development.

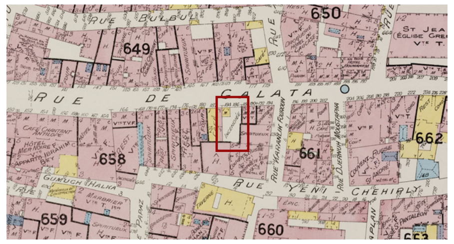

***Map 29:*** *Georeferencing Control Points and Persistent Landmarks Used for Pera – Beyoglu Maps Overlay Accuracy* [347]

347 This figure presents the same georeferenced overlay of Charles E. Goad, Insurance Plan of Constantinople, Vol. II, Sheet 26 (1904–1906, scale 1:600) and Jacques Pervititch, Plans d'Assurances de Constantinople: Beyoğlu–Karaköy, Sheet 36 (1925–1940, scale 1:500), displayed at a different cartographic scale to emphasize control points and persistent urban landmarks used during the georeferencing process.
The red squares indicate historically stable reference elements—including Arap Camii, Saint Benoît School, and long-standing street intersections within the Karaköy–Galata core—that remain identifiable across both mapping campaigns and in the contemporary urban layout.

The two cartographers Goad and Pervititch use color coding to show construction materials yet their color systems do not match each other. The insurance maps from Goad's early twentieth century show pink areas which represent masonry buildings and yellow areas which represent timber buildings because the city was still rebuilding after its major fires during the late nineteenth century.

Pervititch presented his later designs which showed how masonry construction reached standardization because of Tanzimat-era regulations and the 1882 Ebniye Kanunu. The maps display standard masonry buildings through yellow markings but pink markings indicate buildings which require additional support or contain fire-resistant materials or function as institutions. The two map series show opposite color patterns because their mapping methods differ from each other while the early twentieth century standardized masonry building patterns in urban areas.

Overview of the visual representation styles and their meanings of Goad and Pervititch is that the two authors Goad and Pervititch use color coding to show building attributes yet their way of representation show different patterns of urban development and regulatory changes. The Goad maps from the early 1900s use two simple color schemes , pink and yellow, to distinguish timber buildings from masonry structures which demonstrate how fires in the nineteenth century shaped urban design development. The later Beyoğlu plans from Pervititch show a city which had adopted masonry construction as its standard building practice. The color scheme in this design uses different hues to show the level of fire protection and structural strength and building purpose rather than separating timber from masonry construction. Pervititch used yellow in his maps to indicate that masonry architecture now serves as the standard construction practice because he spent many years enforcing building codes and rebuilding destroyed structures.






***Map 30:*** *Overlay of Goad (1904) and Pervititch (1935–1945) insurance maps for Galata–Pera, highlighting zones of ruins, open plots, and post-fire reconstruction. Despite partial misalignment caused by scale and cartographic differences, consistent block geometries reveal material upgrading and densification between the early and mid-twentieth century.*[348]

348 Charles E. Goad, Constantinople Insurance Plan , Vol. II: Pera & Galata (London, 1904); Jacques Pervititch, Constantinople Insurance Plans (Istanbul, 1935–1945). Composite georeferencing and spatial analysis by the author using QGIS and OpenStreetMap base data.

Map 30 above shows specific zones which demonstrate the most significant changes through open and ruined and partially vacant areas from one map series that became rebuilt and reinforced and structurally altered in the other. The Goad maps show these areas as empty spaces which result from fire damage while the Pervititch maps show these same areas being used for masonry and reinforced construction. The different areas in Galata–Pera show how the neighborhood underwent post-fire development through population growth and better construction materials during the first twenty years of the 1900s.

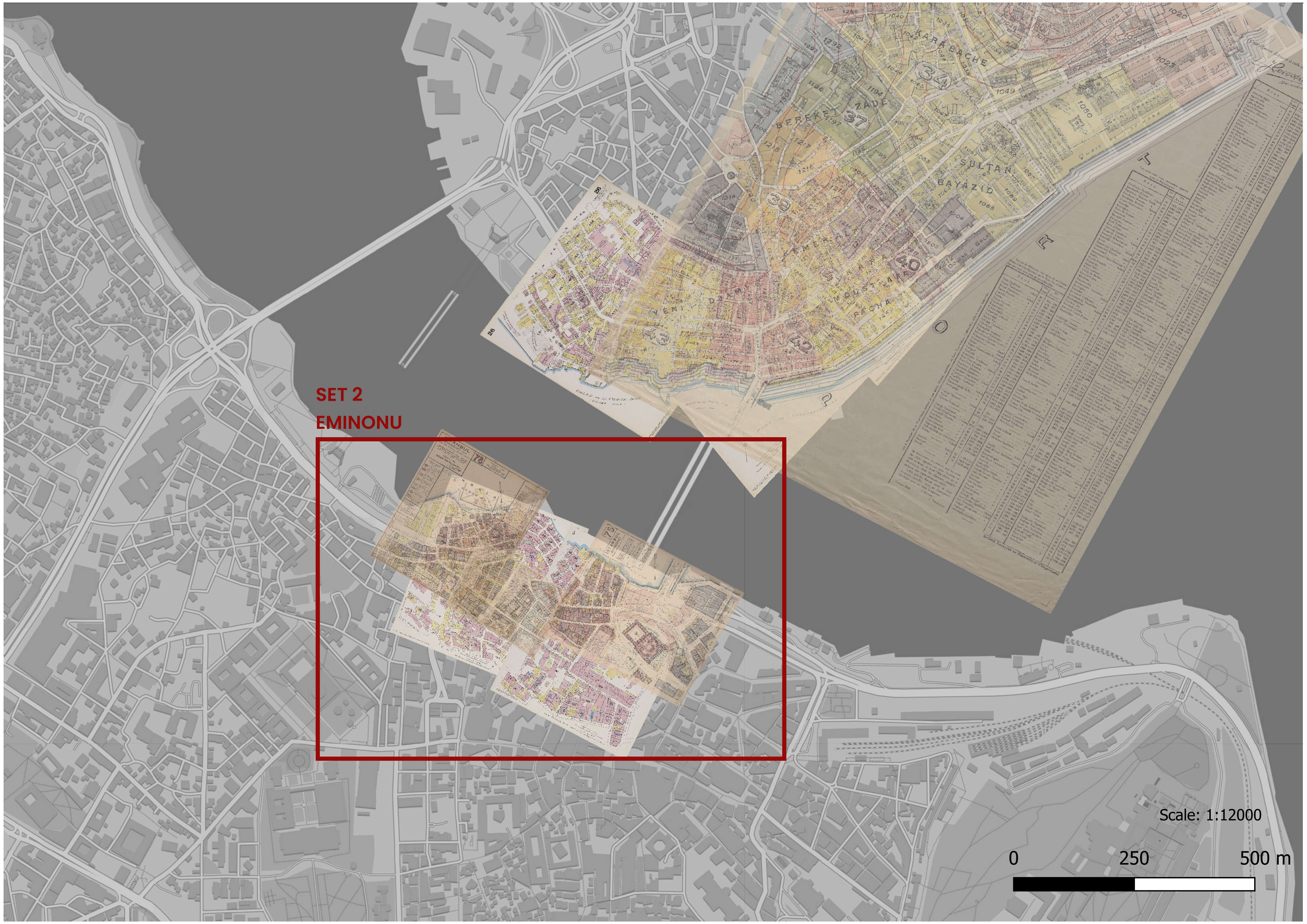
The map demonstrates how Galata–Pera's business district evolved from its initial masonry-and-timber construction during the 1900s into a fireproof urban design which created defensive zones between dangerous and safe zones during the 1940s. The analysis reveals two main developments which affect building materials and how land is used and how commercial areas expand throughout the Golden Horn region.

The two maps present urban development patterns which share the same geographic area. The Goad map shows pink as the primary color in the overlapping area which demonstrates that Beyoğlu–Galata underwent significant masonry reconstruction during the early 1900s in its commercial and insured areas. The urban structure displays signs of recent fire incidents and construction work because this area presents both different colored areas and changing land use patterns.

The area showed uniform material distribution when Pervititch documented it because post-fire construction activities had reached their peak and fire protection building rules had become effective. The construction sector now dedicates its efforts to establishing permanent risk management systems and strengthened regulatory systems because it has moved past its initial emergency construction phase to work on material stability and block form consolidation.

**SET 2 : EMINONU**

The Eminönü district's urban fabric underwent significant transformations between the early 1900s and the 1940s. This report compares Charles E. Goad's 1904 fire insurance maps (Sheets 4 and 5 of the Stamboul series) with Jacques Pervititch's insurance maps from the early 1940s (Sheets 75, 76a/b/c, and 78). These detailed maps – drawn for assessing fire risk – use color codes to denote building construction materials and provide a snapshot of the district's structure at two moments in time. By overlaying the maps, we can trace changes in building materials (notably masonry vs. timber) and identify structural changes such as new constructions, demolitions, and shifts in the street layout. The analysis highlights where wooden buildings were replaced by masonry (or vice versa), reflecting broader urban development and fire-safety measures of the period.




***Map 31:*** *Georeferenced overlay of Charles E. Goad and Jacques Pervititch fire insurance maps in the Eminonu waterfront area (early 20th century)*[349]

349 C. E. Goad, Plan d'Assurance de Constantinople, Vol. I: Stamboul (London, 1904); J. Pervititch, Plans d'Assurances de Constantinople (Istanbul, 1935–1945). Georeferencing and overlay analysis by the author using QGIS and OpenStreetMap.


**Map 32:** Georeferencing Control Points and Persistent Landmarks Used for Eminonu Maps Overlay Accuracy [350]

**Map 32 :** This figure illustrates the georeferencing strategy applied to Set 2 (Eminönü), where Jacques Pervititch's fire-insurance maps (1940–1942) are overlaid onto Charles E. Goad's Plan d'Assurance de Constantinople (1904). The red rectangles mark permanent urban landmarks: Ahi Celebi Cami, Rustem Pasa Cami, Kulliye Han, Tahtakale Hamami, Yeni Cami used as control points during the georeferencing process that maintain their original positions and shapes through all urban development changes.

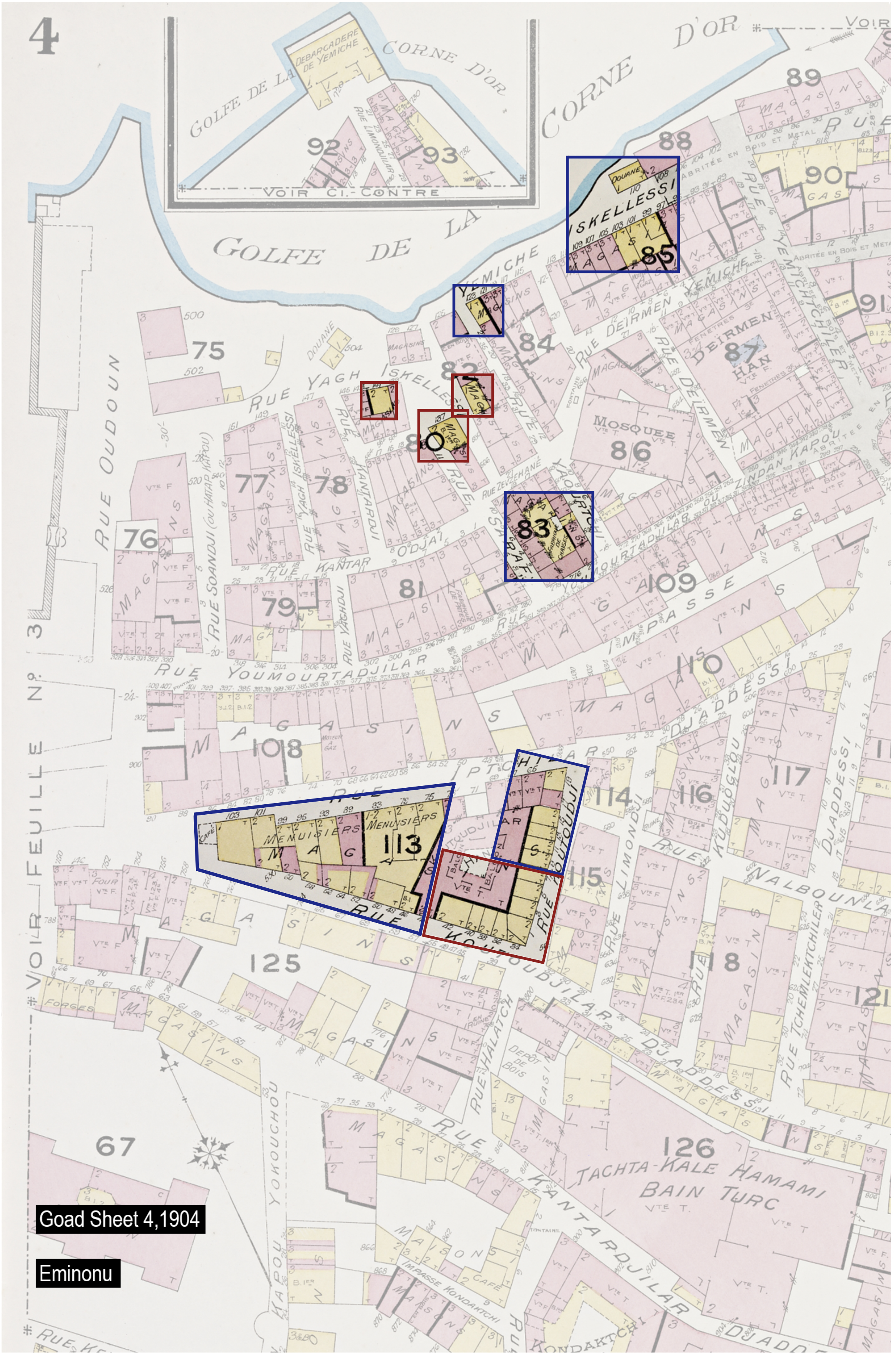
The two map series show manual creation at different scales which makes it impossible to achieve perfect geometric alignment between them. The georeferencing process focuses on maintaining block-level morphological consistency by creating spatial relationships between street patterns and building clusters and important architectural structures. The control points enable historians to link historical maps with modern coordinates which enables them to study building materials and structural changes and post-fire reconstruction methods in Eminönü throughout history. Historical cartography contains natural distortions and edge mismatches which should be viewed as essential elements instead of being treated as spatial interpretation mistakes.

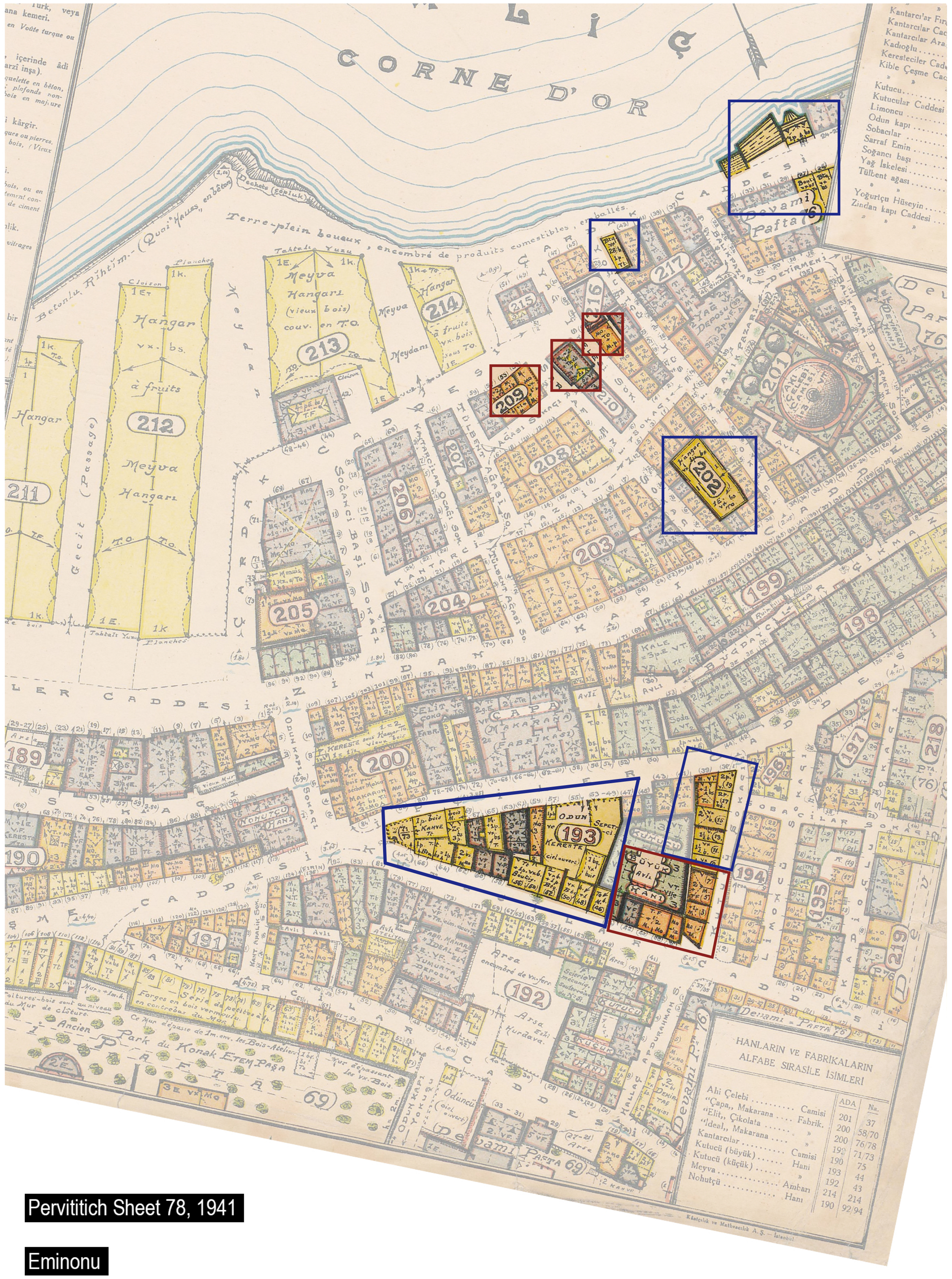
350 Compiled by the author using Charles E. Goad, Plan d'Assurance de Constantinople (1904), and Jacques Pervititch, Sigorta Planları, Eminönü sheets (1940–1942). Georeferencing is based on stable monumental landmarks and block morphology.

The comparison between Goad's 1904 maps and Pervititch's 1940s maps demonstrates that Eminönü underwent a major development because wood-framed buildings from 1904 disappeared to make way for masonry structures which spread across the entire area by 1940. The city of Istanbul works to decrease fire risks because multiple destructive fires occurred during the late 19th and early 20th centuries. Following the great fires (such as the Hocapaşa fire of 1865 that ravaged Stamboul), the Ottoman administration decreed that traditional wooden houses should be replaced with more fire-resistant stone or brick structures. The implementation of these regulations took place through time span of multiple decades while concentrating on specific areas of the city. Eminönü – a dense historic commercial area – was a priority, but change was piecemeal due to financial and logistical constraints.

Goad's Sheet 4 and Pervititich's Sheet 78 are chosen for a deep research to have a better understanding how each building changed over this 37 years period in between the time of these two cartographers. The comparative map below shows specific timber buildings which appear in Goad's 1904 insurance map (Sheet 4) and demonstrates their material development through Pervititch's 1941 Sheet 78. The left map shows Goad's survey data which includes timber structures that have been organized into two groups based on their construction status at 1941. The blue frames in the map show buildings which kept their timber construction until 1941 while the red frames represent buildings that received new construction with fire-resistant materials. The right map shows the same building shapes from Pervititch's map while keeping all parcel boundaries and square shapes exactly the same to allow direct comparison of each building.

The spread of transformations through space shows that materials underwent specific changes instead of undergoing a complete transformation. The transition of buildings from timber to masonry and reinforced systems occurred mainly in commercial areas which had high population density and were located near important urban landmarks during the early 1900s. The timber structures which remain in secondary streets and interior blocks demonstrate that these areas preserve their historic urban design from the past. The comparison between the two maps shows that the preserved footprint geometry proves the observed variations stem from better materials and construction methods instead of changes in land arrangement thus validating the analysis through its scale and projection and cartographic method differences.




***Map 33:*** *Comparison of timber buildings between Goad's 1904 Eminönü map (Sheet 4) and Pervititch's 1941 map (Sheet 78). Blue frames show timber structures that stayed timber, while red frames mark buildings reconstructed using more fire-resistant materials.*

Overall, by 1904, Goad's survey still found many wooden buildings intact (colored yellow), interspersed with newer masonry buildings (pink) in the quarter. By the early 1940s, however, the Pervititch maps show the change from yellow timber structures to orange, pink and purple since Pervititch maps show the material types in a more detailed way. In the same localities, indicating that numerous wooden structures had been replaced or rebuilt in non-combustible materials. Even though we still see timber structures in Pervititch maps, it is clearly seen that the number of them had been decreased.

When we look at the changes that occurred in the Eminonu area it can be summoned under a few topics as listed above;

**Yeni Cami – Egyptian Bazaar – Balıkpazarı Area**

The area surrounding Yeni Cami (the New Mosque) and the Egyptian Bazaar (Misir Çarşısı or "Balıkpazarı") presents an impressive display. The New Mosque complex was stone-built in the 17th century; Goad's 1904 Sheet 5 accordingly colors the mosque and the L-shaped Egyptian Bazaar building in pink (masonry). However, the open plaza and market stalls in front of the mosque (the Eminönü Square/Balık Pazarı area) were historically lined with wooden booths and low structures (fishing sheds, produce stalls, etc.,often temporary and wooden). By the time of Pervititch's 1940 Sheet 75 ("Eminönü – Yeni Cami – Balıkpazarı"), many of those flimsy structures were gone or rebuilt. The bazaar building maintains its masonry structure (pink color remains the same) while the map indicates pink-colored masonry construction has started in the surrounding square area including the Ottoman Bank branch near Yeni Cami and various civic structures built during the 1930s. Meanwhile, the remaining market stalls were likely moved into more permanent facilities or cleared to expand the plaza. Thus the area transitioned from a mix of stone monument + wooden stalls (1904) to a largely masonry environment (1940) as part of early republican era urban improvements.

The wood-to-stone transition appears in multiple residential areas which exist within Eminönü. In Zindankapı and Sarıtimur Mahallesi (covered by Pervititch Sheet 78, 1941), which is at the northwest edge of Eminönü, many late Ottoman wooden rowhouses survived into the early 20th century. Goad's maps of that sector (the edge of Sheet 4/5 coverage) would have shown clusters of yellow. The 1940s Pervititch map shows that several blocks underwent reconstruction through brick apartment house and reinforced-concrete structure (pink) construction following fires and demolition activities. Still, a few yellow-coded wooden houses linger in 1941 on the Pervititch map of Sarıtimur – perhaps older homes not yet redeveloped – illustrating that the complete eradication of timber took longer than a few decades. The overlay analysis shows that masonry construction activities followed the expected pattern of growth which supported both government fire safety initiatives and the early Republic's modernization projects.

**Residential Fabric: Zindankapı and Sarıtimur Mahallesi**

A similar but more gradual transformation can be observed in residential quarters such as Zindankapı and Sarıtimur Mahallesi, documented in Pervititch Sheet 78 (1941). The residential areas situated at the northern boundary of Eminönü featured traditional late Ottoman wooden buildings which dated back to the past. In the corresponding peripheral zones of Goad’s Sheets 4–5, such areas would have been predominantly represented in yellow, indicating timber construction.

The early 1940s Pervititch map shows that multiple blocks in these areas received partial reconstruction work which brought new brick apartment buildings and reinforced concrete buildings together with the remaining wooden houses. The map shows that timber buildings maintained their presence although they became less visible because yellow-coded structures continued to exist throughout the transition period which spanned multiple years. The multiple layers of the pattern indicate that post-fire construction work took place at the same time as building demolition and urban development progressed step by step instead of through a unified master plan.

Overlay analysis of the two map series therefore suggests that masonry and reinforced-concrete construction increasingly replaced timber structures, in line with fire-prevention measures and modernization policies, while also highlighting the persistence of older housing stock well into the Republican period.

**Major Structural Interventions and Urban Reconfiguration**

The comparison between 1904 and the 1940s shows that Eminönü underwent major changes which affected its physical structure. One of the most prominent is the construction of the new Customs House (Gümrük Binası) along the waterfront. The 1904 map from Goad shows a small customs area which extends from Bahçekapı but Pervititch's Sheets 75–76 present a long pink-coded facility which controls the entire waterfront area. The early twentieth century brought forth a major architectural breakthrough through its reinforced concrete structure which implemented innovative construction techniques and block patterns to replace traditional small warehouses and reshape the coastal region.

The city uses Reşadiye Avenue as its main intervention. The 1904 maps created by Goad do not show this broad street which Pervititch depicted in his 1940 map as it passes through the former residential area near the New Mosque. The construction of this street involved the destruction of multiple timber-based buildings which led to a new street design for the surrounding properties. The overlay comparison reveals that multiple thin alleys which existed in 1904 disappeared through two processes which occurred during the 1940s: they either vanished completely or merged into bigger property areas. The urban design became more organized because of early twentieth-century initiatives which worked to enhance street connectivity.

## Expansion of Public Space and Infrastructure

The growth of Eminönü Square showed that the entire area underwent transformations. Goad's map labels a "Place de Yeni Djami," but depicts it as relatively constrained by surrounding buildings. The 1940s map from Pervititch demonstrates how the open area grew larger while it approached the waterfront through the combination of tram routes and ferry terminals and paved surfaces. This transformation required the removal of dense rows of small-scale commercial structures, many of which had been timber-built, in favor of transport infrastructure and improved visual and spatial access to the mosque complex. The implemented changes brought better connectivity and fire safety standards but they resulted in the disappearance of commercial areas which used to characterize the waterfront.

## New Civic and Commercial Buildings

Finally, the Pervititch maps document the appearance of new civic and commercial buildings that were absent in 1904. The buildings from the Republican era along with modern office structures and banking facilities receive pink coding which shows their reinforced concrete construction. The structural improvements made to traditional hans and commercial buildings resulted in developers building new extensive buildings from masonry and concrete which transformed both block measurements and architectural designs. The present developments show how modernization principles allow the construction of permanent buildings which provide fire resistance and improve administrative work.

| Location / Block | 1904 (Goad) | 1940s (Pervititch) | Change Noted |
|---|---|---|---|
| **Yeni Cami & Egyptian Bazaar (Balıkpazarı Square)** | Mosque and bazaar masonry (pink); surrounding market stalls predominantly timber (yellow). | Mosque and bazaar remain masonry (pink); increased presence of masonry and reinforced-concrete civic and commercial buildings; wooden stalls significantly reduced. | Clearance and reduction of temporary wooden structures; enlargement and formalization of the public square. |
| **Rüstem Paşa Mosque Area (Tahtakale markets)** | Dense mix of timber shops and few masonry hans; many yellow-coded structures. | Increased presence of masonry and reinforced-concrete buildings (pink), including market halls and commercial structures; isolated wooden buildings (yellow) persist. | Gradual replacement or upgrading of timber market fabric; modernization of commercial structures. |
| **Customs Warehouse at Bahçekapı (Shoreline)** | Small-scale warehouses (some timber) or open lots by the quay; no large building footprint. | New large-scale reinforced-concrete Customs House (pink) occupying an entire block along the shoreline. | Introduction of a major port facility; significant change in scale and construction technology. |
| **Reşadiye Avenue Corridor (leading inland from Eminönü)** | Tight street grid with wooden row houses and shops; no boulevard. | Reşadiye Avenue cuts through as a wide road; buildings along it are masonry-fronted; several plots cleared for road construction. | Demolition of predominantly timber-built structures and reconfiguration of blocks to create a modern thoroughfare. |
| **Sarıtimur / Zindankapı Quarter (NW Eminönü)** | Mixed-use neighborhood with many timber houses (yellow). | Blocks show increased masonry and reinforced-concrete apartment buildings (pink); a limited number of yellow-coded timber houses remain. | Partial residential redevelopment; gradual infill and replacement rather than complete transformation. |

***Table 11:*** *Observed material and structural changes in selected blocks of Eminönü through comparative map analysis (Goad, 1904; Pervititch, 1940s)*[351]

351 Note: Changes indicated in the table reflect both actual physical transformation and differences in cartographic classification between Goad and Pervititch maps. Pink in Pervititch denotes reinforced-concrete or modern fire-

These examples illustrate the broader pattern: timber building fabric gave way to masonry construction in central Eminönü, and the district's planform opened up in places for new buildings and roads. These changes also reflect contemporary priorities – fire prevention, commercial expansion, and early urban planning efforts – in the late Ottoman and early Republican eras. Many of these 1904–1940s changes were precursors to even larger transformations after the 1950s, when massive road-widening projects erased additional swaths of the old city fabrice-perimetron.org. Notably, the Pervititch maps of the 1940s preserve details of many structures that would vanish in mid-20th-century renewals, which is why they are valued as a record of a transitional cityscape.

### 4.5.4. Replanning Istanbul: Henri Prost and the Institutionalization of Modern Urban Planning

Post-Tanzimat Istanbul no longer simply rebuilt what was lost – it seized each fire as an opportunity to re-plan and "regularize" the neighborhood, introducing wider streets, straighter alignments, and non-combustible construction in an effort to break the cycle of destruction. Fire disaster and urban reform became tightly interconnected. As Çelik succinctly puts it, "Post-Tanzimat urban planning in the Ottoman capital was, therefore, determined first by the fires that periodically leveled portions of the city, and second, by the necessity to provide access to the newly developing areas"[352]

The city of Istanbul has undergone multiple transformations because of disasters particularly fires which occurred so frequently that people considered them an unavoidable destiny for the city. The predominance of timber buildings in Istanbul led to changes in the city's topographical structure following each fire. Two cartographers emerged to create maps of Istanbul for fire insurance purposes: Charles E. Goad (See Chapter 4.5.1.) and Jacques Pervititch (See Chapter 4.5.2.) Disaster risk management in this era was intertwined with urban planning. The traumatic fires of 1864–1870 (which ravaged vast sections of old Istanbul and Pera) were catalysts for reforms. Each fire's aftermath provided an opportunity to re-plan neighborhoods: officials widened streets, rerouted lanes, and cleared dense wooden housing clusters under the guise of modernization and safety.

The combination of frequent fires and modern infrastructure requirements made Istanbul's urban transformation an urgent matter during the early 20th century. Ilhan T. refers to this issue as, "during the middle of the 19th century while urban development planning was becoming institutionalized in Europe, one of its objectives was to find solutions to the health and sanitation problems of the industrial city. Problems in Istanbul were of a different nature. Large scale fires often devastated considerable sections of the city."[353]

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resistant construction, while orange and yellow categories capture hybrid and timber structures that may not have been differentiated in Goad's maps.

352 Zeynep Çelik, The Remaking of Istanbul: Portrait of an Ottoman City in the Nineteenth Century (Berkeley: University of California Press, 1986), 77.

353 İlhan Tekeli, The Development of Urban Planning in the Ottoman Empire and Republican Turkey (Ankara: Turkish Historical Society, 1994), 14-15.

The early twentieth century brought forth disaster-based planning methods which eventually developed into a complete system for urban planning. The designers created ambitious plans to transform the city into a modern urban center through the construction of broad boulevards and standardized blocks and sanitary living spaces which contrasted with the natural dense layout of the Ottoman city. Henri Prost received an invitation to Istanbul during the 1930s to assist in designing a modern and organized urban structure. The appointment of Henri Prost brought Istanbul into a new planning era which combined previous regulatory and post-disaster measures to create a contemporary metropolitan planning approach that transformed Istanbul's transportation network and public areas and its approach to dealing with disasters throughout the Golden Horn region.

Henri Prost (1874–1959) established himself as a key figure in French modern urban planning through his Paris regions plan and his comprehensive approach to Istanbul development. The Turkish Republic moved its capital to Ankara and established a new plan for the city before Istanbul received renewed attention for modernization during the mid-1930s. Throughout the 1930s politicians and city planners began to direct their focus toward the former Ottoman capital.


***Figure 33:*** *Aerial view of the Eyüp–Ayvansaray sector along the Golden Horn, c. 1936–1937 (Henri Prost Collection). This photograph captures the northern shore of the Golden Horn during the early years of Henri Prost's planning work for Istanbul. The image reveals the dense historical neighborhoods of Eyüp and Ayvansaray and their relationship to the waterfront, before major demolitions and urban interventions proposed in Prost's master plans. Such aerial photographs were integral tools in the modernization of Istanbul, enabling the identification of industrial areas, transport corridors, and potential sites for urban clearance and green space planning.*

This aerial photograph of the Eyüp–Ayvansaray sector (Figure X) illustrates the dense historical urban fabric along the northern shore of the Golden Horn in the mid-1930s, prior to large-scale interventions. When compared with the Pervititch fire insurance maps, which document the building typologies and fire-prone wooden structures, this image reveals the vulnerability of the neighborhood to both fire and future urban clearance. Henri Prost used such aerial surveys in conjunction with detailed cartographic resources to plan modern transportation corridors and green spaces while advocating for the removal of obsolete or hazardous waterfront buildings.[354]

354 Cân Bilsel, The Transformations of Istanbul: Henri Prost's Planning of Istanbul (1936–1951), A|Z ITU Journal of the Faculty of Architecture 8, no. 2 (2011): 10–23; Cité de l'architecture et du patrimoine, The Transformations of Istanbul: Aerial view of the Eyüp–Ayvansaray sector,

The photograph also visually contextualizes the transformations mapped in Prost's 1:5,000 plans, where Eyüp and Ayvansaray were earmarked for gradual modernization and partial demolition to open the waterfront to traffic and hygiene-oriented redevelopment.[355]

The mid-twentieth century reconstruction of İstanbul falls into two phases:

The governorship-municipality of İstanbul initiated an urban design competition for city modernization in 1932 and Major-Governor Muhittin Üstündağ invited four foreign city planners (Henri Prost, Jacques Henri Lambert, Donat-Alfred Agache, and Hermann Ehlgötz) to submit proposals in 1933. Among the invited planners was Henri Prost.[356]

"*Similarly to the previous reports prepared by European planners, parts of Prost's plan were characterized by "Haussmanian" boulevards and a powerful visual aspect, reproducing images of Europe."*[357]

He immediately observed that the city lacked up-to-date base maps, hampering any systematic planning. Prost famously "stated that the city's current map was missing and had to be updated," prompting him to request new aerial photographs of Istanbul as the foundation for his plans. This initiative effectively launched a new era of mapping: for the first time, modern surveying methods were employed to create accurate maps of Istanbul's layout – an essential tool for Prost's urban design proposals.

The European Side of Istanbul received its Master Plan from Henri Prost in 1937 which gained approval during June 1939. The Master Plan consisted of two distinct plans at 1/5000 scale which included the Old Istanbul Plan for the Golden Horn's southern region and the Plan of Galata-Pera for the northern Golden Horn area.[358]

The plan followed three main objectives which represented the fundamental principles of modernist urban planning during that period. The plan included three main objectives which focused on transportation and hygiene alongside aesthetics. Prost projected a design visualized by wide boulevards connecting functional zones with a theme of güzelleştirme (embellissement/beautification).[359]

ca. 1936–1937, Fonds Henri Prost, ArchiWebture. Accessed [31.07.2025]. https://archiwebture.citedelarchitecture.fr/ark:/43435/1003156.

(Archival note: This aerial photograph was part of the survey material used by Prost to coordinate urban redevelopment plans with historical cartography.)

355 Hande Coşkun, French Planner Henri Prost's Istanbul Master Plans and the Transformation of the Golden Horn, 2023, [insert DOI or ResearchGate link if available].

356 İpek Akpınar, "The Rebuilding of İstanbul Revisited: Foreign Planners in the Early Republican Years," New Perspectives on Turkey, no. 50 (2014): 60, https://doi.org/10.1017/S0896634600006580. For further reading on the 1933 urban design competition and Henri Prost's 1937 plan, see the full article.

357 Akpınar, "The Rebuilding of İstanbul Revisited," 60.

359 Akpınar, "The Rebuilding of İstanbul Revisited," 77, citing Henri Prost, İstanbul İzah Eden Rapor, 15 October 1937 (İstanbul: İstanbul Belediye Matbaası, 1938) and İstanbul Hakkında Notlar, 1937 (İstanbul: İstanbul Belediye Matbaası, 1938).

Having imagined İstanbul as still occupying the area of the historical city, Prost prepared not a total master plan, but a plan de concentration consisting of a series of propositions for three geographic regions of İstanbul. [360]

The visual structure of Prost's plan maintained strong connections with Hénard's plan and Haussmanian Paris through its central transportation system and auto-route network which served as the foundation of his design while incorporating hygiene principles and zoning regulations and urban extension controls and historical site protection and embellishment. The objectives Prost established for İstanbul shared commonalities with his French colonial city designs and Parisian approach. The plan involved building new boulevards and arterial roads through the city to create open spaces and parks around historic monuments while improving sanitation and housing conditions and establishing functional districts.[361]

360 Akpınar, "The Rebuilding of İstanbul Revisited," 81.

361 In the light of reports prepared by Martin Wagner defining the city's urban problems and enumerating the needs of its citizens, Prost wrote: "Following the proclamation of Ankara as the capital, İstanbul lost its role of being the great imperial center, and remained the primary harbor of the country." He added: "İstanbul has to live a modern life, acknowledging the hygienic problems of the twentieth-century city, having the benefits of all mediums of rapid transportation and commodities of the era. She has to have an international railway station connecting the Bosphorus to the great European capitals." —Quoted in İpek Akpınar, "The Rebuilding of İstanbul Revisited: Foreign Planners in the Early Republican Years," New Perspectives on Turkey, no. 50 (2014): 77, citing Martin Wagner, İstanbul Havalisinin Planı, Arkitekt 10–11 (1936): 301–306; and Henri Prost, La Transformation d'Istanbul: Rapports sur le Plan d'Aménagement d'İstanbul, 8 vols., 1936–1949, IFEA (unpublished).


***Figure 34:*** *French Architect-urbanist Henri Prost's Istanbul, Master Plan, 1937, Istanbul. Historical Peninsula (left) Pera District (top), and Anatolian Side (right), Residential Areas. Plan, Centre d'Archives, IFA Archives, Paris*

The historic fabric of Istanbul received preservation alongside bold intervention from Prost who maintained major monuments by removing surrounding dense neighborhoods for better visual visibility but destroyed traditional urban communities in the process. The New Mosque (Yeni Camii) and the Egyptian Bazaar lost their surrounding warren of buildings when Prost implemented his plan to create a large public square in the city center during the late 1930s. The square expansion required the demolition of historic buildings including Ottoman-era hans (commercial inns like the Valide Han) and several smaller mosques and structures. The project achieved better sightlines to the mosque and improved circulation according to Prost's aesthetic and traffic objectives but it eliminated a historic market area with workshops that operated there for many years.


***Map 34:*** *French Architect-urbanist H. Prost's 1/50 000, Istanbul Plan, 1937. Historical Peninsula, Blocks, Building-Blocks, Plan Centre d'Archives, IFA Archives, Paris*

The essential part of Prost's plan involved a new understanding of the Golden Horn's position in Istanbul's urban structure. The Golden Horn represents a long inlet estuary which divides historic Istanbul (the old peninsula) from the Galata/Pera side and functioned as a harbor and industrial shoreline for many centuries. The early Republican period brought industrialization and modernization goals to the new nation which led Istanbul planners to select the Golden Horn as their industrial development zone. The 1937 plan established the Golden Horn area as Istanbul's industrial zone by directing factories and warehouses and other industrial facilities to establish their operations along its waterfront.

The Sütlüce Slaughterhouse located on the north shore of the Golden Horn serves as proof that modern industrial facilities started appearing in this area when it opened in 1923. The plan implemented by Prost built upon this existing trend by creating an industrial corridor that would run along the Golden Horn shores while maintaining a distance from the historic city center. The 1940s and 1950s saw factories and utility plants and docks and shipyards and manufacturing plants establish themselves along the Golden Horn after Prost implemented his zoning regulations. More than 700 factories together with 2,000 workshops operated in the Golden Horn district by the 1950s which led to both employment opportunities and major environmental contamination. The industrialization process led to major population shifts and physical transformations because workers moved to the city and built informal housing (gecekondus) on Golden Horn's surrounding hills while turning the former natural harbor into an environmental disaster. The industrial development of Golden Horn banks created economic opportunities but simultaneously harmed both natural resources and the historic waterfront structures of the old city.

The 1937 master plan of Henri Prost designated the Golden Horn shoreline for industrial use while establishing main road connections between Beyoğlu (Pera) and the waterfront. The master plan of Prost included circulation corridors along the estuary but there is no evidence that he planned a continuous coastal highway between Eminönü and Unkapanı. The coastal road became a reality when it opened as Ragıp Gümüşpala Caddesi during the late 1950s.[362]

Prost's plans for the Golden Horn were not limited to industrial zoning. He also incorporated major transportation improvements. A coastal road along the Golden Horn had been a recurring idea since the 19th century to reduce traffic through the historic quarters. Prost included such a road in his scheme, and though it was not completed during his tenure, it foreshadowed the later construction of Ragıp Gümüşpala Caddesi in the 1950s. That highway, eventually opened in 1960, cut a swath along the southern shore of the Golden Horn from Eminönü to Unkapanı, fundamentally altering the waterfront. Prost's concept of "hygiene" in planning also played out around the Golden Horn – for example, moving certain noxious uses (like the slaughterhouse or other polluting industries) out of the dense residential core and onto the margins of Golden Horn was seen as a way to improve public health and sanitation in the city center.

In summary, Henri Prost's work (1936–1951 in Istanbul) brought a new cartographic and planning rigor to the city. He produced detailed master plan maps and reports, and although not all his ideas were executed immediately, his influence on the Golden Horn area was profound. Prost transformed Golden Horn into the city's designated industrial hub and set in motion the infrastructure projects (squares, boulevards, and zoning regulations) that reshaped the neighborhoods along the Golden Horn in the mid-20th century.

362 The Golden Horn shore was designated an industrial zone in Prost's master plan, and road axes between Beyoğlu and the shoreline were proposed. However, a continuous coastal highway (Ragıp Gümüşpala Avenue) was not planned by Prost; it was built later, opening around 1960. Sources: Cânâ Bilsel, Shaping a Modern City out of an Ancient Capital (METU, 2011), 105–107; Istanbul Tarihi article (2025) on Prost plans; Istanbul Site Management Directorate report, 2011, pp. 26–27; The Idea of the Modern City in Istanbul (2025).

# Chapter 5

## Disaster Risk Management in the Golden Horn Under Chosen Parameters

# 5. Disaster Risk Management in the Golden Horn– A Critical Analysis

The previous chapter studied how major disasters in the Golden Horn area of Istanbul caused the city to undergo multiple transformations through earthquakes and fires which altered its physical environment and social organization and regulatory frameworks. The following chapter investigates the development of risk management practices which occurred after disaster response systems became operational. It also analyzed fire insurance maps of Charles E. Goad and Jacques Pervititch, as early tools of risk representation, documenting building materials, street patterns, and post-disaster reconstruction practices. Through the comparative and georeferenced analysis of these maps, the chapter studied how destruction, rebuilding, and material change were recorded and translated into urban form.

This chapter expands on a multi-layered analysis of risk and vulnerability in heritage-rich urban zones, building on the theoretical research and historical analysis provided in the previous chapters, as well as the case-oriented context created for Istanbul's Golden Horn.

The disaster risk management system in Istanbul's Golden Horn requires specialized approaches because of its complex nature. The Golden Horn area presents both severe risks and substantial chances for strengthening its defenses because it contains ancient neighborhoods and crowded informal settlements and multiple layers of infrastructure. The chapter 5 analysis assesses how Sendai Framework principles (2015–2030) have been applied effectively in the Golden Horn area.

Structured around five key parameters derived from Sendai—Understanding Risk; Local DRR Strategies and Governance; Build Back Better; Resilient Infrastructure and Services; and Cultural Heritage and Community Memory—this chapter evaluates current policies, historical patterns, institutional practices, and public engagement in Istanbul's DRM framework. These criteria, which were modified to fit the Istanbul context and derived from international risk governance standards, enable an organized investigation of the city's institutional capabilities, cultural conflicts, implementation shortcomings, and readiness.

The research combines original field data with official documents and comparative studies of Tokyo and San Francisco, briefly, to discuss an efficiently working role model for urban disaster risk management in complex metropolitan contexts. The analysis in each section shows both technical achievements and weaknesses together with social and cultural and ethical challenges that affect urban resilience. The chapter provides an analytical assessment of Istanbul's Sendai implementation through its examination of both physical evidence and institutional documents.


***Map 35:*** *Golden Horn Highlighted in a Grid with a Collage of Historical Pictures from Main & Important Neighborhoods. Produced by the author.*[363]

363 The collage combines historical photographs and spatial references to locate major disaster-affected and transformation areas along the Golden Horn, supporting a zone-based reading of urban memory, risk exposure, and planning responses.

## 5.1. Understanding Risk in the Golden Horn Region

The Golden Horn area of Istanbul has experienced numerous urban dangers throughout history because its wooden residential districts burned in massive fires and its ancient structures experienced destructive earthquakes. The process of disaster risk understanding in Istanbul shifted from accepting disasters as inevitable to using scientific data for assessment. The Ottoman chroniclers documented major disasters including the 1509 earthquake known as "Little Doomsday" and destructive fires that consumed entire neighborhoods yet they explained these events through religious or supernatural beliefs about fate. The 19th century brought a new approach to urban hazard management because officials and businesspeople started creating detailed maps of dangerous areas. The late Ottoman and early Republican city underwent its first modern risk assessment through fire insurance maps which Charles E. Goad produced between 1904-1906 and Jacques Pervititch created between 1922-1945 for insurance companies to assess fire risks.

The maps documented building materials and dimensions and occupancy types and other risk-related characteristics which made them one of the first attempts to measure and display urban risks in the city. The Goad map sheet in Figure 5.1 presents a Golden Horn neighborhood section that contains detailed building information through numerous annotations. The maps provided valuable information about specific areas of Stamboul and Pera/Galata but they only covered commercial and high-value districts near the Golden Horn. The maps provided detailed information about building characteristics and vulnerability sources which established a new approach to risk assessment in Istanbul through empirical data collection. The work of Goad and Pervititch introduced a fundamental shift in Istanbul by using empirical data to replace intuitive danger assessments with scientific risk evaluation.[364]

Western insurance companies led the development of early cartographic risk understanding because external market forces created awareness about local risks. The Ottoman authorities started to identify hazardous patterns before Western insurance companies began their operations. The Ottoman Empire issued edicts after major fires which both determined the reasons behind fast fire propagation and established necessary safety measures. The 1820s fire disaster led to an imperial Men-i Harik ("Fire Prevention") regulation that required new buildings to use stone or brick materials and restricted the projection of bay windows which allowed fires to jump between houses. The repeated fires in Balat and Fener and Cibali and other Golden Horn waterfront areas demonstrated which buildings and areas faced the highest danger. The fire insurance maps validated local knowledge through organized surveys by showing how Golden Horn contained many wooden buildings and marking down locations of fire hydrants and warehouses with flammable materials and other dangerous spots. The maps functioned as insurance tools while establishing a permanent record of Istanbul's pre-planning risk profile emerged from their creation.

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364 Jean-François Pérouse notes that these maps' "objective was to map out the fire risk for the insurance companies that commissioned them, by providing as much data as possible about buildings' characteristics and sources of vulnerability," reflecting the emergence of an insurance-driven understanding of urban hazard in late Ottoman Istanbul. Goad's 1904 maps and Pervititch's 1920s–40s maps together covered the historic peninsula and Pera (Galata) – including much of the Golden Horn's shores – at very detailed scales (down to 1:250 in Pervititch's case).

The modern understanding of risk in Istanbul has evolved significantly because of the increasing awareness about the impending seismic danger. Scientific studies from the past forty years have proven that the Marmara Sea segment of the North Anatolian Fault System located near Istanbul will produce the following major earthquake. The scientific community predicts that a ≥7.0 magnitude earthquake will strike the Istanbul area with a 2–3% chance every year. The Turkish national seismic hazard map from 2018 provides detailed ground acceleration predictions for Istanbul while “microzonation” studies show how the Golden Horn's soft alluvial soil intensifies seismic shaking. The field of risk analysis has received extensive study during the last several decades. The Istanbul Metropolitan Municipality together with international organizations including JICA and the World Bank conducted city-wide loss estimation studies after the 1999 Marmara earthquake revealed the potential disaster to Istanbul. The Istanbul Earthquake Master Plan 2003 and other studies conducted during this period revealed devastating statistics about death tolls and building destruction rates which raised public understanding of the situation. The Istanbul Provincial Disaster Risk Reduction Plan (İRAP)[365] serves as the culmination of analytical work which resulted in a complete risk profile and action plan for the 2020s. The 2021 İRAP process combined data from 138 institutions to establish hazard profiles of Istanbul which included earthquakes and floods and landslides and other threats and determined vulnerability levels and established mitigation priorities. The city of Istanbul now possesses abundant risk information through its online interactive risk maps and its detailed database of risky buildings which were identified through rapid assessments at the neighborhood level. The main obstacle exists in converting elevated risk perception into meaningful action which continues to affect all Sendai Framework parameters.

## 5.2 Local DRR Strategies and Governance

The development of disaster risk reduction strategies and governance systems in Istanbul followed a pattern of reforms which started after major crises occurred. The Golden Horn region contains some of Istanbul's oldest residential areas which have received regulatory disaster responses since the Tanzimat period. The Tanzimat reforms of the mid-19th century brought modern building codes and urban administration to Istanbul which established the foundation for local disaster risk governance.

The Sixth Municipal District (Şehremaneti’s 6th Daire) which became the empire's first modern city council in 1857 within Beyoğlu/Pera area took charge of fire response and neighborhood planning responsibilities.[366] The district established a fire brigade system based on European models while improving construction oversight which became a model for local disaster risk reduction governance. The city’s first fire brigade (Tulumbacılar) had been introduced earlier in the 1820s, but it was in Tanzimat times that fire response became more organized, with the import of modern firefighting equipment and the establishment of a fire tower for observation.

365 İstanbul Valiliği, İstanbul İl Afet Risk Azaltma Planı (İRAP), 2021.
366 Aksoylu, “Transformation of the Urban Patterns of Istanbul,” 297–300.

The Sixth District rebuilding commission executed rapid actions that expanded streets and enforced building material rules which proved the first steps of local government disaster management evolving into risk-based urban development initiatives.

Prior to the introduction of formalized building regulations, Ottoman statesmen had initiated early interventions aimed at addressing the structural vulnerabilities revealed by major urban fires.

Ottoman statesman Mustafa Reşit Paşa who wrote to the Sultan in 1836 that the dominance of timber architecture in Istanbul's urban landscape was criticized in European newspapers as they would pose a recurring problem in the destructive city fires that Istanbul was continuously faced with in its history. (Maessen, 2019). Mustafa Reşit Paşa, who admired the urban landscapes of Paris, Vienna and London during his diplomatic missions, therefore suggested to the Sultan to have buildings constructed in stone or brick rather than wood. The Ottoman government then tried to regularize the urban landscape and in the second quarter of the nineteenth century several regulations were drawn up which stipulated, among other things, that apart from the lower classes, no-one was allowed to construct in timber any longer and that timber structures moreover were not allowed to be constructed across from masonry buildings, have significant distance from mason buildings and should be separated from other construction with a masonry wall reaching to the height of the roof. [367]

The Tanzimat reforms (1839-1876) marked a new era of modernizing transformation in Istanbul, with substantial advances in urban planning and measures to alleviate urban dangers. Beginning with the Gülhane Edict of 1839, the Ottoman state stated its intention to reform administration along European principles, with the city becoming a focal point of this effort. According to Zeynep Çelik (1986) and other researchers, the Tanzimat period saw unprecedented involvement in Istanbul's urban fabric. The goal was to turn the old imperial capital into a "modern" city akin to contemporary Paris or London. Ottoman governance adopted a new urbanism lexicon, which included city councils (Belediye), development restrictions, street grids, and infrastructure projects. Crucially, responsibility for urban administration was transferred from religious judges to secular councils, signifying institutional change.

The Building Regulation of 1848 (Ebniye Nizamnamesi) and following regulations established the first organized citywide approach to risk reduction. The new municipal bodies together with these laws worked to control Istanbul's uncontrolled neighborhood expansion through regulations that enforced safe construction methods and urban planning standards which included requirements for masonry buildings in dangerous fire zones and established minimum street sizes for firebreaks and mandated fire walls between wooden houses.

367 Çelik, Remaking of Istanbul, 53.

### 5.2.1. Ebniye Nizamnameleri and Building Regulations

Throughout the nineteenth century, Istanbul's authorities progressively introduced a series of urban building regulations – known collectively as Ebniye Nizamnameleri (Building Regulations) – with the twin aims of modernizing the city and reducing its vulnerability to disasters (especially the frequent, devastating fires in the densely built wooden quarters around the Golden Horn). The first of these was the Ebniye Nizamnamesi of 1848, issued in the Tanzimat reform era. This 1848 regulation – initially applicable only to Istanbul – was the empire's earliest comprehensive building code, laying out new standards for street widths, building heights, and construction materials in the capital.

The 1848 code established three street categories based on width measurements and restricted building projections to prevent street narrowing and fire spread.[368] The 1848 regulations prohibited rebuilding dense wooden neighborhoods in their original configuration after fires while requiring wider streets and promoting non-flammable construction materials. As Zeynep Çelik notes, such measures marked the beginning of a "fire-conscious" urban planning approach: rebuilding plans after major fires were to include straightened, widened streets acting as firebreaks, and wherever possible new structures were to be of masonry construction rather than timber.[369] This represented a dramatic shift for a city that had traditionally been built almost entirely of wood and had consequently been "regularly afflicted by devastating fires" due to "its preponderance of timber-framed buildings".[370]

The 1848 Ebniye Nizamnamesi established European building oversight in Istanbul but it marked the beginning of this process. The following decades brought more detailed regulations , one in 1863 then which built upon the initial principles until the Ebniye Kanunu (Building Law) of 1882 became the final outcome. The 1882 law established a complete building code for the entire empire through the implementation of urban reform knowledge gained during decades of capital city development. The 1882 law incorporated proven building regulations from Istanbul while making them applicable to all Ottoman cities.

These can be seen as the first "building codes" for Istanbul. They addressed public safety and orderly growth, focusing especially on fire prevention and response , a priority after centuries of conflagrations. The new regulations standardized street widths and building materials: wider streets were mandated (to serve as firebreaks and improve access), and the construction of masonry buildings (brick or stone) was strongly encouraged or required in reconstructed areas.

The Tanzimat reforms of the mid-19th century set in motion a profound transformation of Istanbul's urban form. The legal and administrative changes led to physical modifications in the city's spatial arrangement and architectural design. Zeynep Çelik notes that the

368 See Çelik, Z. (1993), The Remaking of Istanbul: Portrait of an Ottoman City in the Nineteenth Century, pp. 46–48, for details on the 1848 Ebniye Nizamnamesi's street and building prescriptions.
369 Çelik, Z. (1986), The Remaking of Istanbul, p. 43. Çelik discusses how the "new method" (usul-i cedide) of post-fire reconstruction – involving street widening and re-parceling of burnt areas – often caused hardship for property owners even as it aimed to reshape the city to prevent future fires.
370 Eldem, E. (2011), "Istanbul: From Imperial to Peripheralized Capital," p. 318. Edhem Eldem notes that nineteenth-century Istanbul, with its overwhelming number of wooden buildings, was regularly ravaged by fires, prompting the state's increasing focus on building regulations for fire prevention.

institutional reforms from the Tanzimat Charter declaration led to physical changes in urban fabric development.[371] The traditional Ottoman/Islamic urban design of Istanbul underwent a transformation into a cosmopolitan urban space that incorporated Western architectural elements. The traditional Ottoman/Islamic urban fabric, which featured narrow organic streets and wooden buildings, evolved into a new urban design pattern that adopted European concepts of order and progress.

### 5.2.2. Post-1870 Fire Modernization in Beyoglu (Pera)

The Great Fire of Pera in June 1870 destroyed the Galata–Beyoğlu (Pera) quarter which led Ottoman authorities to start an aggressive rebuilding initiative. The high real-estate values and extensive foreign ownership of properties in Beyoğlu made a complete transformation necessary.

The government aimed to bring Istanbul's urban landscape's 'quality' to the standard of its European counterparts, regularizing, beautifying, lighting and widening streets, and improving construction methods. To that end the Commission for the Order of the City (İntizam-ı Şehir Komisyonu), set up by the Ottoman government in 1855, proposed to reorder the city in four arrondissements, after the French model, making Galata/Pera and Tophane the Sixth District – arguably with reference to the upscale sixième arrondissement in Paris.[372] This Sixth District would become a pilot area for urban modernization, which was expected to be more broadly implemented in other parts of the city at a later stage.[373]

The Western-style skyline emerged as a result during the 1880s. The new boulevards witnessed the rapid construction of multistory stone-and-brick (kargir) apartment houses which displayed neoclassical or eclectic architectural designs. The Grand Rue de Pera transformed into the "West End" of the European colony according Elliot who noted its dual row of English and French hotels and better-class cafés and well-lit shops and foreign consulates and ambassadorial residences.[374]According to Girardelli, the majority of the Western-style embassy residences in Beyoğlu had neo-Classical or neo-Renaissance architectural styles.[375]

Çelik notes that these changes benefited the already wealthy population:

*"the wealthy groups of the Sixth District were the main beneficiaries of the new municipal reforms. Street lighting and cleaning, and garbage collection served those residing on the streets of Pera. The poor Greeks, Armenians, and Turks living in the ravines behind Taksim… did not benefit from these services".* [376]

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371 Çelik, Remaking of Istanbul, 49.
372 Akpınar, Transformation of Istanbul's Urban Patterns, 38.
373 Çelik, Remaking of Istanbul, 42.
374 Girardelli, "Architecture, Identity, and Liminality," 233–264.
375 Ibid.
376 Çelik, Remaking of Istanbul, 49.

According to urban historian İlhan Tekeli[377] Istanbul under Ottoman rule experienced a quarter-by-quarter modernization process instead of undergoing a complete European-style redesign during the 19th century. The city underwent significant changes by 1876 because gas streetlights appeared in certain areas while new tramlines operated on modern avenues and the 6th Municipal District (Beyoğlu) received Europeanized management that established building and street maintenance bylaws. The Tanzimat era established fundamental principles for modern urban management in Istanbul by implementing city planning ideas and building regulations to reduce risks while creating wider safer streets that preserved the historic city silhouette.

Fires caused a significant change in the physical structure of the city during this period. Throughout the 19th century, fires began to destroy the city's wooden architecture and replaced it with masonry buildings. In time, the fires also changed the road texture; the traditional road texture in Aksaray, Kumkapı, Unkapanı, Fener, Balat, Samatya districts was replaced by a grid road system with steep intersections built with western wannabes, green areas decreased, and residential areas were divided into small pieces with increasing settlement density. New administrative buildings and squares emerged around Sultanahmet and Beyazıt.[378]

The current uniform masonry skyline of Galata–Beyoğlu exists as a direct result of the 1870 fire destruction. Insurance companies flourished in this area because property owners started taking fire insurance for their valuable new constructions. Pervititch's Galata maps from the 1920s indicate that most buildings were made of non-wood materials through their pink shading and include the names of major commercial structures and banking headquarters that developed after the reconstruction. The great fire north of the Golden Horn prompted urban modernization and fire-proofing efforts which focused only on the European-influenced districts.

The governance systems for disaster risk reduction in Istanbul grew into citywide operations during the time of Ottoman rule and the early years of the Republic. The 1874 reorganization of fire services created a modern Fire Brigade Regiment which operated under unified command. A Hungarian expert named Count Széchenyi assisted in establishing a four-brigade fire regiment on September 26 1874 which placed stations throughout key districts including Babıali and Fener and Beyoğlu/Pangaltı to implement professional citywide fire emergency response.[379] The paramilitary fire corps demonstrated the need for strong local emergency response capabilities and coordination systems in a city that frequently experienced fires. The Naval Fire Battalion received its establishment shortly after to combat waterfront fires which directly supported the Golden Horn's coastal residential areas. The municipal government implemented initial disaster risk reduction strategies through institutional measures which concentrated on fire protection.

377 Tekeli, İstanbul'un Planlanmasının ve Gelişmesinin Öyküsü, 45–50.
378 Öztaş, "İstanbul'da Yangınlar ve Kentsel Dönüşüm," 2005.
379 İstanbul Büyükşehir Belediyesi İtfaiye Daire Başkanlığı, "İstanbul İtfaiyesinin Tarihçesi."

| | Ottoman Era Regulations (After Tanzimat Era 1848) | Content |
|---|---|---|
| 1 | **1848 Building Specification**<br><br>**(Ebniye Nizamnameleri)** | • Construction methods for masonry and timber houses<br>• Categorization of masonry and timber houses<br>  ◦ Building heights: 10,5 m for timber, 15m for masonry houses |
| 2 | **1849 Building Regulation** | **HOUSES**<br>**Construction types:**<br>• Varied according to the value of the house:<br>• Houses worth more than 500 coin sacs: masonry construction.<br>• Houses worth less than 500 coin sacs: masonry fire walls<br>• . building heights: 10,5 m for timber. 15 m for masonry<br><br>-----------------------------------<br><br>**SHOPS**<br>**Construction types:** masonry<br>• Eaves and shutters: tin-cladding<br>• Roofs: ceramic tiles embedded in lime mortar.<br>• Building heights for timber shops: 3,75 m single storey, 6 m<br>• Shops with a room above.<br>• Obligations for the shop owners not wealthy enough:<br>• Masonry walls surrounding the shop.<br>• Brick front façade,<br>• Tin-cladding the eaves and shutters,<br>  ◦ fixing the roof tiles with mortar. |
| 3 | **1863 Street and Building Regulation** | . Façade projections: min. 3,75 m high from the ground, support elements 2.25 m from the ground; length of projection 2/3 of the facade length<br>. Projections on adjacent houses: min. 3 m distance between them; if not possible 1.5 m<br>.Building heights: 10,5 m for timber, 15 m for masonry houses<br><br>**SHOPS**<br>building heights for timber shops: 3,75 m single storey, 6 m shops with a room above. |
| 4 | **1875 Regulation on Construction Methods in Istanbul** | • **Construction types:** Istanbul is divided into two zones<br>**First zone:** Obligatory masonry construction<br>**Second Zone:** timber construction under specified conditions |
| 5 | **1882 Building (Ebniye Law)** | • .Construction regulations for empty plots: separate conditions<br>• for fire-burnt zones and unsettled areas.<br>• Construction types: masonry<br>• timber only for outskirts and Bosporus<br>• .Building heights: according to the street width<br>• Façade projections:<br>• only concerned with front facades, defined according to the street width<br>• min. 3,75 m high from the ground. allowed for 2nd and 3rd floors<br>• Projections on adjacent houses: min. 3 m distance between them; if not possible 1.5 m.<br>• Fire preventions measures for houses and shops |
| 6 | **1891 Building Law** | • **Construction types:** complete masonry, half masonry and timber in some parts of the Old City<br>• **Building heights:** according to the street width<br>• Other items are the same |

***Table 12:*** *Ottoman-Era Building Regulations and Construction Controls in Istanbul after the Tanzimat Reforms (1848–1891). Produced by the author.* 380

380 The table synthesizes key provisions of Ottoman-era building and street regulations enacted after the Tanzimat reforms, including the Ebniye Nizamnameleri and subsequent building laws (1848–1891), compiled from Ottoman legal texts and secondary historical literature.

The post-disaster fire regulations served as an early example of the "build back better" approach which will be examined in detail in Section 5.3. The actual implementation of these measures failed to match their intended goals. The 19th-century regulations received official status for the entire city but their actual implementation occurred only in Galata and Pera because of “insufficient administrative resources and funding”. The working-class and minority neighborhoods situated along the Golden Horn maintained their traditional ways of living while facing weak local governance systems. The establishment of a citywide fire brigade in 1857 marked the beginning of Istanbul's municipal development although risk governance faced challenges from multiple authorities including central ministries and religious foundations. The combination of fragmented governance with inconsistent enforcement of laws resulted in ongoing disaster losses throughout Golden Horn during most of the 20th century.

The early Republican period brought fundamental changes to Istanbul's urban governance system through Henri Prost's master plan (1937–1951). The Turkish Republic leaders brought Prost to Istanbul to create a modern city design that matched contemporary urban planning standards for organized and healthy development. The Prost plan established metropolitan-scale governance by creating a complete system of land-use zoning and road hierarchy and green-space networks for Istanbul. The DRR aspects of Prost's plan produced conflicting results. The new road system and boulevards established by Prost enabled better access and functioned as emergency evacuation paths and firebreaks throughout the city (the Golden Horn road and Atatürk Boulevard through the historic district). The plan implemented two strategies to protect important monuments by removing surrounding buildings from their immediate areas (the Suleymaniye and Ayasofya complexes received archaeological park status). The urban resilience improved because the new public spaces served as emergency assembly points while the decongested areas reduced the risk of disasters. The plan from Prost concentrated industrial activities along the Golden Horn but failed to predict how the city would expand in the future.

The 1940s expansion of Golden Horn factories and shipyards under the plan led to economic growth but it established a polluted industrial belt in the city center. The environmental deterioration of Golden Horn’s industrial area became apparent during the 1980s because the aging industrial facilities created safety risks while the area suffered from pollution. The implementation of new city roads according to Prost's plan required extensive demolition of old residential areas which primarily affected the Süleymaniye-Fatih neighborhoods. The displaced residents from these neighborhoods chose to settle in different informal housing areas while numerous historic wooden buildings deteriorated because low-income residents took up residence in them.

In sum, the Prost era demonstrates how urban planning through top-down methods creates modern infrastructure and organized land use which enhances long-term resilience but disregarding social factors leads to increased vulnerability through slum development and heritage destruction. The Golden Horn area received both positive and negative impacts from the modernization process which brought new roads and parks to its borders while industrial activities increased and historic areas remained underdeveloped.

The recognition of earthquake risk led to delayed government intervention. The Turkish government established a complete disaster management system through national legislation during the 20th century following multiple fatal earthquakes in Turkey including the 1939 Erzincan earthquake. The 1944 disaster law (Law No. 4623)[381] established procedures for earthquake preparedness and response between central and local government entities.[382] It was a law focused on seismic events, but its implementation led to the creation of a "Map of Shake Zones" and a companion Earthquake Regulation.[383]

The new Turkish legislation established building safety controls and required provincial governors and municipal departments to create earthquake response and preparedness plans.[384] The Civil Defense Law of 1958 created civil defense organizations throughout cities to handle wartime and disaster situations while the 1959 Disaster Law (No. 7269)[385], established a system for disaster response and recovery across the nation,[386] which, despite being enacted after earthquakes, was actually a general law covering response to all disasters (earthquake, fire, flood, etc.)[387] The authorities in Istanbul created civil defense teams and provincial disaster committees which evolved into the modern local emergency management units of today. These wo laws of 1944 and 1959 show examples of multi-hazard risk management.

Law 7269, still in force, guides how the government declares disaster areas and coordinates relief, regardless of hazard type. Thus by the mid-20th century, Turkey had a dual system: hazard-specific regulations (like building codes for earthquakes, fire codes in buildings, etc.) and an umbrella disaster response law. Applying this to the Golden Horn, we see that building in the area had to gradually comply with both sets – for instance, a new construction in the 1970s in Golden Horn would need to obey the planning/building code (focusing on stability, fire protection, etc.) and, after 1975, meet updated earthquake design standards; simultaneously, the city's emergency planners would include that area in overall disaster response plans.[388]

The disaster management system of Istanbul has shifted toward centralized technocratic control since the late 20th century following the 1999 disaster alert. The 1999 Marmara Earthquake exposed major weaknesses in Turkey's decentralized civil defense system which led to a complete overhaul of governance structures. The national government created the Disaster and Emergency Management Presidency (AFAD) through Law No. 5902 in 2009 to establish a "unified disaster management system" under one authority. The disaster exposed institutional weaknesses and unpreparedness so the government created AFAD by uniting three separate agencies under one authority which required disaster management to follow a complete system from national to local levels. The establishment of AFAD led to improved

381 Law No. 4623 (1944), Yersarsıntısından Evvel ve Sonra Alınacak Tedbirler Hakkında Kanun.
382 Gül, H. T., Erkan, G., & Özmen, B. (2016). "Development of Disaster and Emergency Management System in Turkey: From Past to Present." International Journal of Human Sciences, 13(1), 592–601.
383 Gazi Üniversitesi Afet Yönetimi Uygulama ve Araştırma Merkezi, "Türkiye'de Deprem Mevzuatı."
384 Gül, H. T., Erkan, G., & Özmen, B. (2016).
385 Umumi Hayata Müessir Afetler Dolayısıyla Alınacak Tedbirlerle Yapılacak Yardımlara Dair Kanun (Law No. 7269), 1959.
386 Gül, H. T., Erkan, G., & Özmen, B. (2016).
387 Erkan and Özmen, "Türkiye'de Afet Yönetimi," 2016.
388 AFAD, Türkiye Deprem Yönetmelikleri Tarihçesi.

disaster coordination between the Metropolitan Municipality's Disaster Coordination Center (AKOM)[389] and the provincial directorate of AFAD in Istanbul.

The Earthquake Master Plan for Istanbul (EMPI) 2003 serves as a strategic plan that four universities and municipal agencies developed to coordinate risk reduction efforts across metropolitan districts under city authorization.[390] The master plan established clear roles for different institutions and required local participation to create a social agreement for urban seismic protection.

This Earthquake Master Plan (EMPI) is great example of multi-hazard planning. The EMPI explicitly took an integrated urban seismic risk management approach that considered related hazards and systemic vulnerabilities even though its name focuses on earthquakes. The plan identified 13 “risk sectors” – including not just buildings, but infrastructure, health services, cultural heritage, etc. – and emphasized that mitigating earthquake risk in a dense city like Istanbul also reduces fire risk, environmental hazard risk (e.g. industrial spills), and so forth.[391]

It advocated multidisciplinary cooperation: bringing together urban planners, engineers, social scientists, NGOs, and community groups to agree on actions. In effect, it was moving Istanbul from single-hazard silos towards a multi-hazard framework. For example, the EMPI recommended strengthening of critical lifelines (water, power, communications) to survive earthquakes – this clearly has co-benefits for other scenarios like urban fires or terrorist attacks. It also highlighted the need for open spaces in the city that could serve as emergency gathering areas for any disaster, leading to initiatives to preserve and signpost such areas (parks, stadiums, etc.). In the Golden Horn context, this meant protecting plazas like Beyazıt Square and the outer gardens of the Suleymaniye Mosque as potential refuge sites, rather than allowing infill construction – a planning decision with multi-hazard rationale.

However, the enforcement of building codes in traditional areas remained inconsistent throughout the late 19th and 20th centuries because of insufficient inspection resources and political tolerance.

The disaster strategy of Istanbul operates through a partnership between the Disaster and Emergency Management Presidency (AFAD) provincial office which operates under the Governor's authority and the disaster units managed by the Istanbul Metropolitan Municipality. The dual governance system between national and municipal authorities creates both successful partnerships and occasional political conflicts when implementing disaster risk reduction in the city. The governance reforms established standardized planning through the implementation of the National Disaster Response Plan (TAMP)[392] and the requirement for every province to create a Provincial Disaster Risk Reduction Plan (IRAP)[393] by 2021 according to Sendai Framework Target (e). [394]

389 İstanbul Büyükşehir Belediyesi. “Afet Koordinasyon Merkezi (AKOM).” https://akom.ibb.istanbul
390 İstanbul Büyükşehir Belediyesi, İstanbul Deprem Master Planı (2003).
391 Balamir, “İstanbul Deprem Master Planı ve Kentsel Risk Yönetimi.”
392 AFAD, Türkiye Afet Müdahale Planı (TAMP)
393 İstanbul Valiliği, İstanbul İl Afet Risk Azaltma Planı (İRAP), 2021.
394 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, Target (e).

The Istanbul IRAP from 2021 serves as a multi-partner document which determines key hazards and distributes risk reduction tasks to different organizations. The metropolitan municipality created its Earthquake Risk Management Directorate under new political leadership in 2019 while establishing an Earthquake Council[395] to provide scientific guidance for citywide preparedness initiatives. The current governance system faces ongoing challenges because of existing political and administrative barriers.

The Istanbul Metropolitan Municipality (IBB) holds authority over zoning and building permits but the Ministry of Environment and Urbanization in Ankara maintains responsibility for declaring and transforming disaster risk areas.[396] The central government has used Law 6306 on Transformation of Areas Under Disaster Risk[397] to initiate aggressive urban renewal projects in historic neighborhoods but the municipality and local residents oppose these efforts because they fear damage to heritage sites and community rights (this issue is studied in Section 5.5). The emergency management centers established by AFAD in 2022 across all 39 districts of Istanbul serve as platforms for improved coordination between district municipalities and AFAD.[398]

The Golden Horn districts demonstrate how building and planning regulations evolved from basic fire safety rules (wider streets and non-combustible materials) into advanced urban planning laws which address multiple hazards. The main difficulty throughout history has been the execution of these regulations. The enforcement of regulations has proven to enhance resilience because the areas rebuilt under 19th-century codes (with masonry buildings and grid streets) have experienced significantly fewer catastrophic fires. The areas that ignored or delayed regulations (such as unregulated shantytowns in the mid-20th century) continued to face vulnerability. The relationship between disaster knowledge and urban regulation exists as a fundamental element of the Golden Horn's master plan.

The current events demonstrate that effective governance needs to establish trust with the public population. The 2023 earthquake disaster in southern Türkiye put Istanbul's disaster management system to the test. The lack of physical damage in Istanbul caused widespread public concern which led national and city officials to demonstrate their readiness for emergencies. Experts agree that Istanbul needs to develop transformative risk reduction measures which include building reinforcement or replacement of vulnerable structures because the city lacks proper readiness. The dual challenge for governance requires both the maintenance of strong disaster risk reduction plans and institutions and the fast implementation of political will and funding and enforcement measures.

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395 İstanbul Büyükşehir Belediyesi, “Deprem Risk Yönetimi Dairesi Başkanlığı” and “İstanbul Deprem Konseyi.”
396 Law No. 3194 (İmar Kanunu) : municipal zoning/building permits
397Türkiye Cumhuriyeti, Law No. 6306 (2012); Çavuşoğlu and Strutz, “Urban Transformation in Istanbul,” 2014.
398 AFAD İstanbul İl Müdürlüğü, “İlçe Afet Yönetim Merkezleri,” 2022.

| | Period | Building and Planning Regulations |
|---|---|---|
| 1 | **Ottoman Era Regulations** | • **Building Regulation of 1848 (Ebniye Nizamnamesi)**<br>∘ First modern building code in Istanbul<br>∘ Required standard street widths (~15m, adjusted to ~7.5m)<br>∘ Encouraged use of stone/brick over wood to reduce fire risk<br>∘ Discouraged reconstruction of narrow alleys and cul-de-sacs<br>• **Street Regulation of 1859**<br>∘ Refined provisions from 1848, focusing on urban layout<br>• **Streets and Buildings Regulation (Turuk ve Ebniye Nizamnamesi) – 1863**<br>∘ Further refined urban design and construction standards<br>• **Building Law of 1882 (Ebniye Kanunu)**<br>∘ Consolidated earlier regulations<br>∘ Introduced fire zones, road layouts, and construction standards citywide |
| 2 | **Late Ottoman and Early Republican Planning Responses** | • **Post-Fire Urban Planning (1865–1870)**<br>∘ Grid plans introduced in Hocapaşa and Pera after major fires<br>∘ Street widening and use of fireproof materials were mandated<br>∘ Reconstruction proposals like the Haussmannian plan for Beyoğlu aimed at geometric order |
| 3 | **Early Republican Period** | • **Henri Prost's Master Plan (1937–1951)**<br>∘ Introduced major boulevards (e.g. Atatürk Boulevard)<br>∘ Cleared dense wooden areas to reduce fire risk<br>∘ Proposed parks and coastal roads to improve access and prevent re-densification |
| 4 | **Mid–Late 20th Century Legal Developments** | • **Land Development Law No. 6785 (1956)**<br>∘ Required municipalities to implement zoning plans.<br>∘ Called for identifying disaster-prone zones during planning.<br>• **First Turkish Seismic Code (1944)**<br>∘ Revised in 1949 and several times afterward |
| 5 | **Post-1999 Earthquake Reforms** | • **Building Inspection Law No. 4708 (2001)**<br>∘ Introduced independent supervision of design and construction<br>∘ Initially applied to 19 provinces, later expanded nationwide<br>• **Urban Transformation Law No. 6306 (2012)**<br>∘ Allows declaration of "risky areas" and buildings<br>∘ Enables forced reinforcement, demolition, or redevelopment<br>∘ Includes property expropriation if owners fail to act<br>∘ Applied in Fatih and Beyoğlu near the Golden Horn |
| 6 | **Contemporary Municipal and Heritage Regulations** | • **Istanbul Municipal Building and Heritage Retrofitting Rules**<br>∘ Special retrofitting rules for historical wooden buildings<br>∘ Internal steel reinforcement permitted.<br>∘ Oversight provided by Protection Boards to balance safety and heritage |

***Table 13:*** *Evolution of Building and Planning Regulations Related to Disaster Risk in Istanbul (1848–Present). Produced by the author.*[399]

399 The table synthesizes major regulatory milestones affecting building construction, urban planning, and disaster risk management in Istanbul, from the Ottoman period to contemporary municipal and heritage regulations.

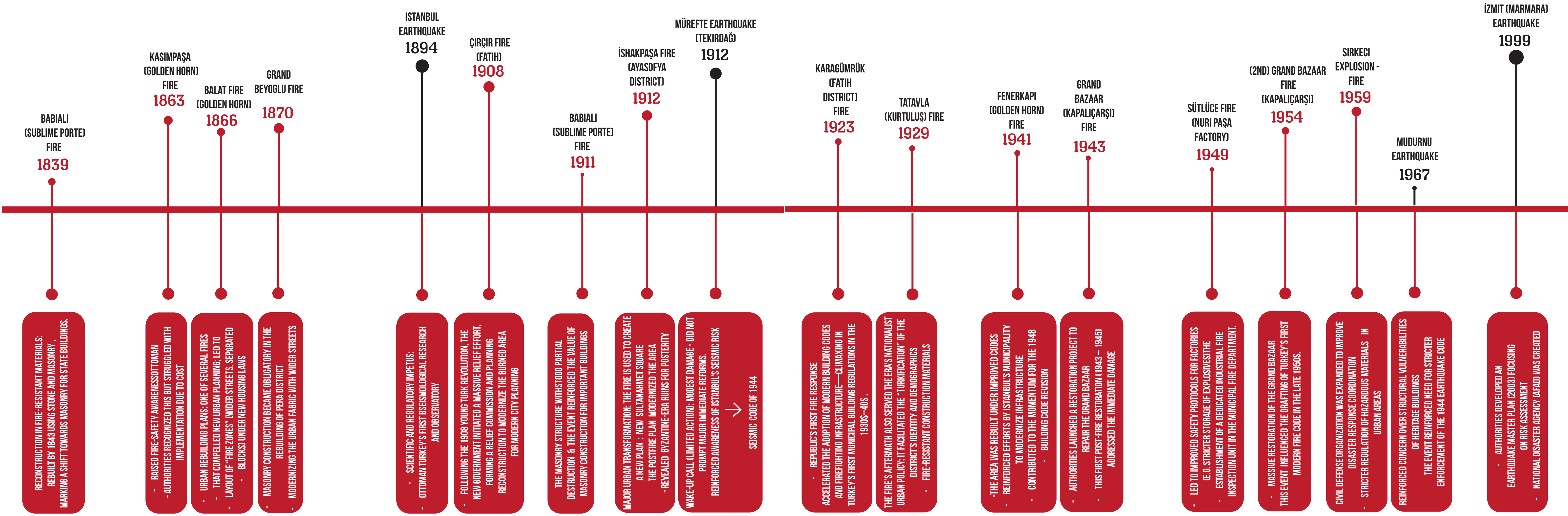


***Figure 35:*** *Timeline of Major Fires, Earthquakes, and Regulatory–Planning Responses in Istanbul (1839–1999). Produced by the author.*[400]

400 The timeline synthesizes major fire and earthquake events with subsequent regulatory reforms, planning interventions, and institutional developments shaping Istanbul's urban transformation.

## 5.3 “Build Back Better”: Historical and Contemporary Practices

The concept of “Build Back Better” emerged in Istanbul's history through its post-disaster reconstruction efforts for enhancing resilience even though the specific terminology was not used. The 19th century post-fire reconstruction efforts in the Golden Horn area demonstrate the first attempts to construct safer and more intelligent buildings. The Ottoman Empire experienced destructive urban fires which occurred every ten years and the state implemented reconstruction efforts to create better conditions from the burned areas. The authorities issued two sets of post-fire reconstruction orders which required new buildings to adopt standardized street arrangements and incorporate fire-resistant construction elements after the Cibali Fire of 1782 and the Hocapaşa Fire of 1865 destroyed major parts of the historic peninsula near the Golden Horn. The burned areas underwent replanning with wider streets and geometric patterns which replaced the previous maze of alleys thus demonstrating better urban design. The new reconstruction plans imposed European-style grid layouts with broad boulevards and squares, aiming to give the city a more orderly and “civilized” appearance. While not all such plans were fully realized (due to budget and resistance), they mark the beginning of conscious urban planning in Istanbul.

The Great Fire of 1870 led to the reconstruction of the Pera district, with a new plan which encountered strong resistance from property owners which forced authorities to abandon most of the Haussmannian grid design and resulted in only limited main road expansions, through new straighter and wider streets including Istiklal Avenue extension and mandatory masonry building codes that transformed the area into a safer district.

The Tanzimat-era building codes required wealthier property owners to build their new structures with masonry materials while less affluent owners needed to insert masonry firewalls between their rebuilt wooden houses. The implementation of these measures led to decreased fire occurrences in areas that adopted the new construction standards. The “build back better” approach following fires led to a gradual transition of Golden Horn neighborhoods from timber-based construction to a combination of timber and stone buildings during the early 20th century. The 1894 Istanbul earthquake known as the “1894 Büyük Deprem” left behind destruction throughout the city which led to improved construction methods. The Marmara fault offshore earthquake of 1894 triggered construction practice updates throughout the city. The Ottoman government conducted building inspections of thousands of structures which led to the destruction of damaged buildings throughout Eminönü and along the Golden Horn area. Engineers recommended reinforced masonry and improved foundation methods after the earthquake and the early 20th century brought limited adoption of iron tie-rods in major buildings[401] and enhanced permit regulations which represented early seismic “build back better” initiatives before seismic codes became available. The rebuilding process in Istanbul following disasters involved more than basic reconstruction since it incorporated modern knowledge and materials but remained restricted by available technology and political support.

401 Bein, “The Istanbul Earthquake of 1894,” 909–924.

The current disaster recovery and pre-disaster planning in Istanbul follows the "Build Back Better" (BBB)[402] approach as its official guiding principle. The Sendai Framework's Priority 4[403] which focuses on disaster preparedness for effective response and recovery through better reconstruction has directly shaped Turkish policy development. The Turkish government implemented new building codes in 2007[404] and 2018[405] which established progressively higher standards for earthquake-resistant construction of new buildings. The updated building codes established minimum requirements for post-disaster building repairs and strengthening which applied to all existing structures. The September 2019 Istanbul earthquake with its 5.8 magnitude caused damage to 400 buildings which required rehabilitation work that followed the new stricter building standards for a small-scale implementation of BBB principles.[406] The massive destruction from the February 6, 2023 Kahramanmaraş earthquakes[407] pushed Istanbul to speed up its disaster resilience development before its own disaster occurs. The central government initiated a nationwide "Urban Transformation Mobilization" which followed BBB principles to replace dangerous buildings with resilient structures. [408]

The National Risk Shield Project (Ulusal Risk Kalkanı Projesi) led to the establishment of the Earthquake and Urban Transformation Council in 2023, with the aim of developing national guidelines for post-earthquake reconstruction and formulating strategies for proactive renewal of the housing stock, particularly in high-risk cities such as Istanbul.[409]

The "Yarısı Bizden" (Half of Us) financing program, launched by the state in 2023, provides up to 50% financial support through grants and low-interest loans to private apartment building owners in Istanbul who agree to voluntarily renew buildings identified as seismically risky.[410] According to official statements by the Ministry of Environment, Urbanization and Climate Change and reporting by Anadolu Ajansı, more than 70,000 independent housing units in Istanbul had entered transformation processes under the "Yarısı Bizden" campaign by 2024–2025.[411]

The program forms part of a broader urban transformation mobilization that aims to accelerate the renewal of Istanbul's building stock at a metropolitan scale, with government authorities indicating that hundreds of thousands of housing units are targeted for phased transformation in the coming years.[412] This approach reflects the principles of Build Back Better (BBB) by prioritizing proactive strengthening and replacement of vulnerable buildings before a major earthquake occurs, rather than relying solely on post-disaster reconstruction.

402 AFAD; İstanbul Valiliği, İstanbul İl Afet Risk Azaltma Planı (İRAP), 2021.
403 UNDRR, Sendai Framework for Disaster Risk Reduction 2015–2030, Priority 4.
404 Türkiye Cumhuriyeti. Deprem Bölgelerinde Yapılacak Binalar Hakkında Yönetmelik (2007).
405 Türkiye Cumhuriyeti. Türkiye Bina Deprem Yönetmeliği (TBDY-2018).
406 AFAD. 26 Eylül 2019 İstanbul–Silivri Depremi Değerlendirme Raporu. Ankara, 2019.
407 AFAD. 6 Şubat 2023 Kahramanmaraş Depremleri Raporu. Ankara, 2023.
408 UNDP. Türkiye Earthquake Recovery Assessment, 2023.
409 Cumhurbaşkanlığı, Ulusal Risk Kalkanı Projesi Tanıtımı, 2023.
410 Çevre, Şehircilik ve İklim Değişikliği Bakanlığı, "Yarısı Bizden Kampanyası," 2023.
411 Anadolu Ajansı, "İstanbul'da 73 bin konut 'Yarısı Bizden' kampanyasıyla dönüştürüldü," 12 September 2024/2025.
412 Çevre, Şehircilik ve İklim Değişikliği Bakanlığı, "İstanbul'un dönüşümü Yarısı Bizden kampanyasıyla hızlanıyor," 2024.

## 5.4 Resilient Infrastructure and Services

The disaster management capabilities of Istanbul depend on its resilient infrastructure and services which the Golden Horn area demonstrates through its historical development and present-day shortcomings. The Ottoman Empire constructed infrastructure without explicit DRR goals yet multiple improvements delivered additional benefits for disaster resilience. The Taksim water line from 1874 brought pressurized water to European-style fire hydrants in Beyoğlu and later extended service to sections of the historic peninsula.[413] The modern fire brigade established in 1874[414] brought professional firefighters with steam pumps to replace neighborhood volunteers which resulted in systematic urban fire response capabilities for Istanbul during the late Tanzimat period.[415] The professional firefighters and enhanced road and bridge infrastructure including the cisr-i cedit (New Bridge)[416] across the Golden Horn in 1836 helped reduce response times to fires that used to spread freely until winds stopped or firebreaks like mosques and gardens intervened.[417] The early 20th century introduction of telegraph and telephone systems enabled authorities to send aid to emergency locations at a faster pace than before. Istanbul developed resilient urban systems through incremental improvements which included better bridges and modern ports and rail lines (Sirkeci-Halkalı commuter railway since 1875) that created backup systems for emergency situations.

### Structural Reinforcement

Istanbul has been developing resilient infrastructure throughout the modern era with emphasis on post-1999 Istanbul. The Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP) made Istanbul's seismic resilience efforts the symbol of 2006 via international financing. The ISMEP implemented seismic standards upgrade measures for 1643 public buildings such as hospitals, schools, and dormitories in Istanbul during the 2010s.

The Istanbul authorities devoted large budgets to improving the structural resilience of critical infrastructure. The public facilities industry experienced a comprehensive upgrade program involving schools, hospitals, and administrative offices. The citywide program for improving earthquake resilience contributed to the reconstruction or upgrade of hundreds of school buildings in the Istanbul metropolitan area. The program of the ISMEP succeeded in meeting its objective by retrofitting or rebuilding at least 50% of the public schools in the Istanbul metropolitan area. The Golden Horn region surrounding the Golden Horn benefits from the upgrade of the school buildings since they serve as earthquake shelters for the residents.

The Golden Horn area entails various historical schools within the districts of Fatih and Beyoğlu. These were made earthquake-resistant to retain the original architectural look. The emergency gathering points of the city increased from 2,864 to 5,633 in order to create accessible zones of security for the citizens through parks and stadiums.

413 Çeçen, Kazım. İstanbul'un Osmanlı Dönemi Su Yolları. İTÜ, 1999.
414 İstanbul İtfaiyesi. İstanbul İtfaiyesi Tarihi. İBB Yayınları.
415 Aksoylu, "Transformation of the Urban Patterns of Istanbul," 302–304; İstanbul İtfaiyesi, İstanbul İtfaiyesi Tarihi.
416 Kuban, İstanbul: Bir Kent Tarihi, 218; Çelik, The Remaking of Istanbul, 49–53.
417 Çelik, The Remaking of Istanbul, 49–53.

The infrastructure of transportation systems has undergone improvements to boost their disaster resistance capabilities. The Galata Bridge operates as a vital connection between different city sections through its operation with the Atatürk (Unkapanı) Bridge and Golden Horn Metro Bridge. The metro bridge entered service in 2014 through advanced earthquake-resistant engineering during its construction process. The Marmaray rail tunnel operates as a vital transportation route because it extends beyond the Golden Horn area. The construction team at Marmaray installed 3,000 grout columns throughout the tunnel sections to create a stable foundation which protects against liquefaction and tunnel floatation. The tunnel segments used flexible joints to handle seismic movements that occur during earthquakes. The Marmaray project functions as a safety reference point for earthquake-resistant infrastructure development because its advanced design features make it one of the most resilient critical lifelines according to expert assessments.

**Lifeline Services**

The continuity of essential services including electricity and water supply and transportation and communication and emergency response systems represents a fundamental element of resilience. The old city of Golden Horn contains numerous lifeline networks which exist in close proximity to each other because power and telecom cables and water mains and natural gas lines run throughout the area. The existing utility infrastructure faces a known risk because most of it operates with outdated systems. The water and sewer lines beneath the historic peninsula and Beyoğlu district represent some of the oldest systems in the entire city. The city of Istanbul has started infrastructure renewal efforts by replacing cast-iron water pipes with ductile pipes that resist breakage and installing automatic gas line shut-off systems to stop fires after earthquakes. The emergency management center (AKOM) operates with backup power systems and communication networks while maintaining detailed plans for infrastructure repair routes that prioritize essential areas such as government buildings in Fatih and the Port of Karaköy near the Golden Horn. The emergency plans aim to provide fast service restoration to essential locations, including government facilities in Fatih and critical transportation centers at the Port of Karaköy near the Golden Horn.

Several weaknesses continue to exist in the system. The recent disasters worldwide have demonstrated that backup systems play a crucial role, providing alternative solutions when primary systems fail. The transport network of Istanbul has enhanced its backup systems through the construction of multiple bridges and tunnels across continents and various transit lines, preventing a complete citywide shutdown if one element fails. The 2019 flash floods caused public transit and road disruptions in the Golden Horn area: the Eminönü tram line stopped operating due to track flooding, underpasses became inaccessible, and ferry services on the Golden Horn and Bosphorus stopped due to floating debris and reduced visibility.[418] The emergency response to the flood disaster involved 2,000 personnel and hundreds of vehicles, which restored most transit services within a few hours. The city demonstrated improved ability to handle service disruptions caused by unexpected events. The flood exposed weaknesses in drainage systems because new stormwater tunnel construction

418 Daily Sabah, "Heavy downpours, flash floods hit Istanbul, NW Turkey," Aug 17, 2019dailysabah.com Reports from that date describe flash floods inundating seafront areas like Eminönü, Karaköy and the Unkapanı underpass by the Golden Horn – where a man's body was found after floodwaters reached 1.9 m. Lower parts of Kasımpaşa (a neighborhood on the Haliç) were also flooded. Notably, drainage infrastructure improvements were underway but not yet completed in some affected areas.

projects in affected areas had not yet finished, which could have reduced the flood's impact if they had been completed earlier.[419]

**Future Initiatives**

The city of Istanbul has established multiple programs to integrate resilience into its future infrastructure development plans. The Climate and Disaster Resilient Cities project receives international funding to perform utility and building improvements in areas that face high disaster risks. The Kandilli Observatory uses smart city technology to create an earthquake early warning system which enables automatic system shutdowns before strong seismic waves hit the city. The systems have the capability to stop trains operating on Golden Horn bridges and tunnels and disconnect power grids to minimize fire hazards. The implemented technological solutions function as part of the system which maintains operational services and enables fast recovery processes.

The Golden Horn 's infrastructure shows both positive aspects and weak points in its resilience system. The construction of major public facilities has made schools hospitals and public transportation systems more resistant to damage. The majority of urban buildings which make up the private sector face the greatest risk because their collapse would trigger massive population displacement and create overwhelming demands on all available services. The historic neighborhoods contain secondary infrastructure elements such as neighborhood roads and smaller bridges and local power distribution systems which do not meet contemporary resilience requirements. The protection of major infrastructure projects requires a complete strategy which combines strong security measures for large-scale facilities with enhanced support for smaller community networks. The Golden Horn depends on both strong physical structures and trained service providers to survive and recover from future disasters because of its densely populated urban area.

The most significant progress in urban service protection has emerged through technological advancements and strategic planning initiatives. The city of Istanbul operates one of the most extensive seismic monitoring systems worldwide because it installed 250 modern accelerometers and 8 borehole seismic stations throughout its metropolitan area to provide emergency response data.[420] The automatic natural gas network shut-off system demonstrates how well different systems can be integrated. The gas provider İGDAŞ collaborated with the Boğaziçi University Kandilli Observatory to create a system which connects seismic sensors to automatic shut-off valves for gas supply during strong earthquakes above threshold levels to stop fires and explosions.[421] The system performed as intended when a moderate earthquake struck in 2025 because it produced immediate shaking maps and disabled gas supply in specific areas of the city.[422] The fire risk that threatens the old quarters of Golden Horn receives direct protection through these disaster prevention measures. The power grid and water network operate as separate systems which enable damage containment within specific areas. Emergency service capabilities in Istanbul have expanded substantially since the 1990s. The AKOM (Disaster Coordination Center) operates

419 Ibid.
420 Babaoğlu, C. (2025, May 5). Warning shakes Istanbul: Building a resilient city against the next quake. Daily Sabah.
421 Temblor. (2025, September 14). April 2025 magnitude 6.2 earthquake near Istanbul highlights strengths and weaknesses in seismic mitigation. PreventionWeb.
422 Ibid.

from bases that store disaster response equipment and supplies while a new logistics hub for emergency supplies opened on the European side of Istanbul in 2021 to serve the entire city during catastrophes.[423] The metropolitan government established 963 neighborhood disaster support offices which trained thousands of volunteers through AKUT and AFAD Volunteer programs. The "Disaster-Ready Türkiye" national initiative has trained more than 10 million citizens about disaster preparedness through basic training programs that include evacuation drills and first aid education.[424] The residents of Golden Horn neighborhoods have learned about earthquake readiness through seminars which their local teachers and imams and shopkeepers attended to discover their emergency meeting locations. The community-based disaster preparedness system serves as essential soft infrastructure that supports the enhanced hard infrastructure systems.

The Golden Horn region still faces challenges regarding its resilient infrastructure and service delivery systems. The historic quarters contain outdated infrastructure which requires modernization because their ancient masonry sewers and retaining walls become dangerous when neglected. Heavy rainfall events have caused periodic flooding in the lower sections of the Golden Horn as seen during the 2020 summer flash floods which flooded underpasses at Unkapanı. The city started implementing stormwater drainage improvements and stream bed restoration projects to reduce flood backflow after the Kâğıthane creek mouth expansion.[425] The large number of unretrofitted old buildings remains a major concern because more than half of Istanbul's housing stock was built without modern building codes.[426] The historical buildings in Golden Horn neighborhoods hold cultural value but would probably collapse during a major earthquake. The collapse of thousands of buildings would disable essential services and roads even when all emergency preparations are in place. The city emergency plans recognize this challenge so the organization focuses on proactive renewal as its main priority (Section 5.3). Emergency response becomes challenging in narrow streets of Balat and Fener because these streets block access for emergency vehicles during normal times and become completely impassable after disasters. The municipality has tested smaller fire engines with neighborhood response teams to address this problem but the issue persists.[427] The effectiveness of high-tech systems that include sensors and automatic shutdowns depends on regular maintenance and public understanding of their operation. The systems which depend on power and communication will fail during critical moments when they need to function. The implementation of backup communication systems including satellite phones for emergency responders and citywide radio networks for crisis situations along with personnel training for multiple roles represents the current focus of resilience efforts.[428] The Golden Horn area together with other parts of Istanbul now possess significantly improved disaster-resistant infrastructure which includes fortified bridges and emergency response centers. The city needs to maintain its focus on resilience development because the next

423 İstanbul Büyükşehir Belediyesi [İBB]. (2021). İstanbul Afet Koordinasyon Merkezi (AKOM) and Disaster Logistics Hub Updates. AFAD Reports.
424 Ibid.
425 İstanbul Büyükşehir Belediyesi (2023, December 29). Unkapanı Yağmur Suyu Tüneli Çalışmaları. İstanbul İçin Çalışıyoruz; Ege Postası (2013, September 21). Kağıthane Deresi ıslah ediliyor.
426 Atun, F., & Menoni, S. (2014). Vulnerability to earthquake in Istanbul: An application of the ENSURE methodology. ITU A|Z Journal, 11(1), 107–113.
427 Hürriyet Daily News. (2023, April 4). Istanbul's narrow streets cause concern for emergency situations. Hürriyet Daily News.
428 Türksat A.Ş. (2025, February 5). Acil Durum Haberleşmesinde Türksat ile Kesintisiz İletişim; AFAD. (2021, March 2). Minister of Interior Süleyman Soylu addresses the İstanbul Provincial Disaster Risk Reduction Plan Meeting.

disaster will determine the true strength of its preparedness systems. The city needs to maintain its focus on resilience development through continuous investments in infrastructure upgrades and smart technology implementation and community readiness to protect its systems from future threats.

## 5.5 Cultural Heritage and Community Memory in DRR

The Golden Horn serves as a cultural heritage center of Istanbul which protects Byzantine churches and Ottoman mosques and traditional timber row houses and Roman city wall remnants. The protection of cultural heritage and community memory functions as essential elements for disaster risk management analysis in this area. The social elements within risk management discussions gain depth through these additional factors which stem from technical risk assessment.

Throughout history Istanbul maintained a strong connection between disaster management and heritage preservation activities. The rulers and communities of Istanbul dedicated themselves to reconstructing famous buildings after disasters while implementing better construction methods. The Fatih Mosque dome collapse during the 1766 Great Istanbul Earthquake led to Ottoman reconstruction efforts which built a new design in 1771 that combined stability with different architectural elements.[429] The Ottoman Empire demonstrated its eighteenth-century dedication to cultural heritage preservation through rebuilding the Fatih Mosque after the disaster which established a precedent for modern cultural BBB practices.

The protection of historic monuments from natural disasters has been a fundamental principle in Istanbul's cultural values since ancient times. The wooden houses in Balat/Fener and the ancient workshops along the Golden Horn received insufficient structural maintenance which resulted in their complete destruction during fires and earthquakes.[430] The humble heritage-rich structures vanished completely during disasters while leaving behind only oral traditions and written accounts to preserve their memory. The transmission of disaster-related warnings and moral teachings occurred through community-wide through shared disaster memories. The Golden Horn region during the 19th and early 20th centuries consisted of multiple ethnic and religious communities including Muslim Turkish, Greek, Armenian, Jewish, Levantine European and others who maintained their own institutions and social networks. The groups united through charitable foundations including foundations (*vakif*), churches and synagogues to support victims during reconstruction efforts after disasters. The community took an active role in recovery and mitigation efforts before the establishment of modern NGOs.

The people of Balat recall their multiple Jewish and Armenian quarter fires throughout the 18th and 19th centuries through local stories which describe how "we rebuilt after fires but everything changed forever." The community's shared memories about past disasters have shaped their actions through time as shown by the 19th-century visitor who documented Balat residents storing important documents in underground clay containers because of their

429 Archnet. (2019). Fatih Camii (Fatih Mosque) – Istanbul, Türkiye. Archnet Architectural Heritage Database. (Original mosque collapsed in 1766 and was rebuilt entirely by 1771 under Mustafa III)

430 “Istanbul Fires During the Ottoman Period and Their Effect on the City’s Topography.” (n.d.). In History of Istanbul (online ed., Istanbul 2015). İstanbul Tarihi. (A fire on July 27, 1729 in Balat burned down one-eighth of the city; repeated 18th-c. fires devastated districts like Fener-Balat)

past fire experiences. The people of Istanbul learned about their city's earthquake risk through written inscriptions and oral traditions. Major “Little Judgment Day” (Küçük Kıyamet) and the 1894 Istanbul earthquake became so severe that people described experiencing both terror and religious awe during its aftermath.[431] The people of Istanbul lost their direct experience of major earthquakes because of the extended time between significant seismic events which made the 1999 earthquake feel like a complete disaster to the population.[432] These emotional stories maintained public awareness of collective trauma which made people more likely to follow safety precautions.

The public demonstrated better adherence to safety protocols during periods when disaster memories remained vivid in their collective memory. During the first years following the 1894 disaster some residential quarters established night-watch groups for fire patrol and adopted fire insurance services that foreign companies started offering in Istanbul. The success of fire insurance maps created by Goad and Pervititch stemmed from public understanding of fire risks because communities needed to identify dangerous wooden buildings.

**Modern Efforts to Protect Cultural Heritage from Disaster**

The protection of cultural heritage during disaster planning has become an official goal for Istanbul authorities in modern times while they use community memory to create new preservation methods. The Istanbul Metropolitan Municipality (IMM) operates a Cultural Heritage Department that started including seismic risk assessments in its conservation projects since 2019. The head of the department Mahir Polat explains that Istanbul contains more than 36,000 registered historic buildings which require structural reinforcement for protection while serving as a model for Turkish heritage preservation.[433]

The Basilica Cistern and City Walls represent two major examples of complete restoration work that the city has undertaken on its most famous landmarks. The IMM implemented a groundbreaking initiative at the Basilica Cistern (Yerebatan) near the Golden Horn's southern edge by lowering water levels and removing concrete additions from past restoration work to decrease structural weight and column stress and implementing a new steel support system with 630 base isolator bearings between 2020–22.[434] The 2022 structural intervention followed engineer guidance to make the Byzantine cistern more resistant to earthquakes.

The Zeyrek Çinili Hamam serves as a 16th-century bathhouse which faces the Golden Horn. The private company that restored this building from 2010 to 2023 performed a detailed seismic retrofit by constructing internal support systems and placing 20 concrete/steel caisson

431 “A Seismic Cityscape: Earthquakes in Istanbul’s History.” (n.d.). In History of Istanbul (online ed., Istanbul 2015). İstanbul Tarihi. (The 1894 earthquake had profound cultural impact; Halide Edip wrote that religious devotion increased due to fear after the quake)

432 “A Seismic Cityscape: Earthquakes in Istanbul’s History.” (n.d.). İstanbul Tarihi. (The 1999 İzmit earthquake galvanized public outcry and civil society, leading to new disaster management institutions, an Earthquake Master Plan in Istanbul, and retrofitting of historic buildings over the following decade)

433 Yackley, A. J. (2023, May 31). “We’re not ready”: The race to protect Istanbul’s heritage from another earthquake. The Art Newspaper. (Mahir Polat of IMM notes Istanbul has ~35,000 heritage sites, over half in the high-risk quake zone, and urgently needs seismic reinforcement protocols for historic buildings)

434 Javaid, M., & O’Brien, E. (2025, October 18). Saving Istanbul’s ancient structures from the next big earthquake. The Washington Post. (During 2020–22 restorations, the Basilica Cistern’s water load was lowered, concrete additions removed, and ~630 steel base isolators installed on its columns to improve earthquake resilience)

foundations underground to stabilize the structure on the hillside while exchanging wooden tension beams with steel bands that blend into the original structure.[435]

The technical solutions of caisson foundations, steel tie-bars, and lighter construction materials work to enhance the earthquake resistance of heritage buildings while maintaining their original visual appearance. The success of these initiatives depends on effective collaboration between local and national government entities. The Ministry of Culture and Tourism and the General Directorate of Foundations (Vakıflar) manage most of Turkey's key monuments, which include mosques, museums, and historical buildings. The agencies have released guidelines that require earthquake protection systems to be integrated into restoration projects. The 2021 disaster action plan update from Turkey specifically added cultural heritage protection to its scope, and ministry staff have executed seismic risk reduction measures in all ministry-affiliated buildings across Istanbul and throughout Turkey since previous years, according to ministry officials.[436] The implementation of modern conservation in Istanbul now unites traditional preservation techniques with engineering solutions for disaster preparedness in all projects managed by the IMM and the central government.

**Community Initiatives for Heritage Preservation and Disaster Memory**

The Golden Horn area depends on community-based initiatives that work to defend local heritage from development threats and disaster events. The residents of Fener-Balat united to stop urban renewal plans, which used earthquake safety and revitalization as excuses to destroy their historic homes throughout the 2000s and 2010s. The 2006 renewal project, for which a development firm received a contract to execute, faced strong neighborhood resistance and legal battles that forced the project to stop because civil society organizations and local residents protected the area's architectural heritage.[437] The area's Ottoman-era timber houses receive protection through grassroots initiatives and NGO activities, which both document their cultural importance and address their seismic risks. The “Save Our Roofs” initiative, which received UNESCO backing during the mid-2000s, worked to document historic wooden buildings in Zeyrek and obtained public funding for restoring multiple 19th-century houses before they disappeared through decay or subsequent disasters.[438] The community-based restoration approach focuses on repairing roofs and structural components with traditional materials, enhancing earthquake resistance and fire safety while preserving the historical integrity of the buildings. The community has adopted innovative methods to

435 Javaid, M., & O’Brien, E. (2025, October 18). Saving Istanbul’s ancient structures from the next big earthquake. The Washington Post. (The Zeyrek Çinili Hamam restoration added 20 caisson “well” foundations to stabilize the structure, removed incompatible cement, repaired cracks with traditional materials, and replaced old wooden dome ties with steel bands for strength)

436 Yackley, A. J. (2023, May 31). “We’re not ready”: The race to protect Istanbul’s heritage from another earthquake. The Art Newspaper. (Turkey’s Ministry of Culture stated in 2021 that its updated national disaster plan includes cultural heritage, and that earthquake precautions have for years been implemented in museums and historic structures under its care)

437 Engin, E., & Öztürk, Ş. (2017, April 30). Balat: A Modern İstanbul Project in a Historical Setting. Bianet (Independent Communication Network). (The Fener-Balat renewal project initiated in 2006 under Law 5366 was halted after 2007 due to sustained community and NGO objections, which opposed demolitions in this historic area)

438 UNESCO World Heritage Centre. (2005). State of Conservation Report: Historic Areas of Istanbul (SOC 2005). UNESCO WHC Archives. (The “Save Our Roofs” campaign, launched in 2003 by a Turkish timber association with UNESCO support, secured government funds to restore several important wooden houses in the Zeyrek area; local authorities began working with owners of historic timber houses to carry out these restorations)

achieve its goals. Local organizations use storytelling and theatrical performances to preserve disaster history while teaching people about preparedness. The workshops allow residents to share their personal stories about neighborhood fires and earthquakes, which artists and educators transform into theatrical performances and oral history events. The process transforms personal memories into a shared story, enabling neighbors to learn from their shared past. The "memory theatre" approach, which resembles Playback Theatre, allows survivors to share their stories through acting and has proven effective in reducing fear while fostering shared risk understanding among community members.[439] The Golden Horn communities use storytelling events to preserve memories of past earthquakes and fires, while maintaining the transmission of local wisdom and acquired knowledge. Local stakeholders, including heritage activists, artists, and residents, have established essential roles in safeguarding the Golden Horn's physical and cultural heritage by building grassroots resilience that supports official disaster risk management efforts.

The residents of Balat achieved a historic victory through their opposition to total demolition plans which demonstrated how community members who understand their connection to their environment can shape disaster risk reduction strategies. The plan required planners to return to their work and combine risk reduction measures with conservation principles.

The way people in communities remember past events influences their willingness to prepare for disasters. The people of Istanbul remember the 1999 disaster through shared memories which continue to exist even though new generations have learned about the "17 August" disaster through family stories. The collective memory of the disaster has produced two opposing results because it maintains public fear while encouraging people to back resilience programs (people join annual earthquake drills in November because they recall the necessity of these drills). The combination of insufficient public education with memory can produce widespread panic among people. The April 2025 Silivri earthquake with its 6.2 magnitude caused no building collapses in Istanbul but resulted in hundreds of injuries from people who panicked by leaping from balconies or running down stairs in disarray, according to the Istanbul Governor's Office.[440] The incident, widely covered in local media, highlighted that psychological preparedness is as important as structural safety.

The enduring fear of a major earthquake since 1999 has led people to respond with excessive panic during smaller tremors which results in more casualties. The authorities need to use past experiences constructively by running regular drills and public awareness campaigns which teach proper response techniques (Drop-Cover-Hold and orderly evacuation) to transform fear into useful preparedness instead of dangerous panic. The Golden Horn area has adopted storytelling and artistic programs to enhance public awareness about disaster preparedness. The community theaters of Kumkapı and Balat present historical fire and earthquake plays which teach viewers about past mistakes and neighborly support during emergencies. Cultural programs transform shared historical memories into educational

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439 Smetanova, A. (2024, Feb 27). When theatre tackles the effects of climate extremes: the "science-art" approach to disaster risk reduction. The HuT Project Blog (EU Horizon 2020). (Interactive "playback theatre" workshops have been used in disaster risk reduction – survivors share stories which actors then perform, turning individual experiences into a collective narrative and helping the community emotionally process and learn from past disasters)
440 Butler, D. (2025, April 23). Powerful earthquake shakes Istanbul, dozens hurt jumping from buildings. Reuters. (During the April 2025 Silivri-centered quake, 151 Istanbul residents were injured after jumping in panic; no one was critically hurt and only an abandoned building collapsed, with no major structural damage reported in the city)

resources which build social unity and enhance community resilience. Any relocation or major structural intervention requires respect for community memory because ignoring intangible heritage and place attachment will drive away the necessary public support for DRR measures (as seen in previous renewal oppositions).

**Linking Cultural Heritage and DRR: Sendai Framework Principles**

The disaster risk reduction strategy of Istanbul follows the recommendations established in the Sendai Framework for Disaster Risk Reduction (2015-2030). The Sendai Framework emphasizes that successful disaster risk reduction requires local knowledge, traditional practices, and cultural heritage to serve as resilience assets. The framework supports communities and authorities in using indigenous knowledge and traditional practices alongside scientific research for risk assessment and intervention planning, as local wisdom provides valuable information that enhances modern scientific disaster risk reduction efforts.[441]

A precise observation that can be made from this is that when modern engineering is combined with traditional Ottoman construction techniques and principles, the best results are achieved in the preservation and resistance of cultural and traditional structures – monuments. A great reminder to not overshadow cultural heritage and years of traditional practice, as these techniques made it possible for monuments to resist earthquakes and fires for years

The human-centered approach of the Sendai Framework also highlights the reality that preserving cultural heritage – whether monuments or community traditions – is part of building resilience in society. Engaging local societies in DRR, being attuned to their cultural memory, and utilizing adapted vernacular solutions can facilitate greater public acceptance of safety solutions. Istanbul's new buildings replicate this mantra: the incorporation of steel reinforcement bands subtly incorporated as part of the traditional building practice, or the collaboration between scientists and craftsmen during restorations, indicates an awareness that heritage and innovation go hand-in-hand. By uniting structural engineering with the “living” knowledge of heritage, disaster risk reduction strategies can be both technically sound and culturally sustainable. This holistic strategy is very much in the spirit of Sendai’s call to “build back better” by marrying new knowledge with the wisdom from the past, thereby protecting both lives and livelihoods as well as the historic legacy that communities value.[442]

441 United Nations Office for Disaster Risk Reduction (UNDRR). (2015). Sendai Framework for Disaster Risk Reduction 2015–2030 (adopted March 2015). UNDRR. (Priority 4 of the Sendai Framework emphasizes traditional, indigenous, and local knowledge in DRR; calls for integrating local wisdom and cultural heritage practices with scientific information to foster resilience at all levels)

442 ICCROM. (2024, August 9). Embracing Indigenous and Traditional Knowledge in Disaster Risk Reduction (ICCROM News). (Traditional knowledge is dynamic and can blend with modern technology, enhancing innovation and local acceptance of DRR measures. Integrating diverse knowledge systems – engineering expertise together with indigenous practices – is in line with Sendai’s people-centered approach and leads to more holistic, effective disaster management strategies)

| | Parameter | Definition & Importance | Relevance to Golden Horn / Istanbul |
|---|---|---|---|
| 1 | **Understanding Risk** | Systematically identifying, assessing, and communicating disaster risks | Historical fires and earthquakes in Golden Horn led to development of hazard maps, firebreaks, and risk-based planning (e.g., 1848 Building Regulation, 1882 Ebniye Kanunu) |
| 2 | **Local DRR Strategies & Governance** | Empowering local institutions to create DRR strategies and coordinate across scales. | Istanbul's shift from decentralized civil defense to centralized AFAD system; creation of IRAP in 2021; dual governance of IBB and AFAD in disaster planning. |
| 3 | **Build Back Better** | Using post-disaster recovery to improve resilience and reduce future risks | Rebuilding Beyoğlu and Hocapaşa after fires with wider streets and masonry; urban renewal laws (e.g., Law 6306) aim to improve safety but raise heritage and displacement concerns |
| 4 | **Resilient Infrastructure & Services** | Protecting and retrofitting essential infrastructure to withstand hazards | Prost Plan introduced firebreak boulevards and infrastructure improvements; recent seismic retrofitting efforts for historic structures and emergency coordination centers across districts |
| 5 | **Community Engagement & Urban Memory** | Involving communities in DRR and preserving collective memory and identity | Resistance to renewal plans in Beyoğlu and Balat; citizen pushback during Tanzimat reforms; modern debates over retrofitting vs. heritage protection reflect public awareness and memory. |

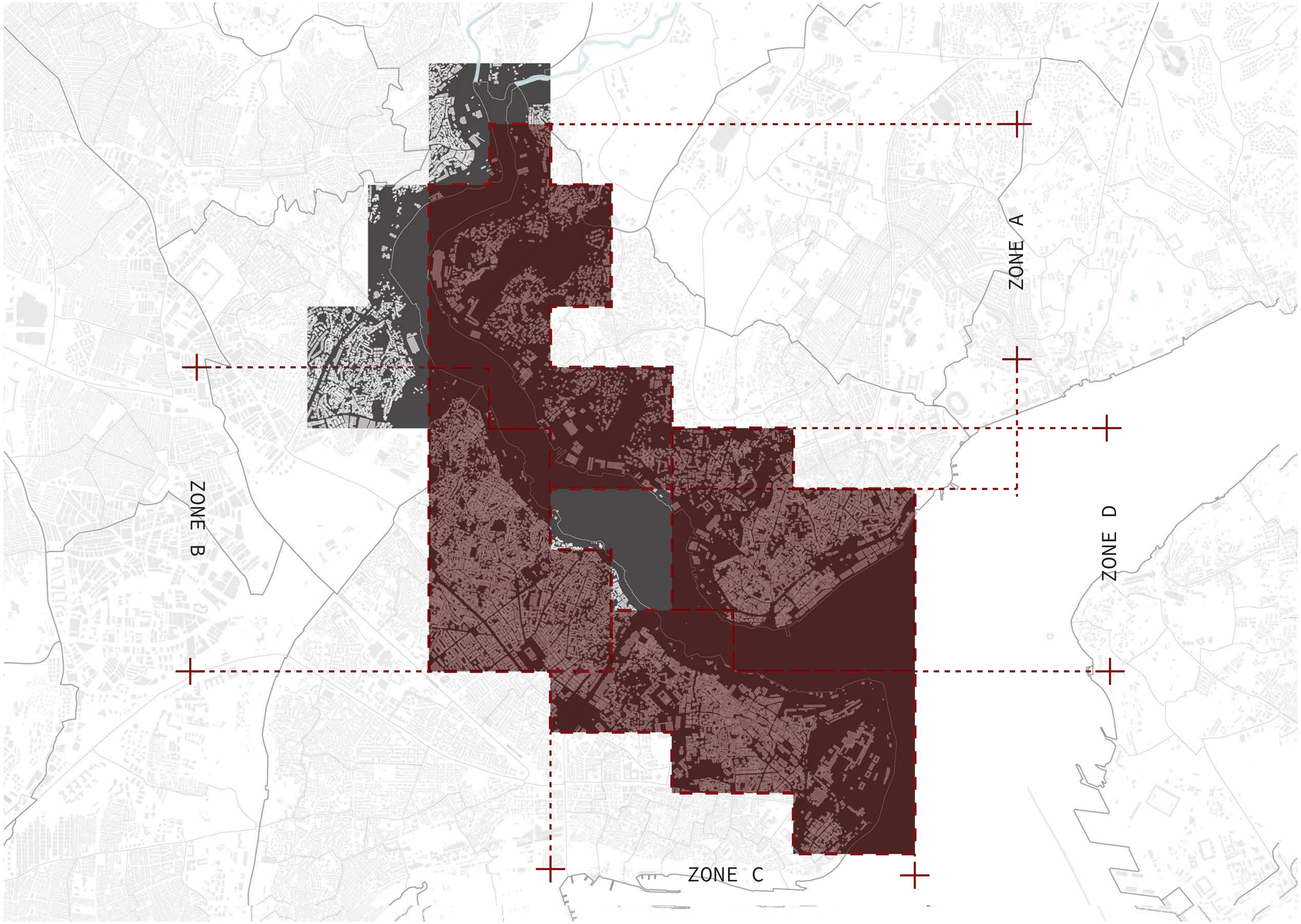
***Table 14:*** *Primary chosen 'Disaster Risk Reduction Parameters' for the thesis and their relevance to the Golden Horn and Istanbul*[443]

443 These parameters have been discussed and used as a main research criteria throughout this thesis. The table indicates a summary of their definition , importance and relevance to the Golden Horn by bringing together all the information given in Chapter 5.

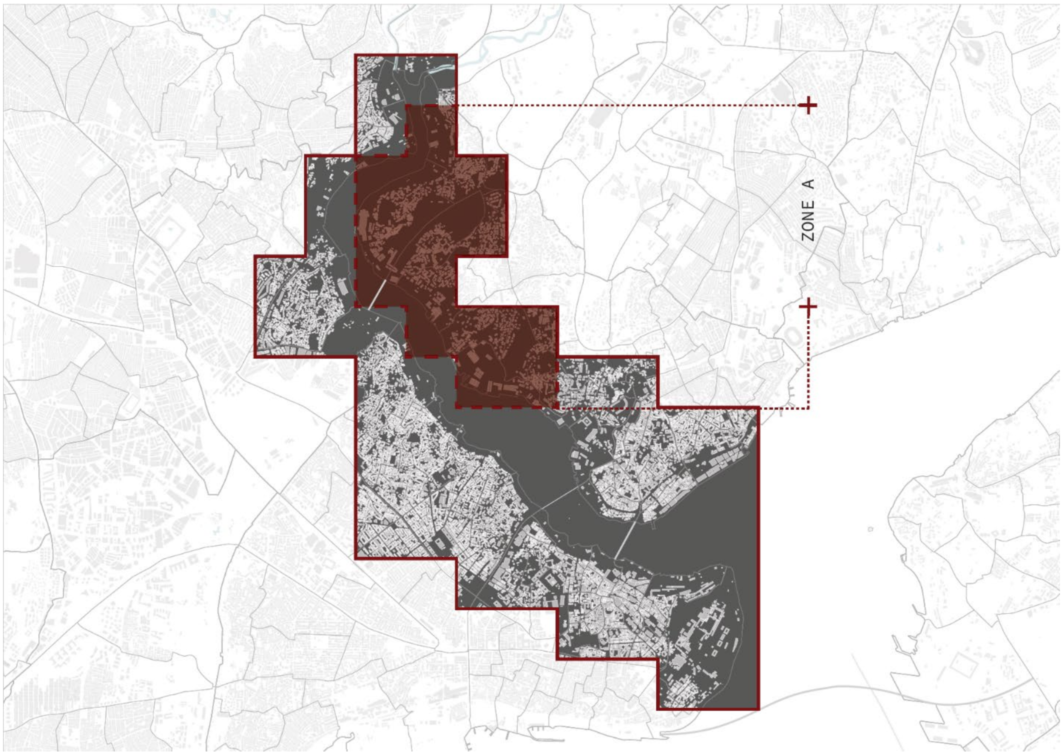
## 5.6. Spatial Synthesis of Disaster Risk Management in the Golden Horn

This research analyzed disaster risk management in the Golden Horn through the five parameters of the Sendai Framework, from historical disaster experience to contemporary regulatory and planning measures. These five parameters apply to the Golden Horn as a whole but these parameters create different effects throughout its different sections. The research data was organized into four spatial sections (Zones A–D), each highlighting different configurations of exposure, vulnerability, governance responses, and resilience capacities. Rather than assigning specific Sendai priorities to these areas, these zones illustrate how the same disaster risk reduction principles intersect and materialize differently across the urban fabric, through maps produced by the author.

The figure below (Map 36) shows disaster risk management through fragment-based spatial synthesis which operates in the Golden Horn area. The four zones (A–D) demonstrate how historical development patterns and hazard exposure and vulnerability and governance frameworks and community memory create different patterns of interaction. The spatial elements in these fragments enable readers to see how disaster risk reduction principles operate at different locations throughout the area based on Chapter 5.




***Map 36:.** Analytical Zoning Framework of the Golden Horn (Zones A–D). Produced by the author.*




***Map 37:** Zone A Industrial Legacy and Natech Risk Zone (Sütlüce–Hasköy)[444] Produced by the author.*

Zone A includes the upper and middle parts of the Golden Horn which used to be industrial areas that operated shipyards and slaughterhouses and big facilities. The combination of industrial activity concentration with waterfront conditions and soil structure changes has created multiple risk layers which connect technological failures to natural disasters. The area shows how previous industrial operations continue to produce environmental contamination which threatens both the environment and weakens its infrastructure.

**Key characteristics:**

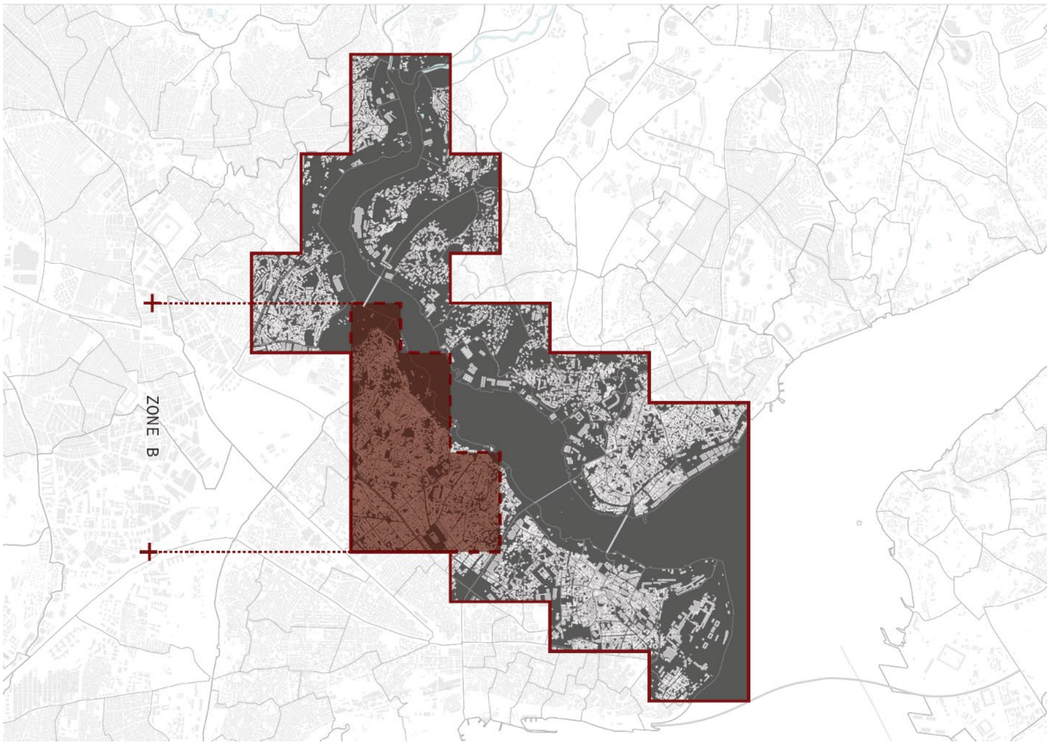
- Concentration of former slaughterhouses, shipyards, and industrial facilities
- Accumulated technological and environmental risk (Natech logic)
- Large industrial parcels replacing historic fine-grain urban fabric
- Heightened exposure due to soil conditions and waterfront adjacency

**Core argument:**
Fragment A illustrates how historical industrial land use has produced layered and persistent risk conditions, particularly where technological hazards intersect with natural processes.

**Applied Sendai Parameters:**

- Understanding Risk
- Build Back Better
- Resilient Infrastructure and Services

444 This map translates disaster risk reduction (DRR) parameters into spatial evidence for the Sütlüce–Hasköy zone, characterized by its industrial legacy and potential Natech (natural–technological) risks. The mapping highlights the interaction between historical industrial land uses, waterfront exposure, and disaster risk governance, enabling zone-based comparison and demonstrating how risk profiles along the Golden Horn vary according to land-use history and infrastructural vulnerability.




***Map 38:*** *Zone B Dense Historic Fabric and Informal Resilience Zone (Fener–Balat–Ayvansaray)*[445] *Produced by the author.*

The Zone B area contains historic urban areas with wooden and mixed buildings and narrow streets and small parcel structures. The physical appearance of this area resulted from multiple fire incidents which people used to construct their homes through unregulated building methods. The area demonstrates how physical instability exists alongside local community resistance while showing the points where official management systems break down.

**Key characteristics:**

- Predominantly wooden and mixed construction typologies
- Narrow streets and small parcels intensifying fire vulnerability
- Recurrent fire cycles shaping urban form
- Informal rebuilding practices outside strong regulatory control
- Strong continuity of community memory and social resilience

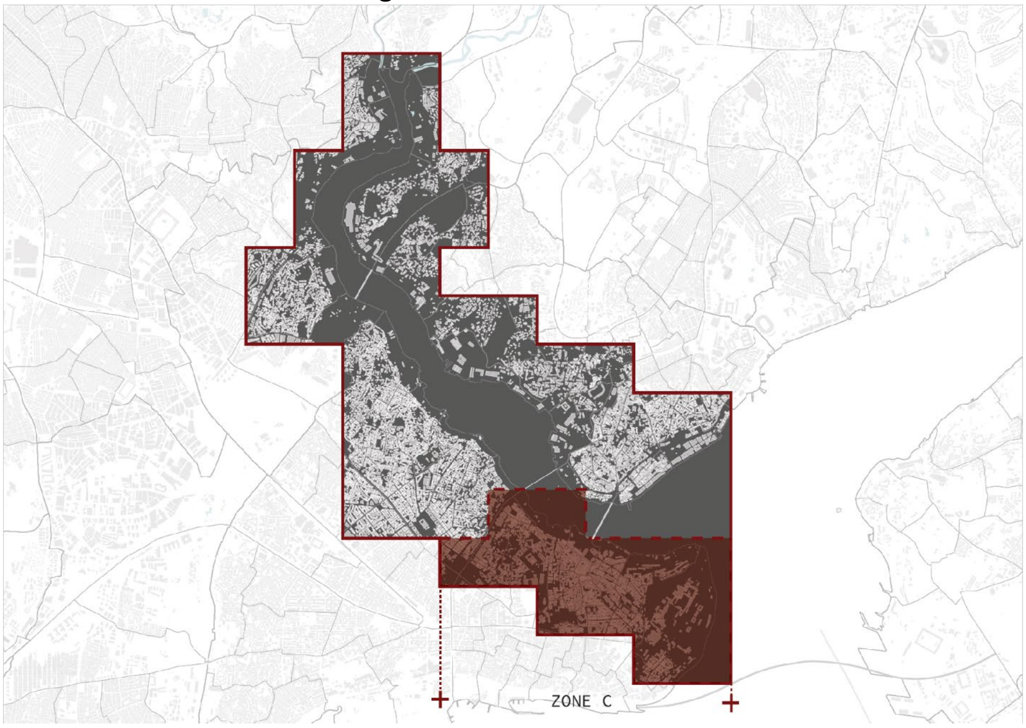
**Core argument:**
Fragment B represents the convergence of high vulnerability and strong cultural resilience, where repeated disaster experience shaped informal adaptation rather than formal governance.

**Applied Sendai Parameters:**

- Understanding Risk

445 The map represents disaster risk reduction parameters within the dense historic fabric of Fener, Balat, and Ayvansaray, where timber-based building typologies, repeated fire events, and strong community networks have historically shaped informal resilience practices. By spatializing these parameters, the map supports zone-by-zone comparison and illustrates how collective memory, heritage values, and everyday coping mechanisms influence disaster risk responses in the Golden Horn.

- Cultural Heritage and Community Memory
- Limits of Governance and Regulation




***Map 39:*** *Zone C Waterfront Interface and Exposure Zone (Eminönü–Inner Estuary)*[446] *Produced by the author.*

Zone C covers the lower Golden Horn waterfront, where reclaimed land, port infrastructure, and transport networks dominate the urban landscape. The area faces increased flood risk and earthquake-triggered soil shaking because it sits near water sources which would lead to major destruction. The exposure in this area becomes more intense because of the high concentration of infrastructure even though the buildings follow organized construction methods.

**Key characteristics:**

- Reclaimed land and port-related infrastructure
- Concentration of transport and service networks
- Flood exposure and potential seismic amplification
- Dominance of infrastructural systems over residential fabric

**Core argument:**
Fragment C highlights the role of waterfront conditions and infrastructural concentration in amplifying exposure, even where formal construction dominates.

**Applied Sendai Parameters:**

- Understanding Risk
- Resilient Infrastructure and Services

446 This map focuses on the Eminönü–Inner Estuary zone, where intense commercial activity and proximity to the waterfront generate high levels of exposure to multiple hazards. The visualization translates abstract DRR concepts into spatial evidence by linking historical fire insurance mapping, regulatory interventions, and risk-aware planning measures, and demonstrates how exposure dynamics differ markedly from adjacent zones along the Golden Horn.

- Exposure Analysis


***Map 40:** Zone D Early Regulatory Intervention and Planned Fabric Zone (Beyoğlu / Pera Edge)*[447]

Zone D represents areas shaped by post-1870 fire reconstruction and early planning interventions, where the application of the Ebniye Nizamnameleri resulted in wider streets, masonry construction, and clearer spatial order. The zone demonstrates how repeated disaster experience, particularly large-scale fires, triggered state-led regulatory responses aimed at reducing fire propagation, improving accessibility, and enforcing construction standards. While these interventions reduced certain vulnerabilities, they also produced a distinct risk profile, where exposure is shaped less by informal practices and more by infrastructure dependency.

**Key characteristics:**

- Planned urban fabric shaped by post-fire reconstruction policies
- Wider street sections improving firebreak capacity and emergency access
- Predominance of masonry construction following regulatory enforcement
- Clear block and parcel organization compared to adjacent historic zones
- Reduced fire vulnerability but persistent exposure to seismic risk due to aging structures

**Core argument:**

Fragment D illustrates how formal regulatory intervention can reduce specific hazards (notably fire) while simultaneously creating new forms of vulnerability linked to standardized planning, aging building stock, and reliance on early infrastructure systems.

447 The mapping of the Beyoğlu / Pera Edge zone highlights early regulatory intervention and planned urban fabric as key drivers of disaster risk reduction. By illustrating the spatial imprint of post-fire regulations, street widening, and planned reconstruction, the map demonstrates how formal planning responses produced a distinct risk profile compared to the more organically evolved districts of the Golden Horn, reinforcing the need to treat the area as a set of differentiated risk environments.

**Applied Sendai Parameters:**

- Planning and Building Regulations
- Understanding Risk
- Resilient Infrastructure and Services

## 5.7. Conclusion: Progress, Failures, and the Road Ahead for Golden Horn's Resilience

This thesis's examination of Istanbul's disaster risk management (DRM) by five Sendai Framework-origin parameters has revealed a mixed record of achievement and shortcomings, particularly as magnified through the microcosm of the Golden Horn region. Historically, the Istanbul experience is one of early risk identification – seen in comprehensive fire insurance maps and Tanzimat legislation – but also with a history of reactive, imbalanced implementation that tends to leave the most vulnerable groups (many of whom are in the Golden Horn area) exposed. With respect to risk understanding (Parameter 1), the city has progressed from believing in fate when it came to disasters to sophisticated risk models and maps; intelligence is no longer the hindrance today. If anything, Istanbul has more risk data than it is putting to good use. The Golden Horn districts are well known as being earthquake-risk districts (due to old building stock and soft ground) – now is the time to address that with some urgency.

On local DRR planning and governance (Parameter 2), the Istanbul case serves as both evidence of the strength and of the failure of top-down policies. Strong-arm measures such as Henri Prost's master plan or post-1999 institutional reforms have actually moved the needle on city safety (e.g., the imposition of planning controls and the centralization of disaster response in AFAD). However, governance breakdown is evident in the continued misalignment between central and local government priorities and bureaucratic complacency that slowly advances projects. The conflict between the central government pushing for clearance and local interest groups pushing for preservation for renewal projects in Balat/Ayvansaray is an example of how governance tensions can block synergistic DRR progress. In addition, while Istanbul has numerous plans in place these days – from IRAP to emergency response planning – the enforcement of risk-reducing regulations (like building codes) remains patchy. This is a matter of great concern: rules did not prevent shoddy construction in the past, and even now, illegal or unapproved construction occurs in some areas. Governance must turn paper intentions into reality, specifically by cracking down on hazardous buildings and channeling urban growth away from hazard zones.

The "Build Back Better" (Parameter 3) initiative in Istanbul shows a combination of positive and negative results that have been improving over time. The city demonstrated its ability to learn from disasters by implementing safer construction materials and building designs after past fires.[448] The city failed to expand its safety improvements throughout the entire urban area because new priorities and complacency took over after brief periods of attention. The current adoption of BBB principles during both the 1999 and 2023 periods demonstrates a

448 Çelik, Z. (1986). The Remaking of Istanbul: Portrait of an Ottoman City in the Nineteenth Century. University of California Press. (Discusses post-fire reconstruction reforms and safer urban layouts in the Tanzimat period as proto-BBB practices.)

positive development in the city.[449] The urban transformation initiative of Istanbul has the potential to significantly decrease risk through its plan to replace or enhance hundreds of thousands of vulnerable buildings.

The success of BBB depends on achieving both equity and completeness because the transformation efforts that exclude vulnerable populations or historic areas and face economic challenges will not achieve their full potential.[450] It is also fair to note that preventative "build better before" efforts have not reached everyone due to many residents being still reluctant or unable to finance the reinforcement of their buildings absent greater public subsidy.[451]

The Golden Horn area contains numerous traditional wooden and low-rise masonry houses which follow local building regulations yet face challenges when attempting to upgrade all structures at once. The fieldwork showed that community members strongly connect to their location so developers must handle this attachment with care when performing demolition or reconstruction work. The Build Back Better initiative for this area requires developers to construct safer buildings while simultaneously enhancing public areas through seawall reinforcement and waterfront preservation to create a safe and lively Golden Horn environment.

Every year of inaction before the Big One strikes represents a lost chance to construct more resilient structures. As Seker, M lamented in 2025, "Istanbul remains unprepared — transformation is essential, and time is running out."[452]

The upcoming years will determine if Istanbul can overcome administrative challenges, funding issues, and social obstacles to establish new construction standards with enhanced resilience.

The analysis of resilient infrastructure and services (Parameter 4) shows substantial progress in Istanbul. The physical infrastructure of Istanbul including its roads ,bridges and emergency facilities and utility systems demonstrates better disaster readiness than it did during past decades. The Golden Horn area received new transportation systems and utility network improvements which should boost its operational capacity during disaster situations. Emergency response teams operate with advanced technology that includes automatic gas shutdown systems and drone-based real-time damage assessment to perform their duties. The systems will stop functioning when they lack proper maintenance and testing protocols.

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449 United Nations Office for Disaster Risk Reduction. (2015). Sendai Framework for Disaster Risk Reduction 2015–2030. UNDRR. (Sendai's Priority 4 explicitly promotes "Build Back Better" in recovery, rehabilitation, and reconstruction, which Turkey adopted after the 1999 Marmara earthquake.)

450 OECD. (2022). Governance for a Resilient Future: Strengthening Disaster Risk Governance in Türkiye. OECD Publishing. (Analyzes socioeconomic disparities in Turkey's disaster resilience and how urban renewal programs risk excluding low-income and historic districts.)

451 AFAD – Disaster and Emergency Management Authority. (2022). Türkiye Afet Risk Azaltma Planı (TARAP). Ankara: AFAD. (Details the challenge of funding citizen-led retrofits and highlights the need for greater state subsidies to expand pre-disaster strengthening programs.)

452 Babaoğlu, C. (2025, May 5). Warning shakes Istanbul: Building a resilient city against the next quake. SETA Perspectives (Foundation for Political, Economic and Social Research). Available at https://www.setav.org/en/warning-shakes-istanbul-building-a-resilient-city-against-the-next-quake/ (Accessed October 2025). (The article argues that Istanbul remains insufficiently prepared for a major earthquake and that rapid, inclusive urban transformation is essential.)

The areas that need priority resilience support change over time because infrastructure requires continuous financial backing through funding. The growing population of Istanbul and its expanding urban development in the Golden Horn area puts pressure on infrastructure systems which threatens disaster resilience unless appropriate solutions are implemented.

The city needs to improve its soft infrastructure development through community organizations and neighborhood response teams. The city has established disaster preparedness volunteer programs for neighborhoods but faces ongoing difficulties in sustaining public involvement. The city needs to keep its outreach programs and training exercises active because people tend to lose interest in disaster readiness when there are no recent disasters. The resilient services need to focus on people while using multiple backup systems to achieve effectiveness. The strong infrastructure of Istanbul faces two major weaknesses because human mistakes and unanticipated occurrences lead to small-scale disasters such as panic injuries in 2025 and localized flooding. The Golden Horn area needs continuous development of its infrastructure design to address climate change projections because stagnation will occur when sea levels rise and precipitation intensifies.

Finally, regarding cultural heritage and community memory (Parameter 5), The Sendai Framework (2015) establishes cultural heritage and community identity as essential elements which need protection during disasters because it requires risk reduction for people's health and cultural heritage to build resilience.[453] The World Bank together with UNESCO state that "heritage sites serve as fundamental elements which unite national and community identities while preserving historical ties and social bonds between people."[454] The Golden Horn in Istanbul represents this connection because it contains multiple historical periods of Byzantine and Ottoman and industrial development within its single urban structure. As established in the previous chapters: natural risk factors like fires and earthquakes were repetitive in the the city's history: showing that both material and social memory of disaster are long embedded in this landscape. As a recent report on earthquakes in Turkiye confirms that "earthquake memory should be kept alive and transmitted to new generations,"[455], recognizing memory itself as a resilience tool.

The current DRM strategies of Istanbul do not completely achieve Sendai's requirement for cultural heritage integration. The 2022 Provincial Risk Plan (IRAP) supports Sendai's main objectives through its emphasis on infrastructure and emergency logistics but it lacks specific details about heritage protection and community involvement.[456] The World Bank's 2025 Istanbul Resilience Project provides essential support for hospitals and infrastructure but it lacks any dedicated heritage protection measures for the Golden Horn area. The World Bank recognized the ISMEP project as a "comprehensive approach to improving disaster resilience

453 United Nations Office for Disaster Risk Reduction (UNDRR). (2015). Sendai Framework for Disaster Risk Reduction 2015–2030. UN Doc. A/RES/69/283. https://sustainabledevelopment.un.org/content/documents/21591Sendai_Framework_for_Disaster_Risk_Reduction_2015-2030.pdf

454 World Bank. (2016). Promoting Disaster-Resilient Cultural Heritage: Knowledge Note on Managing Disaster Risks for Cultural Heritage. Washington, DC: World Bank.

455 Göğüş, N. (2024). Workshop Report: Case Study – Earthquakes in Turkey. Global Risk (GFDRR / European Commission). https://preparecenter.org/wp-content/uploads/2024/02/Case-Study-Earthquakes-in-Turkey-Workshop-1.pdf

456 AFAD. (2022). İl Afet Risk Azaltma Planı (IRAP) – İstanbul İli. Ankara: Disaster and Emergency Management Authority (AFAD).

of important cultural heritage."[457] However, the current initiatives fail to protect the vernacular waterfront and industrial heritage and timber housing of Golden Horn which face equal risks from earthquakes and fires.

The city of Istanbul needs to learn from its past mistakes by protecting its irreplaceable cultural heritage from both abandonment and destructive modernization projects. The twentieth century brought about the destruction of numerous historic wooden buildings and monuments through the name of advancement which resulted in an irrevocable loss of cultural heritage. The Fener-Balat conflict demonstrates that the threat of destructive development continues because residents successfully blocked an ill-conceived project that threatened to erase a historic neighborhood under the pretext of disaster safety. The protection of both human lives and their historical environment requires heritage conservation to work together with risk reduction instead of fighting against it. The preservation of community memories through respect will create a bond between residents to accept necessary changes in their community.

There were some promising researches and measures seen such as, the global DRR workshops conducted by UNESCO and ICCROM now promote heritage preservation through the concept of "living heritage" which depends on local community support thus following Sendai's people-centered approach.[458] Then, regarding another risk factor, such as , flooding, as the launch of "Water as Heritage: Keeping the Golden Horn Estuary Alive" program in 2025, linking flood risk management with heritage conservation and community awareness by Haliç University's UNESCO Chair on Water Heritage (HEWACC).[459]

The city of Istanbul needs to prevent the destruction of its irreplaceable cultural heritage which occurred because of abandonment and unwise urban development initiatives. The urban transformation policies under Law No. 5366 have created confusion between risk mitigation and redevelopment because projects like Sulukule and Tarlabaşı used earthquake safety and modernization arguments "to justify" demolishing late-Ottoman neighborhoods and destroying social and cultural heritage sites.[460][461] Under the guise of seismic safety, Fatih Municipality has demolished dozens of Ottoman-era timber houses. Officials justified the demolitions by claiming these buildings were "not earthquake-proof", yet in practice many were torn down to their frames and replaced with imitative façades.[462] The residents of Fener-Balat-Ayvansaray neighborhoods fought against renewal plans through legal action because they worried their historic neighborhood would suffer the same destructive fate.[463] The Fener-Balat Rehabilitation Project (2003–2008) started as a successful model because it received

457 World Bank. (2016). Promoting Disaster-Resilient Cultural Heritage. Washington, DC: World Bank.
458 UNESCO. (2025, September 5). Disaster Preparedness Capacities in Culture Sector Strengthened in Central Asia. UNESCO News. https://www.unesco.org/en/articles/disaster-preparedness-capacities-culture-sector-strengthened-central-asia
459 Haliç University UNESCO Chair (HEWACC). (2025). Water as Heritage: Keeping the Golden Horn Estuary Alive. https://hewacc.halic.edu.tr/activities-outputs/
460Kuyucu, T., & Ünsal, Ö. (2010). Urban transformation as state-led property transfer: An analysis of two cases of urban renewal in Istanbul. Urban Studies, 47(7), 1479–1499. https://doi.org/10.1177/0042098009353629
461 Dinçer, İ. (2011). The impact of neoliberal policies on historic urban space: Areas of urban renewal in Istanbul. International Planning Studies, 16(1), 43–60. https://doi.org/10.1080/13563475.2011.552477
462 Voxeurop. (2019, March 12). Istanbul, all a façade. Süddeutsche Zeitung / Voxeurop. https://voxeurop.eu/en/istanbul-all-a-facade/
463 Türkün, A. (Ed.). (2014). Urban regeneration and neoliberal policies in Istanbul: The case of Fener-Balat-Ayvansaray. In Mülk, Mekân, ve Politika [Property, Space and Politics]. Istanbul: İstanbul Bilgi University Press.

backing from the European Union and UNESCO which enabled the restoration of 100 historic buildings and 35 landmarks in the Golden Horn area.[464] The government passed Law No. 5366 in 2006 to establish the Fener-Balat area as a "renewal zone" which enabled extensive demolition activities. GAP İnşaat (Çalık Group) introduced a new plan in 2007 which terminated the EU program while targeting 121 restored sites and more than 3000 historic parcels for expropriation and destruction.[465] The Fener-Balat-Ayvansaray Renewal Project sparked widespread public protests and multiple legal challenges. The administrative court declared the municipal plan invalid in 2012 because it violated both social and cultural rights according to resident and NGO complaints.[466] The case demonstrates how risk prevention through modernization initiatives endangers the cultural heritage they aim to safeguard.

The restoration work throughout the Golden Horn area has received negative feedback from experts. The process of awarding heritage project tenders showed a preference for private companies that did not possess proper conservation knowledge. The restoration work focused on creating a fictional "original" appearance by removing accumulated historical elements from buildings.[467] These restoration projects create "grotesque facadism" which replaces genuine architectural elements with artificial duplicates.[468] The World Heritage in Danger List threatens Istanbul's Old City, including Balat and Fener, because UNESCO has issued multiple warnings about ongoing destructive restoration practices.

These examples show how disaster prevention measures can transform into tools that result in the “destruction of authentic cultural heritage and the loss of cultural identitity” as it can be observed from solid examples from the past years that, modernization efforts sometimes led the way to losing the city’s authenticity and identity.

The lesson demonstrates that heritage preservation needs to unite with risk mitigation efforts instead of operating as opposing forces. The protection of both human lives and their cultural heritage needs to occur simultaneously because they support each other. The Golden Horn requires a dual approach to safety which protects human lives while preserving its living historical environment that provides purpose to human existence.

The approach of Istanbul lacks strong integration between community memory and cultural heritage although Sendai frequently mentions these elements. The Golden Horn used to function as an active industrial and maritime center until old boathouses and shipyards and workers' neighborhoods remained along its shoreline. The sites along the waterfront preserve communal historical records which include Ottoman guild activities and the 1918 Armistice Day riot and the area's pollution and cleanup efforts during the 20th century. The research revealed that most risk management plans “fail” to recognize the cultural significance of these sites. The Golden Horn parks have received heritage-sensitive restoration while museums have emerged from industrial warehouse conversions at the Rahmi M. Koç Museum. The

464 UNESCO. (2006). Joint ICOMOS/UNESCO Expert Mission to the Historic Areas of Istanbul (Fener-Balat), 6–11 April 2006. Paris: UNESCO World Heritage Centre.
465 Öncü, A. (2010). Gentrification and the Politics of Renewal in Istanbul’s Historical Districts. International Journal of Urban and Regional Research, 34(4), 817–835.
466 SonDakika. (2012, June 21). Fener-Balat sakinleri projenin iptalini sevinçle karşıladı. İstanbul Haber Ajansı (İHA).
467 Kuyucu, T., & Ünsal, Ö. (2010). Urban transformation as state-led property transfer: An analysis of two cases of urban renewal in Istanbul. Urban Studies, 47(7), 1479–1499.
468 UNESCO. (2019). State of Conservation Report: Historic Areas of Istanbul (Turkey). Paris: UNESCO World Heritage Centre.

official disaster planning process fails to incorporate historical stories from Golden Horn and its diverse community ties. The Sendai framework misses a chance to use cultural heritage sites and historical memories as community engagement tools for resilience development. The integration of heritage into DRR should include two examples: placing educational signs about past disasters near waterfront walkways and working with local historians and artists to create risk-awareness campaigns. The implementation of these measures will help Sendai achieve its goal of people-centered risk reduction through culturally sensitive approaches.

In summation, the Golden Horn area of Istanbul represents the city's DRM development process through its continuous struggle between historical preservation, modernization and disaster risk management and resilience. The city has achieved substantial progress through elevated risk perception and established institutions and dedicated investments for safer infrastructure and preparedness culture development. The current situation shows both positive developments and major unresolved issues because building safety enforcement remains insufficient and thousands of dangerous structures exist while project delays stem from coordination problems and local community participation in decision-making remains insufficient. The Sendai Framework has revealed multiple critical points of disagreement between different stakeholders. The achievement of full disaster risk management requires sustained political backing together with large financial resources and social participation at every organizational level. The Golden Horn's ability to become resilient depends on implementing integrated strategies which unite urban development with heritage preservation and scientific education with cultural traditions.

The current position of Istanbul during the Sendai Framework's 2015–2030 period makes it impossible to disregard the impending major earthquake threat and other potential dangers such as floods and historic district fires. The current analysis indicates Istanbul has improved its disaster readiness since previous times yet its readiness remains insufficient. The Golden Horn area serves as a critical testing ground because it combines elements of risk with significant cultural importance. A successful disaster response and recovery operation in Golden Horn during a future disaster would prove the effectiveness of decades-long disaster management efforts but a catastrophic outcome would demonstrate the price of ignoring these efforts. The true assessment of Istanbul's DRM progress will emerge from the protection of its citizens and the conservation of its eternal architectural landmarks which reflect in the Golden Horn's waters.

**Recent AFAD and IMM Initiatives**

AFAD and Istanbul Metropolitan Minicipality have showed some efforts regarding the improvement of disaster resilience. AFAD'S Istanbul Provincial Risk Reduction Plan (IRAP) comes as the principal key framework to work on disaster resilience, putting the spotlight on the historical neighborhoods such as Fatih and Beyoglu which are also linked to the Golden Horn area. These districts are selected for priority structural reinforcement and public education initiatives.[469]

Scientific data shows that a large portion of living areas in Turkey are at risk of natural disasters. Earthquakes, in particular, constantly remind us that our country needs to be more

469 SETA. (2025). Warning Shakes Istanbul: Building a Resilient City Against the Next Quake.

prepared for disasters. This disaster, which is an important reality of our geography, is made dangerous by buildings constructed without precautions. For this reason, various legal regulations have been enacted in our country. However, most of these legal regulations are based on a wound-dressing approach and target the post-disaster rehabilitation process.[470] What needs to be done, however, is to ensure transformation without injury and to eliminate dangers. In this regard, the enactment of Law No. 6306 in 2012 was a turning point.[471] This Law is based on the concept of "preventing injury" rather than "treating injury" after a disaster occurs. After the enactment of this law, urban transformation projects accelerated nationwide.

The seismic and early-warning networks of AFAD have expanded through the integration of Istanbul's 250+ accelerometers into emergency response systems that operate in real-time.[472] This project aligns with Sendai Priority 2 by bolstering both the "hardware" and "institutional muscle" of disaster management in the Golden Horn and beyond.

The Istanbul Metropolitan Municipality (IMM) has upgraded its fire department through new vehicle additions and search team deployment and training facilities and Deprem Zemin portal-based seismic microzone mapping.[473] The World Bank-supported Istanbul Resilience Project (2025) brought significant progress through its funding of 19 new fire stations and essential public building retrofits which directly addressed Sendai's "Build Back Better" objective.[474] The main objective of public education programs continues to be their core mission.

250,000 residents received disaster-preparedness training in 2023–2024 as part of AFAD's "Afete Hazır Türkiye" (Disaster-Ready Turkey) program.[475] The Golden Horn area demonstrates how technical readiness exceeds community participation in resilience planning efforts.

**Weaknesses and Shortcomings**

Despite the clear efforts of AFAD or the municipality, not just Istanbul but the whole country seem to be lacking effective and permanent outcomes when they face disasters, which points out ongoing DRM weaknesses. The initial issue comes from irregular code enforcement. Many historical stone and wooden buildings remain the same without any proper reinforcement or any measures taken against fires and earthquakes. The city claims to have set up more than 5,500 spots for people to gather safely during emergencies. Investigations point out that close

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470 Emre Açar, 6306 sayılı Kanun kapsamında riskli yapı kavramı [Risky building concept under Law No. 6306], Türkiye Adalet Akademisi Dergisi, 15(57), (2024): 225–246. https://doi.org/10.54049/taad.1418228

471 Filiz Daşkıran and Duygu Ak, 6306 sayılı Kanun kapsamında kentsel dönüşüm [Urban transformation within the scope of Law No. 6306], Yönetim ve Ekonomi Araştırmaları Dergisi, 13(3), (2015): 259–273. https://dergipark.org.tr/tr/download/article-file/203266

472 World Bank. (2025, August 8). World Bank Supports Istanbul's Disaster Resilience with New $650 Million Project.

473 Adalı Dergisi. (2023, August 10). AFAD ve İBB'den İstanbul için Deprem Raporu: 12 İlçe Diken Üstünde.

474 World Bank. (2025, August 8).

475 AFAD. (2021, May 20). 2021 Afet Eğitim Yılı kapsamında ulaşılan kişi sayısı 10 milyonu aştı [Over 10 million people reached through the 2021 Disaster Education Year]. Republic of Türkiye Disaster and Emergency Management Presidency (AFAD). https://www.afad.gov.tr/2021-afet-egitim-yili-kapsaminda-ulasilan-kisi-sayisi-10-milyonu-asti---basin-bulteni-17052021

to 40 percent of districts still miss out on reachable safe areas. Unprotected redevelopment in urban spots plays a key role in that problem.[476]

The reason for which is that previously designated gathering points for emergencies have been converted into commercial or residential zones which gives an idea of the corrupted mentality of "money over safety", in our current day world.

Another issue comes from social unfairness in the system. Most investments head straight to upscale or tourist-heavy neighborhoods like Karaköy. This leaves at-risk groups in places such as Balat or Hasköy with hardly any real improvements. In a way, without fair distribution of funds, building resilience ends up as something only certain people can access. It shifts from a shared right to more of a luxury.[477]

On top of that, involvement from communities and their collective memories stays underutilized in many cases, as well as memory preservation. Official planning efforts frequently sideline local residents altogether. The formal plans and guidelines created by the officials seem to be lacking the participation from locals in the planning stages. That breeds distrust when it comes to urban renewal projects or messages about risks.

Another important issue derives from the need of utilization of community involvement and historical knowledge. Residents in Golden Horn areas who have lived there for a long time witness choices being made without consulting them. The implementation of evacuation plans and the effectiveness of retrofitting programs are affected by the absence of participatory and an open governance. Using cultural memory could change things in a better way. Integrating tales of past disasters, local rituals, and histories tied to neighborhoods would help turn basic knowledge into lasting readiness; which is also suggested by the Sendai Framework, highlighting that risk discussions need to be sensitive to social and cultural factors.

Technical policies for risk reduction have gotten better overall. But the process of integrating context still feels incomplete in several ways. The Golden Horns wetlands together with parks and waterfront boulevards have evolved into important urban attractions that people get use of. These areas were neglected before under the subject of emergency planning. The Golden Horn plans fail to properly address flood risks which occur when heavy rainfall or rising sea levels affect the area. Tough, the 2021 Climate Action Plan of Istanbul includes flood mitigation as one of its main objectives, the installation of drainage systems throughout the city remains behind schedule.[478] Similarly, fire risk in Golden Horn has not been reevaluated, as most of the historical areas around Golden Horn were built from masonry and timber elements, the older wooden upper floors of these buildings call for an updated security check for fire safety. Apparently, Istanbul Fire Department (İBB İtfaiyesi) released research about rooftop solar fire risks but there is no matching survey available for the Golden Horn's historic residential

476 Turkey Recap. (2025, February 4). Out of space: Lack of safe zones deepens Istanbul's earthquake risks. Turkey Recap. https://www.turkeyrecap.com/out-of-space-lack-of-safe-zones-deepens-istanbuls-earthquake-risks
477 Stewart, I. (2021, March 4). Risk communication in tomorrow's Istanbul. Tomorrow's Cities – Urban Disaster Risk Hub, University of Edinburgh. Available from: https://www.tomorrowscities.org/news/risk-communication-tomorrows-istanbul
478 İstanbul Büyükşehir Belediyesi [IMM]. (2021). İstanbul İklim Eylem Planı 2050 [Istanbul Climate Action Plan 2050]. Istanbul: IMM Directorate of Environmental Protection and Climate Change.

buildings.[479] The current policy approach handles earthquake and fire incidents independently without recognizing their potential to create combined disaster events. The Sendai framework requires active implementation of multi-hazard risk management systems.[480] All earthquake retrofitting projects need to include fire hydrants and ladders as mandatory equipment.

**Toward a More Resilient Golden Horn**

The evidence also shows that resilience in Golden Horn requires a multi-dimensional strategy – policy making of history and innovation. The principal recommendations, following Sendai Framework principles and the outcome of this analysis, some recommendations will be listed below.

Modernizing & updating old regulations while implementing new ones. The municipality must ensure that Istanbul's latest seismic and fire codes are applied rigorously in the Golden Horn district. This means paying for routine examinations of historic wooden and masonry structures and demolishing any unauthorized top-floor expansions or dangerous renovations.

Legally, the city should clearly define and protect assembly areas & gathering spots—like closing development zones around existing parks and schoolyards. This way, the “weak surveillance” that are noted will be addressed through stricter code enforcement.

An expanded and inclusive approach towards renovations and planning. The implementation of disaster-risk reduction measures needs to occur with fairness for all affected populations. The municipality should provide financial support for low-income Golden Horn neighborhood residents to perform retrofits through collective housing cooperatives instead of requiring individual homeowners to fund their own projects.

Other similar examples in the world can be implemented in the Turkish system, as the community action plan of San Francisco : “Earthquake Resilience in San Francisco”. As recommendations suggest under the Community Action Plan for Seismic Safety (CAPSS) Project:

“The City should provide technical and financial assistance to important non-profit organizations, medical clinics, and similar organizations that meet the basic needs of many cizitens to seismically retrofit their buildings or relocate to better buildings.” (Recommendation 6) [481]

479 İstanbul İtfaiyesi [Istanbul Fire Department]. (2024). Güneş paneli yangın riski değerlendirmesi [Solar panel fire-risk assessment]. Retrieved from https://itfaiye.ibb.gov.tr
480 United Nations Office for Disaster Risk Reduction [UNDRR]. (2015). Sendai Framework for Disaster Risk Reduction 2015–2030. Geneva: United Nations.
481 Applied Technology Council, Here Today—Here Tomorrow: The Road to Earthquake Resilience in San Francisco: A Community Action Plan for Seismic Safety (ATC-52-2) (San Francisco: San Francisco Department of Building Inspection, 2010), p. 16.

“The City should enact a range of meaningful programs to help building owners afford retrofits. Owners ultimately are responsible for the earthquake performance of their buildings: they have the most to gain from improved performance, and the most to lose because of damage and liability. However, the City has an overriding interest in reducing the amount of damage that occurs to privately-owned buildings in future earthquakes. Therefore, it makes sense for the City to invest in encouraging building owners to make their buildings safer.” (Recommendation 9)[482]

The upcoming urban development initiatives need to include seismic safety measures during their design process while seeking community feedback about their design elements. Additionally, local historians and craftspeople must be involved in any Build Back Better restoration. For example, when restoring balconies or eaves following an earthquake, getting help from traditional design techniques to preserve heritage should be highly suggested.

As Recommendation 13 suggests, “Enact a façade ordinance.” , an ordinance should mandate that façades, parapets, and ornamental elements affixed to building exteriors be inspected on a regular basis and that objects deemed to constitute falling dangers be repaired. During earthquakes or at any other moment, parts of building façades can come off and kill passersby. [483]

Istanbul and Golden Horn could also benefit from this recommendation if adopted into its resilience frameworks and plans, given the city’s history architectural character and the prevalence of aging buildings constructed with outdated materials and techniques, these measures would help to ensure safety and conservation of its built heritage.

Another great example is Tokyo and its Earthquake Preparedness Ordinance, in which the city conducts a survey in every five-year, covering all neighborhoods, then designating the worst risk areas, which is called “Community Risk Assessments”. The areas operate under rigid construction standards together with newly implemented urban planning regulations. The Tokyo government has extended its Disaster-Resistant Urban Development Plan until 2030 to build more improvement routes and establish firebreak parks throughout residential areas. The government offers substantial financial benefits through tax reductions and subsidy programs to encourage homeowners to replace their wooden exterior walls with fire-resistant cladding, shutters and seismic ties.[484]

When it comes to Istanbul, Golden Horn, with some similar traits like the wooden building fabric situation in Tokyo, can implement some measures from Tokyo’s Urban Development Plan into its own. To build on the already existing seismic building codes, the 2012 Transformation Law and the Istanbul Provincial Risk Reduction Plan, Istanbul could emulate Tokyo by formally mapping community risk (as in Tokyo’s five-year surveys) and then zoning its worst districts as “redevelopment” areas. In practice this could mean widening key streets and adding parks as firebreaks in the Golden Horn, while offering home-owners grants or tax

482 Ibid.

483 Applied Technology Council, Here Today—Here Tomorrow: The Road to Earthquake Resilience in San Francisco: A Community Action Plan for Seismic Safety (ATC-52-2) (San Francisco: San Francisco Department of Building Inspection, 2010), p. 17.

484

relief to replace old timber facades and install fire shutters or seismic reinforcements – exactly as Tokyo has done

Leverage cultural memory. The Golden Horn's identity serves as a strength that helps people endure difficult times. Educational institutions at local schools and museums should teach students about historical disasters and recovery narratives starting from the 1509 "Little Judgment Day" earthquake until the flammable wooden city structure. The Golden Horn Resilience Center could operate from a restored boathouse to let residents show historical Golden Horn photographs while teaching basic emergency readiness techniques. The Golden Horn waterfront should host annual community events which include earthquake simulation exercises and boat evacuation training demonstrations. The integration of risk awareness into Golden Horn's cultural activities enables us to preserve community history while teaching residents practical emergency skills.[3]

Establishing green-blue infrastructure as an investment. The Golden Horn area has experienced significant ecological restoration work during the last few decades. The current ecological restoration progress needs to maintain its forward movement while focusing on disaster resistance. By retaining moisture, restored wetlands and flood zones at the Horn's head (Alibeyköy Creek) can serve as fire and storm surge barriers. Earthquake erosion can be minimized by planting drought-resistant vegetation along steep slopes. Golden Horn schools or mosques could benefit from the Istanbul Resilience Project's focus on rainwater gathering in public buildings, which would make them twice as helpful as water supplies in a disaster.

Istanbul will always be under the risk of having earthquakes and other natural hazards in its future, but with foresight and effort, the consequences of those hazards can be reduced so that the city can achieve faster recovery times and protect its architectural and cultural heritage through dedicated governance and long-term planning and risk reduction strategies. Golden Horn area presents a vital point where historical protection meets disaster readiness requirements. The area needs ongoing long-term planning and regular heritage structure inspections and disaster-risk reduction strategies must become standard in urban governance. Istanbul will reduce damage while speeding up recovery processes and protecting its historic urban environment through dedicated efforts to implement these measures. The Golden Horn area will establish itself as a resilience model which unites historical preservation with modern safety measures in its developing urban structure.

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## C. International Comparative Case Studies

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# Annex

## Annex I - Glossary

***/ Build back better /***

The use of the recovery, rehabilitation and reconstruction phases after a disaster to increase the resilience of nations and communities through integrating disaster risk reduction measures into the restoration of physical infrastructure and societal systems, and into the revitalization of livelihoods, economies and the environment. Annotation: The term "societal" will not be interpreted as a political system of any country.[485]

***/ disaster /***

A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts[486]

***/ disaster risk /***

The potential loss of life, injury or destroyed/damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity[487]

***/ disaster risk management /***

The application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to strengthening resilience and reducing disaster losses. It includes prospective, corrective and compensatory actions and can involve community-based and indigenous approaches[488]

***/ exposure /***

The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas. Measures of exposure can include counts of people or assets in the area[489]

***/ hazard /***

A process, phenomenon or human activity that may cause loss of life, injury, property damage, social and economic disruption or environmental degradation. Each hazard is characterized by its location, intensity (or magnitude), frequency and probability[490]

***/ heritage /***

Heritage refers to the cultural, historical, and social legacies passed down through generations[491]

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485United Nations Office for Disaster Risk Reduction (UNDRR). 2017. The Sendai Framework Terminology on Disaster Risk Reduction. Accessed 31 December 2025. https://www.undrr.org/terminology/disaster.
486 UNDRR, Terminology on Disaster Risk Reduction.
487 UNDRR, Terminology on Disaster Risk Reduction.
488 UNDRR, Terminology on Disaster Risk Reduction.
489 UNDRR, Terminology on Disaster Risk Reduction.
490 UNDRR, Terminology on Disaster Risk Reduction.
491 UNESCO, Operational Guidelines for the Implementation of the World Heritage Convention, Paris: UNESCO World Heritage Centre, latest ed., definition of "Cultural Heritage."

***/ indigenous knowledge /***

Indigenous knowledge refers to traditional/local practices and understandings that can complement scientific risk assessments and contribute to community-based disaster risk management[492]

***/ resilience /***

The capacity of a system, community or society exposed to hazards to resist, absorb, adapt to, transform and recover from those impacts in a timely and efficient manner[493]

***/ risk /***

Risk is the probabilistic function of hazard, exposure, vulnerability and capacity, expressed as potential loss of life, injury, or destroyed/damaged assets in a defined period[494]

***/ risk assessment /***

A *qualitative or quantitative approach to determine the nature and extent of disaster risk by analysing potential hazards and evaluating existing conditions of exposure and vulnerability*, including hazard characteristics and capacities[495]

***/ Tanzimat /***

A period of Ottoman reform (1839–1876) characterized by *modernizing legal, administrative and social structures*, including efforts toward centralization and equality under law[496]

***/ urban resilience /***

The ability of a city or urban community to withstand, recover from or adapt to natural and human-made disasters and stresses, maintaining key functions, structures and identities[497]

***/ vulnerability /***

The conditions determined by physical, social, economic and environmental factors or processes that increase the susceptibility of an individual, community, assets or systems to the impacts of hazards. Vulnerability makes exposure more likely to suffer harm when hazards occur[498]

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492 UNDRR, Words into Action: Engaging for Resilience—Working with Indigenous and Local Knowledge, Geneva: United Nations Office for Disaster Risk Reduction, 2018

493 UNDRR, Terminology on Disaster Risk Reduction.

494 UNDRR, Terminology on Disaster Risk Reduction.

495 UNDRR, Terminology on Disaster Risk Reduction.

496 Halil İnalcık, The Ottoman Empire: The Classical Age 1300–1600, London: Phoenix Press, 1994.

497 UNDRR, Terminology on Disaster Risk Reduction

498 UNDRR, Terminology on Disaster Risk Reduction.

## Annex II - Institutional Acronyms and Explanations

**AFAD - Disaster and Emergency Management Authority of Türkiye (Afet ve Acil Durum Yönetimi Başkanlığı)**
The national institution responsible for disaster risk reduction, emergency response, and post-disaster recovery in Türkiye.[499]

**DRM - Disaster Risk Management**
Disaster risk management is the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses.[500]

**DRR - Disaster Risk Reduction**
Disaster risk reduction is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development.[501]

**İBB - Istanbul Metropolitan Municipality (İstanbul Büyükşehir Belediyesi)**
The primary local authority responsible for metropolitan planning, infrastructure, and disaster preparedness policies in Istanbul.[502]

**ICCROM - International Centre for the Study of the Preservation and Restoration of Cultural Property**
ICCROM is an intergovernmental organization dedicated to the conservation of cultural heritage worldwide. In the context of disaster risk, ICCROM focuses on heritage risk management, promoting prevention, preparedness, emergency response, and recovery strategies to protect cultural heritage from natural and human-induced hazards, while integrating disaster risk reduction principles into heritage conservation practices.[503]

499 Republic of Türkiye, Disaster and Emergency Management Authority (AFAD). About AFAD. Ankara: AFAD. Accessed 31 December 2025. https://www.afad.gov.tr.
500 UNDRR, Terminology on Disaster Risk Reduction.
501 UNDRR, Terminology on Disaster Risk Reduction.
502 Istanbul Metropolitan Municipality (İBB). About IMM. Istanbul: İBB. Accessed 31 December 2025. https://www.ibb.istanbul.
503 ICCROM, Disaster Risk Management of Cultural Heritage: A Training Manual, Rome: ICCROM, 2016.

**İDMP - İstanbul Deprem Master Planı (2003) -** *Earthquake Master Plan for Istanbul*
The İstanbul Deprem Master Planı (İDMP) was prepared in 2003 under the coordination of the Istanbul Metropolitan Municipality (İBB) in collaboration with four universities and multiple expert groups. The plan represents the first comprehensive, scientific attempt to assess earthquake risk at the metropolitan scale and to develop an integrated strategy for risk reduction in Istanbul. Although earthquake-focused in name, İDMP adopted a systemic urban risk management approach by identifying **13 risk sectors**, including buildings, infrastructure, health services, cultural heritage, and emergency response capacity. The plan emphasized the interdependence of hazards, recognizing that reducing seismic vulnerability would also mitigate secondary risks such as fires, industrial accidents, and infrastructure failures. İDMP marked a transition from hazard-specific thinking toward multi-sectoral urban resilience planning.[504]

**IFRC - International Federation of Red Cross and Red Crescent Societies**
A global humanitarian organization that supports national Red Cross and Red Crescent societies in disaster preparedness, emergency response, recovery, and resilience-building worldwide.[505]

**IPCC - Intergovernmental Panel on Climate Change**
The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body responsible for assessing the scientific knowledge related to climate change, its impacts, risks, adaptation, and mitigation, by systematically reviewing and synthesizing peer-reviewed scientific literature to inform policymakers.[506]

**İRAP -** ***İl Afet Risk Azaltma Planı*** **(Provincial Disaster Risk Reduction Plan**
A strategic planning instrument developed by AFAD to identify provincial hazard profiles, assess disaster risks, and define risk reduction actions, integrating land-use planning, building regulations, and sectoral responsibilities at the local level.[507]

**NAF - North Anatolian Fault**
The North Anatolian Fault (NAF) is a major right-lateral strike-slip fault system extending across northern Türkiye. It is one of the most seismically active fault zones in the Eastern Mediterranean region and has been responsible for numerous destructive earthquakes affecting major urban areas, including Istanbul. The NAF constitutes a primary seismic hazard influencing disaster risk, urban vulnerability, and resilience planning in the Marmara Region.[508]

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504 İstanbul Büyükşehir Belediyesi. İstanbul Deprem Master Planı. Istanbul: İBB, 2003.
505 International Federation of Red Cross and Red Crescent Societies (IFRC). About IFRC. Geneva: IFRC. Accessed 31 December 2025. https://www.ifrc.org.
506 Intergovernmental Panel on Climate Change (IPCC), About the IPCC, accessed 2026.
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**TAMP - Türkiye Afet Müdahale Planı (2014) (*Turkish National Disaster Response Plan)***
The Türkiye Afet Müdahale Planı (TAMP) is Turkey's national disaster response framework, prepared by AFAD to standardize emergency management during and immediately after disasters. Unlike İRAP, which focuses on risk reduction and prevention, TAMP is a **response-oriented plan** that defines operational coordination, command structures, and sectoral responsibilities. It establishes "service groups" (e.g., shelter, health, transportation, communication) and outlines how national, provincial, and local actors interact during emergencies. TAMP ensures interoperability between central government agencies, provincial AFAD directorates, and municipal emergency units such as AKOM.[509]

**UNDRR - United Nations Office for Disaster Risk Reduction**
The United Nations Office for Disaster Risk Reduction (UNDRR) is the United Nations entity responsible for coordinating global efforts to reduce disaster risk. UNDRR supports the implementation, monitoring, and review of the Sendai Framework for Disaster Risk Reduction, develops official DRR terminology, promotes risk-informed development policies, and facilitates cooperation among governments, institutions, and communities to reduce disaster losses worldwide.[510]

**UNESCO - United Nations Educational, Scientific and Cultural Organization**
UNESCO is a specialized agency of the United Nations that promotes international cooperation in education, science, culture, and communication. In disaster risk and urban studies, UNESCO plays a key role in cultural heritage protection, particularly through the World Heritage Convention, and supports the integration of risk management, resilience, and sustainability principles into heritage conservation and urban development policies.[511]

**UN-SPIDER - United Nations Platform for Space-based Information for Disaster Management and Emergency Response**
A United Nations programme under the Office for Outer Space Affairs (UNOOSA) that supports disaster risk reduction and emergency response through the use of satellite data, geospatial information, and space-based technologies.[512]

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