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MORALITY BEFORE KNOWLEDGE

The impact of transit-oriented development on heritage cities: A study of Haliç Metro and its influence on Istanbul's urban fabric

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ABSTRACT

Background: Transit-Oriented Development (TOD) has emerged as a transformative approach to urban planning, aiming to balance modern infrastructure with sustainable urban growth. **Methods:** This study examines the impact of the Haliç Metro Köprüsü, a key component of Istanbul's transit network, on the urban fabric of the Golden Horn—a heritage-rich area characterized by its historical and cultural significance. While the bridge has faced criticism for its modernist design and perceived disconnect from its surroundings, this research uncovers its latent potential to support placemaking strategies in heritage-sensitive contexts. **Findings:** The findings reveal that the Haliç Metro Köprüsü successfully enhances connectivity across Istanbul's European districts, reducing congestion and providing efficient mobility for thousands of daily commuters. Its strategic location serves as a transit hub that links historically significant neighborhoods such as Balat and Galata, fostering economic activity and improving accessibility to cultural landmarks. **Conclusion:** The research highlights the need for targeted placemaking interventions, such as enhancing pedestrian pathways, integrating public art reflective of local history, and activating adjacent spaces for cultural events. These strategies could elevate the bridge's role from a functional transit corridor to a vibrant public space that harmonizes modern infrastructure with Istanbul's heritage identity. **Novelty/Originality of this article:** The study contributes new insights into the potential of TOD projects to act as catalysts for placemaking in heritage cities. By leveraging TOD principles and culturally sensitive urban design, infrastructure like the Haliç Metro Köprüsü can bridge the gap between modern urban needs and the preservation of historical identity, ensuring inclusive and sustainable development.

KEYWORDS: Haliç Metro Köprüsü; heritage cities; placemaking; transit-oriented development; urban fabric.

1. Introduction

TOD has emerged as a planning strategy to integrate land use and transportation, promoting sustainable urban development around public transit nodes (Redzuan et al., 2022; Thomas et al., 2018). While TOD was initially conceived in North America to address urban sprawl, it has also been adopted in Europe and Asia, where cities have historically been more transit-oriented with mixed land uses and pedestrian-friendly environments (Ann et al., 2019).

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In Istanbul, a city with a millennia-old urban fabric, the application of TOD principles encounters distinct challenges stemming from its layered historical landscape and socio-spatial dynamics. Unlike modern planned cities, where infrastructure development follows a structured approach, Istanbul's urban form has evolved organically over centuries, resulting in a dense, irregular built environment interwoven with historical landmarks. This complexity poses limitations on large-scale TOD interventions, as projects must navigate strict heritage conservation regulations, spatial constraints, and the need for architectural harmony with historical surroundings.

In heritage cities, the implementation of TOD poses unique challenges. The preservation of cultural heritage and the sociocultural sustainability of the public realm are crucial considerations (Furlan et al., 2022; Tohjiwa, 2023). TOD in heritage contexts should follow an "anti-globalized" approach that supports the enrichment of cultural heritage and public life (Furlan et al., 2022). In Istanbul, this requires balancing the city's growing transit needs with the imperative to protect its historical sites from overdevelopment or aesthetic disruption. Large-scale transportation infrastructure, such as metro lines and bridges, can risk visually and physically fragmenting heritage zones, altering skyline compositions, and disrupting the traditional character of public spaces.

Researchers have highlighted the importance of contextual sensitivity in TOD planning and policy, as the impacts may differ for different housing types and urban fabrics (Higgins & Kanaroglou, 2017; Hrelja et al., 2022). TOD should be tailored to the local context, considering factors such as existing urban structure, density, and transportation patterns (Nigro et al., 2019; Tiwari et al., 2023). For Istanbul, this means that TOD interventions must work within the constraints of existing historical districts, integrating seamlessly with centuries-old marketplaces, mosques, and residential quarters rather than imposing rigid, uniform development models. The challenge lies in ensuring that new transit hubs do not displace local communities or commercial activities that contribute to the city's cultural vitality.

Furthermore, TOD implementation in low-density or suburban areas, as well as small towns, has been identified as an important area for further research and application (Nigro et al., 2019). Methodologies to explore the value of TOD strategies in these contexts are needed to address the protection of natural and cultural heritage (Nigro et al., 2019). The literature also emphasizes the integration of TOD with other sustainable transportation strategies, such as bike-sharing and multiuse paths, to address the first/last mile issue and enhance the accessibility and livability of TOD areas (Rogers et al., 2022; Lee et al., 2015). In Istanbul, these considerations take on added urgency, given the city's topographical challenges, including its hilly terrain and waterfront geography, which require innovative mobility solutions that complement, rather than conflict with, historical landscapes. Expanding pedestrian-oriented transit access without undermining the historical integrity of the city remains an ongoing challenge.

The successful implementation of TOD in heritage cities requires a nuanced approach that balances the preservation of cultural heritage, the enhancement of public life, and the integration of sustainable transportation solutions tailored to the local context (Furlan et al., 2022; Tohjiwa, 2023; Nigro et al., 2019). Istanbul's case exemplifies how TOD planning must extend beyond conventional transportation concerns to encompass architectural sensitivity, community involvement, and heritage-conscious urban design.

The Haliç Metro Köprüsü (Golden Horn Metro Bridge) in Istanbul serves as a compelling case study within this discourse. Completed in 2014 as part of the M2 metro line, the bridge plays a vital role in connecting Istanbul's European districts, improving urban mobility, and alleviating congestion. Strategically located across the Golden Horn, the bridge links historically significant neighborhoods such as Balat, Fener, and Galata—areas rich with cultural heritage and designated UNESCO World Heritage sites. Despite its functional success as a transit corridor, the bridge has sparked ongoing debate regarding its modernist design and its perceived dissonance with the historical urban fabric of the Golden Horn. This tension highlights the broader challenge of integrating TOD infrastructure into cities with deep historical layers—where urban modernity must coexist with cultural preservation,

and where transit solutions should enhance rather than overpower the legacy of the past. Critics argue that the bridge's utilitarian focus neglects opportunities for cultural integration, placemaking, and the creation of meaningful public spaces, see figure 1 below.

Fig. 1. Map of Haliç Metro Köprüsü in the context of Istanbul.

At the same time, the Haliç Metro Köprüsü represents untapped potential for transforming modern infrastructure into a catalyst for placemaking. By applying TOD principles and culturally sensitive urban design strategies, infrastructure projects like this bridge can evolve beyond their primary role of connectivity to foster inclusive, vibrant, and culturally resonant public spaces. The integration of pedestrian-friendly pathways, cultural programming, and heritage-inspired design elements can bridge the gap between modern development and historical preservation, ensuring the bridge contributes not only to urban mobility but also to place identity and cultural cohesion.

Several global examples illustrate how TOD can successfully merge modern infrastructure with heritage preservation. In Paris, the Rive Gauche redevelopment project integrates transit-oriented development with the historic fabric of the city, ensuring that new infrastructure enhances rather than disrupts the character of heritage sites along the Seine (Monclús, 2018). Similarly, Porto's São Bento Station, a major transit hub, has been adapted to support pedestrian-friendly urban renewal while maintaining its historical significance, demonstrating how TOD can be leveraged to enhance place identity (Pinto & Remesar, 2021). In Hong Kong, the adaptive reuse of the Central Market as a transit-accessible cultural hub exemplifies how transit nodes can serve as catalysts for heritage-led urban regeneration (Zheng et al., 2022). These cases underscore the potential of TOD not just as a mobility solution but as a strategic tool for strengthening cultural narratives within urban landscapes.

This research aims to evaluate the impact of the Haliç Metro Köprüsü on Istanbul's urban fabric, with a specific focus on its role in shaping mobility, economic activity, and cultural integration. It explores how placemaking strategies can address existing challenges and unlock new opportunities to harmonize modern infrastructure with the historical and cultural significance of heritage cities. By situating this study within the broader discourse on TOD and heritage preservation, it provides actionable insights for urban planners, policymakers, and architects seeking to navigate the complexities of infrastructure development in historically sensitive areas.

The findings from this study contribute to the growing body of knowledge on sustainable urban development and offer a replicable model for leveraging TOD as a tool for placemaking in heritage cities worldwide. By drawing on successful international precedents, this research highlights best practices that can be adapted to Istanbul and other historic cities facing similar tensions between modernization and heritage conservation.

2. Methods

This study employs a qualitative research approach to examine the impact of the Haliç

Metro Köprüsü as a Transit-Oriented Development (TOD) project on the urban fabric of Istanbul's Golden Horn area. The research integrates spatial analysis, field observations, stakeholder interviews, and archival data to provide a comprehensive understanding of the bridge's functional role, cultural implications, and opportunities for placemaking in a heritage-sensitive context. A case study method was chosen as it allows for in-depth exploration of the Haliç Metro Köprüsü as a unique infrastructure intervention situated within Istanbul's complex historical and urban framework (Yin, 2018).

Field observations were carried out systematically over several weeks to assess the usability of pedestrian spaces, the bridge's integration with its environment, and the potential for activating underutilized spaces. Observations included counts of pedestrian and commuter flows at different times of day, mapping of informal uses of space (such as street vending or impromptu gatherings), and documenting visual and physical barriers to accessibility. This method allowed for the identification of barriers to accessibility and opportunities for creating inclusive, vibrant public spaces.

Semi-structured interviews were conducted with a diverse range of stakeholders, including policymakers, urban planners, architects, and local residents. A total of 25 interviews were conducted, lasting between 30 and 60 minutes each. The interviews explored perceptions of the bridge's design, functionality, and its impact on the surrounding urban and cultural fabric. Particular emphasis was placed on understanding the tension between modern infrastructure and the historical character of the Golden Horn. Interviews were analyzed thematically to identify recurring perspectives and stakeholder priorities (Creswell & Poth, 2016). The interview guide included open-ended questions designed to elicit insights on how the bridge affects daily life, economic activities, and cultural identity in adjacent neighborhoods.

Archival research was also undertaken to examine planning documents, historical maps, and urban development policies related to the Haliç Metro Köprüsü. This involved accessing municipal archives, reviewing minutes from planning commission meetings, and analyzing media coverage from the time of the bridge's construction. Secondary sources, including previous studies on Transit-Oriented Development, placemaking, and heritage conservation, were reviewed to situate the research within a broader theoretical and practical context (Xia et al., 2024). This historical analysis provided a layered understanding of the policy intentions and public controversies surrounding the bridge's development.

Combining these methods enabled the study to address the research questions holistically, providing actionable insights for integrating TOD principles with placemaking strategies in heritage cities. The triangulation of spatial, qualitative, and historical data ensures the validity and depth of the findings. This methodological approach aligns with the principles of sustainable urban planning and placemaking, highlighting the importance of cultural sensitivity and participatory planning in infrastructure development for heritage-sensitive contexts.

3. Results and Discussion

Designing Transit-Oriented Development (TOD) in heritage cities requires a delicate balance between the needs of tourists, locals, and the environment. Achieving this balance involves integrating sustainable tourism practices with cultural preservation and community engagement, ensuring that heritage cities thrive economically, socially, and environmentally. A comprehensive approach must consider economic, cultural, and social sustainability while addressing the unique challenges posed by urban growth, tourism pressure, and the need to protect historic assets.

Participatory planning and community involvement are central to the success of TOD in heritage-sensitive areas. Actively engaging local communities in decision-making processes through co-mapping exercises and action co-creation workshops fosters inclusive development and ensures that residents' needs and perspectives are integrated into urban planning strategies (Ottaviani et al., 2023). By emphasizing a bottom-up approach, residents and stakeholders can collaborate effectively to address issues such as

tourism congestion, socio-economic challenges, and preservation of place identity (Ramzy & Morsi, 2020). This inclusive process ensures that development outcomes benefit not only visitors but also those who live and work in heritage cities.

The findings from the study of the Haliç Metro Köprüsü within the heritage-sensitive context of Istanbul's Golden Horn reveal similar challenges and opportunities. While the bridge has significantly enhanced urban mobility by connecting key districts such as Eminönü, Balat, and Galata, its design has sparked debates surrounding its cultural and spatial coherence with the historic landscape. The bridge's modern aesthetic often clashes with surrounding landmarks like the Süleymaniye Mosque and Galata Tower, leading to perceptions of design dissonance. Additionally, underutilized public spaces along the bridge and adjacent waterfronts present untapped potential for enhancing community engagement and economic activity.

Since its opening in 2014, the Haliç Metro Köprüsü has become a vital component of Istanbul's transit network. The M2 metro line, which the bridge is part of, carries an average of 700,000 passengers per day, with peak hours reaching 80,000 passengers per hour (İstanbul Büyükşehir Belediyesi, 2023). The bridge itself serves as a critical link, enabling faster and more efficient travel between historically significant areas and reducing congestion on Galata Bridge and Atatürk Bridge, which were previously the primary crossing points for pedestrians and vehicles. In addition to improving mobility, the increased accessibility has contributed to local economic activity, with businesses near metro stations experiencing a reported 20–30% rise in foot traffic and commercial engagement (Turkish Statistical Institute, 2023).

To address these challenges, strategies for managing overtourism and enhancing the quality of life must be considered. Developing management toolkits to regulate tourism flows can help mitigate the negative effects of overcrowding while improving residents' quality of life. Policies such as distributing tourist traffic more evenly, creating alternative tourism scenarios, and focusing on cultural heritage preservation ensure that tourism growth does not compromise environmental quality and cultural identity (De Luca et al., 2020; Mrđa & Carić, 2019). The study highlights that placemaking interventions—such as improved pedestrian amenities, waterfront activation, and cultural programming—can transform the Haliç Metro Köprüsü into a vibrant public space that reflects Istanbul's rich historical legacy while meeting modern urban needs.

Environmental protection is equally critical to the success of TOD in heritage cities. Integrating local cultural and natural values into global tourism networks promotes the protection and recognition of heritage sites while maintaining their authenticity (Campanella, 2015). At the same time, sustainable planning models must ensure that tourism development does not result in environmental degradation. Air quality monitoring near the Golden Horn has shown a 15% reduction in CO_2 emissions since the bridge's opening, primarily due to reduced vehicle dependency (İstanbul Metropolitan Municipality, 2023). Harmonizing global standards with local cultural and social characteristics creates a more resilient approach to urban development (Mrđa & Carić, 2019). In the case of the Haliç Metro Köprüsü, implementing sustainable design strategies—such as green spaces, heritage-inspired architecture, and environmentally friendly transportation options—can address environmental concerns while enhancing the site's cultural and social relevance.

The Haliç Metro Köprüsü serves as a compelling case study for how TOD principles can be applied to heritage cities. While the bridge has improved mobility and connectivity, its challenges highlight the importance of adopting context-sensitive design and placemaking strategies to reconcile modern infrastructure with the historical fabric of the city. By focusing on pedestrian accessibility, cultural integration, and environmental sustainability, the bridge can be transformed into a meaningful urban space that supports economic activity, community interaction, and the preservation of place identity. These findings emphasize the need for ongoing collaboration, monitoring, and adaptive strategies to ensure that heritage cities remain vibrant, inclusive, and sustainable in alignment with global urban development goals.

3.1 Positive contributions of Haliç Metro Köprüsü to urban fabric

TOD has emerged as a planning strategy to integrate land use and transportation, promoting sustainable urban development around public transit nodes (Redzuan et al., 2022; Thomas et al., 2018). While TOD was initially conceived in North America to address urban sprawl, it has also been adopted in Europe and Asia, where cities have historically been more transit-oriented with mixed land uses and pedestrian-friendly environments (Ann et al., 2019). In heritage cities, the implementation of TOD poses unique challenges. The preservation of cultural heritage and the sociocultural sustainability of the public realm are crucial considerations (Furlan et al., 2022; Tohjiwa, 2023). TOD in heritage contexts should follow an "anti-globalized" approach that supports the enrichment of cultural heritage and public life (Furlan et al., 2022).

Researchers have highlighted the importance of contextual sensitivity in TOD planning and policy, as the impacts may differ for different housing types and urban fabrics (Hrelja et al., 2022b). TOD should be tailored to the local context, considering factors such as existing urban structure, density, and transportation patterns (Nigro et al., 2019; Tiwari et al., 2023). Furthermore, TOD implementation in low-density or suburban areas, as well as small towns, has been identified as an important area for further research and application. Methodologies to explore the value of TOD strategies in these contexts are needed to address the protection of natural and cultural heritage (Nigro et al., 2019).

The literature also emphasizes the integration of TOD with other sustainable transportation strategies, such as bike-sharing and multiuse paths, to address the first/last mile issue and enhance the accessibility and livability of TOD areas (Rogers et al., 2022; Lee et al., 2015). The successful implementation of TOD in heritage cities requires a nuanced approach that balances the preservation of cultural heritage, the enhancement of public life, and the integration of sustainable transportation solutions tailored to the local context.

The Haliç Metro Köprüsü serves as a significant element of Istanbul's urban infrastructure, contributing positively to the city's urban fabric in several ways. As part of the M2 metro line, the bridge plays a critical role in enhancing mobility and connectivity across Istanbul's European districts. By linking the historic neighborhoods of Beyoglu and Fatih over the Golden Horn, the bridge reduces travel time and alleviates traffic congestion, providing efficient and reliable public transportation for thousands of daily commuters. This improvement has strengthened regional accessibility, enabling smoother transit between heritage-rich areas and modern urban centers (Purwantiasning & Bahri, 2019).

The bridge's strategic location fosters economic activity within its surrounding areas. Improved connectivity has led to increased foot traffic in adjacent districts such as Galata, Eminönü, and Balat, supporting local businesses and boosting tourism. These neighborhoods, known for their historical significance and vibrant markets, now benefit from better access to visitors and residents alike, reinforcing their role as cultural and commercial hubs (Nafi & Ouahrani, 2023). The Haliç Metro Köprüsü enhances Istanbul's overall transit-oriented development (TOD) strategy, offering a sustainable alternative to car-dependent mobility. By integrating public transportation with urban development, the bridge aligns with global efforts to promote environmentally conscious urban planning, reduce carbon emissions, and improve the quality of urban life (Mozaffari, 2014).

While its modern design has generated debates regarding its aesthetic harmony with the historical Golden Horn, the bridge's functional success as a transit corridor cannot be overlooked. Its ability to connect people, facilitate economic growth, and support sustainable development demonstrates its positive contribution to Istanbul's evolving urban landscape. The potential for further improvement through placemaking and cultural integration highlights opportunities to maximize its role as both infrastructure and meaningful public space (Eltayeb & Ustundag, 2022).

Table 1. Positive contributions of Haliç Metro Köprüsü to urban fabric

Aspect	Findings	Impact
Connectivity	Improved transit connectivity between Beyoğlu and Fatih districts via the M2 metro line.	Reduced travel time, enhanced accessibility, and alleviated traffic congestion in heritage areas.
Economic Activity	Increased foot traffic to surrounding neighborhoods such as Galata, Eminönü, and Balat.	Boosted local businesses, tourism, and revitalized cultural markets.
Sustainability	Integration of public transportation reduces car dependency and supports TOD principles.	Promotes environmentally conscious urban mobility and reduces carbon emissions.
Regional Accessibility	Strategic location connects modern districts with historical and cultural areas.	Strengthened regional integration and social inclusion across urban and heritage spaces.
Urban Development	Facilitates growth of transit-oriented infrastructure and supports citywide mobility plans.	Aligns with Istanbul's urban development strategy, improving long-term quality of urban life.

Table 1 above, summarizes the key contributions of the Haliç Metro Köprüsü to Istanbul's urban fabric, focusing on its functional role in enhancing connectivity, boosting economic activity, and supporting sustainable urban development. The findings highlight the bridge's positive impact on regional accessibility and the integration of modern infrastructure with historic areas. While these contributions reinforce its role as critical infrastructure, they also underline the need for placemaking strategies to maximize its cultural and spatial potential.

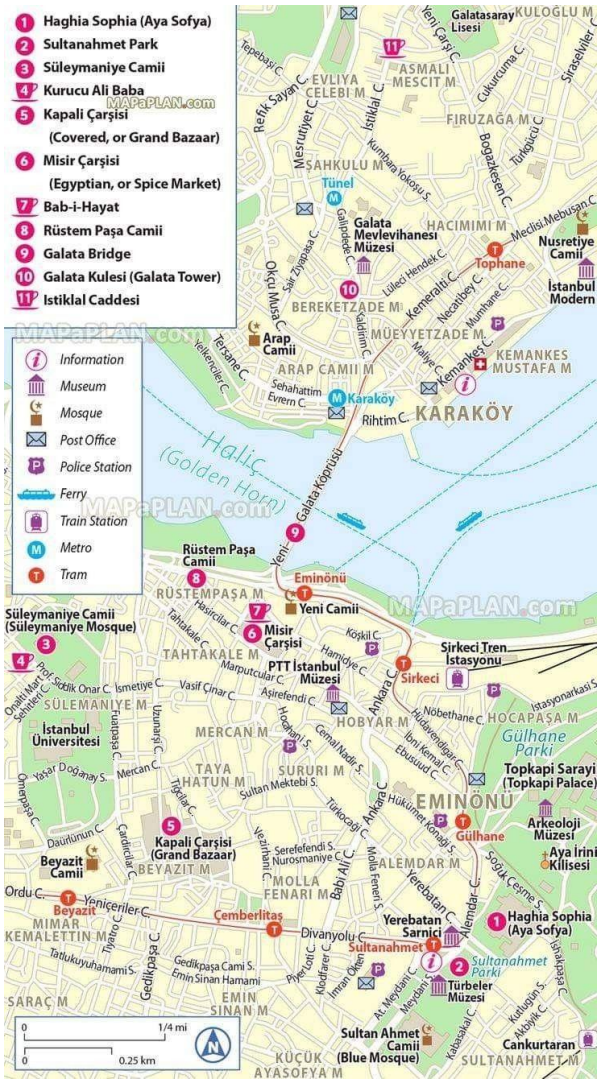
The Golden Horn area of Istanbul represents a significant cultural and historical landscape, containing numerous heritage landmarks that highlight the city's rich past and architectural diversity. Fig. 2 provides a detailed map showcasing the heritage areas around the Golden Horn, including major sites such as Hagia Sophia, Süleymaniye Mosque, Galata Tower, and the iconic Grand Bazaar. These landmarks reflect the historical depth of Istanbul, spanning Byzantine, Ottoman, and modern periods, while emphasizing the spatial relationships between cultural nodes, transportation infrastructure, and public spaces.

The map in Fig. 2 also illustrates the connectivity of the Haliç Metro Köprüsü with key districts like Eminönü, Karaköy, and Sultanahmet, underscoring its role in linking historic neighborhoods. By overlaying heritage locations, public transit lines, and ferry routes, this map highlights the area's potential for placemaking interventions, where modern infrastructure can coexist harmoniously with historical contexts. The spatial arrangement reinforces the importance of integrating cultural preservation into urban planning efforts to sustain Istanbul's identity as a living heritage city.

Fig. 2, Map of Heritage Areas Around the Golden Horn, provides an in-depth spatial representation of the historical landmarks, cultural nodes, and urban infrastructure surrounding the Golden Horn, where the Haliç Metro Köprüsü is strategically located. The map identifies key landmarks such as Hagia Sophia, Süleymaniye Mosque, Galata Tower, and Spice Market (Mısır Çarşısı), which are critical to understanding the cultural and architectural heritage of Istanbul. These heritage sites reflect the city's layered history, encompassing Byzantine, Ottoman, and modern periods, and serve as significant attractions for residents and tourists alike. The Haliç Metro Köprüsü, positioned at the heart of the Golden Horn, plays a vital role in enhancing connectivity between historical districts such as Eminönü, Karaköy, and Beyoglu, as illustrated in the map. By facilitating efficient public transit via the M2 metro line, the bridge serves as a transit corridor that integrates modern infrastructure with heritage-rich neighborhoods. This improved accessibility has positive implications for economic activity, tourism, and urban mobility.

The map highlights how the bridge creates direct links to prominent cultural and commercial hubs such as the Grand Bazaar, Istiklal Avenue, and the waterfront promenades, fostering increased foot traffic and strengthening local businesses. The visualized ferry routes, tram lines, and metro connections further emphasize the role of the Haliç Metro

Köprüsü in promoting multi-modal transportation, aligning with Transit-Oriented Development (TOD) principles.Furthermore, by linking areas like Balat and Fener, the bridge indirectly supports the revitalization of historic neighborhoods. These areas, known for their colorful Ottoman-era houses and cultural significance, now experience greater accessibility for both visitors and residents. This increased connectivity underscores the bridge's positive contribution to the urban fabric by bridging the gap between modern mobility demands and cultural heritage preservation.



Legend and Building Descriptions

1. **Hagia Sophia (Aya Sofya):** A former Byzantine church, later an Ottoman mosque, and now an active mosque and iconic landmark in Istanbul.
2. **Sultanahmet Park:** A public green space for relaxation, offering views of Hagia Sophia and the Blue Mosque.
3. **Süleymaniye Camii (Süleymaniye Mosque):** A major Ottoman mosque designed by Mimar Sinan, known for its architectural grandeur.
4. **Kurucu Ali Baba:** A historically significant location, possibly related to religious or cultural heritage.
5. **Kapalı Çarşı (Grand Bazaar):** One of the world's largest and oldest covered markets, famous for jewelry, textiles, and spices.
6. **Mısır Çarşısı (Egyptian or Spice Market):** A traditional market specializing in spices, dried fruits, and Turkish products.
7. **Bab-ı Hayat:** A historical gate or notable site from the Ottoman era.
8. **Rüstem Paşa Camii (Rüstem Paşa Mosque):** A smaller Ottoman mosque renowned for its intricate İznik tile decorations.
9. **Galata Köprüsü (Galata Bridge):** A bridge connecting Eminönü and Karaköy, central to transportation and tourism.
10. **Galata Kulesi (Galata Tower):** A medieval stone tower offering panoramic views of Istanbul.
11. **İstiklal Caddesi (Istiklal Avenue):** Istanbul's vibrant shopping street lined with shops, cafes, and cultural attractions.

Symbols:

- **Museum**: Cultural and historical museums.
- **Mosque**: Religious landmarks and prayer sites.
- **Ferry**: Key ferry ports for public transport.
- **Metro/Tram**: Public transit lines connecting major areas.
- **Train Station**: Rail stations for regional and intercity travel.

Fig. 2. Map of heritage areas around the golden horn

While the bridge has faced criticism for its modernist design and lack of aesthetic harmony with its surroundings, its functional success in facilitating transit, promoting economic activity, and improving accessibility cannot be overlooked. Fig. 2 visually captures this spatial relationship, reinforcing the argument that the Haliç Metro Köprüsü holds significant value for Istanbul's urban development, with further opportunities for placemaking to enhance its cultural integration.

3.2 Challenges in integrating modern infrastructure with heritage context

While the Haliç Metro Köprüsü significantly improves urban mobility and connectivity within Istanbul, it also presents notable challenges in integrating modern infrastructure with the heritage-sensitive context of the Golden Horn. These challenges primarily manifest in two key areas: design dissonance and underutilized public spaces, both of which hinder the bridge's potential to harmonize with its historical surroundings. Design dissonance

refers to the visual and aesthetic disconnect between the modernist structure of the bridge and the rich architectural heritage of the Golden Horn area. The sleek, utilitarian form of the Haliç Metro Köprüsü contrasts sharply with the ornate and historical landmarks nearby, such as the Süleymaniye Mosque, Hagia Sophia, and Galata Tower. This perceived incongruity has sparked criticism from architects, urban planners, and local communities, who argue that the bridge disrupts the visual continuity and historical authenticity of the area (Serra-Coch et al., 2018).

Fig. 3. Pedestrian Access and Underutilized Public Spaces on Haliç Metro Köprüsü

The images in Fig. 3 above, illustrate two key challenges in integrating the Haliç Metro Köprüsü with its heritage context. The first image highlights the pedestrian access area, which, while functional, appears underutilized and uninviting due to its lack of amenities and engagement features. The second image showcases adjacent spaces with limited pedestrian-friendly design and insufficient integration of cultural or social elements. These underutilized public spaces underscore the need for placemaking strategies to enhance usability, cultural relevance, and community interaction around the bridge.

The second challenge involves underutilized public spaces, particularly the pedestrian walkways and adjacent waterfront areas surrounding the bridge. Although the bridge includes pathways for pedestrians, these spaces lack amenities, cultural elements, and engaging features that could encourage public use (Xia et al., 2024). The underpasses and waterfronts remain largely unused, presenting missed opportunities for vibrant public spaces that could enhance community interaction and cultural engagement. These areas, if redesigned through placemaking strategies, could foster stronger connections between the bridge and its historical context (Wippel, 2019). Addressing these challenges requires context-sensitive design approaches that integrate cultural and historical references into the modern infrastructure. By enhancing the aesthetic coherence of the bridge and activating its underutilized spaces, the Haliç Metro Köprüsü has the potential to bridge the gap between modern urban development and heritage preservation, creating a more inclusive and culturally resonant environment.

Table 2. Analysis of challenges in integrating modern infrastructure with heritage context

Challenge	Findings	Impact
Design Dissonance	Modernist aesthetic clashes with surrounding heritage landmarks (e.g., Süleymaniye Mosque).	Perceived visual disconnect and criticism of cultural insensitivity by residents and experts.
Underutilized Public Spaces	Pedestrian pathways and waterfront areas lack amenities, seating, and cultural features.	Limited pedestrian activity, missed opportunities for placemaking and community interaction.
Limited Cultural Integration	Absence of art, historical narratives, or design elements reflective of the Golden Horn's identity.	Weak sense of place and cultural relevance, reducing the bridge's role as a meaningful public space.

Table 2 above, summarizes the primary challenges identified in integrating the Haliç Metro Köprüsü with its heritage context. The findings highlight the bridge's aesthetic dissonance with surrounding landmarks, the underutilization of pedestrian and waterfront spaces, and the lack of cultural elements that could enhance its role in Istanbul's historical urban fabric. These challenges underscore the need for strategic design interventions to align the bridge with the cultural and spatial identity of the Golden Horn, while addressing its underperforming public spaces through placemaking initiatives.

3.3 Opportunities for placemaking in heritage contexts

The Haliç Metro Köprüsü, despite its challenges in integrating with the surrounding heritage fabric, presents significant opportunities for placemaking interventions that can transform it into a vibrant and inclusive public space. By leveraging its strategic location across the Golden Horn, the bridge can act as a connector between historical districts and serve as a platform for cultural engagement, economic activity, and community interaction (Babalik-Sutcliffe & Cengiz, 2015). Placemaking in heritage-sensitive contexts emphasizes creating spaces that are not only functional but also reflective of the cultural identity and collective memory of the area (Paköz et al., 2019).

One of the most promising opportunities lies in enhancing pedestrian accessibility and amenities. While the bridge provides pathways for pedestrians, they remain underutilized due to the lack of seating, shading, and design features that invite prolonged use. Adding pedestrian-friendly infrastructure, such as green spaces, shaded walkways, and rest areas, can improve the usability of the bridge and attract more people. Additionally, integrating public art installations—such as murals, sculptures, or historical narratives inspired by the Golden Horn—can strengthen the bridge's cultural resonance and align it with its heritage surroundings.

The adjacent waterfront areas under and around the bridge offer untapped potential for creating dynamic public spaces. By activating these spaces with cultural programming, such as open-air markets, art exhibitions, or small-scale events, the bridge can serve as a social and cultural hub. These activities would not only enhance the sense of place but also promote local economic opportunities and tourism, encouraging a deeper connection between the infrastructure and the community it serves. Moreover, incorporating heritage-inspired design elements into the bridge's architecture—such as motifs from Ottoman-era structures or materials that reflect Istanbul's historical identity—can help bridge the visual and symbolic gap between modern infrastructure and the surrounding cultural landmarks. This design integration can address the criticisms of aesthetic dissonance while fostering a sense of continuity within the urban landscape.

Through these interventions, the Haliç Metro Köprüsü has the potential to become a transformative space that balances modern mobility demands with cultural preservation. Placemaking strategies that prioritize accessibility, cultural integration, and active programming will allow the bridge to serve not only as a transit corridor but also as a meaningful urban space that reflects Istanbul's rich historical identity.

Fig. 4 illustrates the placemaking potential around the Haliç Metro Köprüsü, focusing on spatial opportunities to transform the bridge and its adjacent areas into inclusive, accessible, and culturally resonant public spaces. The maps highlight key zones surrounding the Golden Horn, including historically significant neighborhoods and areas with untapped potential for cultural and social activation.

The first map on the left emphasizes the urban districts adjacent to the bridge, such as Eminönü, Galata, and the surrounding waterfront areas. These districts are shown as zones that could benefit from improved accessibility and connectivity to encourage greater interaction between the bridge and heritage landmarks. The second map in the center identifies specific spaces—such as waterfronts, pedestrian pathways, and open areas under the bridge—that are prime locations for placemaking interventions, including public art, cultural programming, and green spaces. The third map on the right provides a detailed spatial view of the immediate area around the Haliç Metro Köprüsü, showcasing the

proximity of transport infrastructure to underutilized spaces. These areas, if activated through carefully planned placemaking strategies, can foster vibrant public spaces that bridge the gap between modern infrastructure and the historical identity of the Golden Horn.

Fig. 4. Map of placemaking potential around Haliç Metro Köprüsü

Collectively, these maps underscore the potential of the Haliç Metro Köprüsü to act as a catalyst for cultural and urban revitalization. By prioritizing pedestrian-friendly design, cultural integration, and dynamic programming, the bridge can evolve beyond its functional role as a transit corridor and contribute to the preservation of Istanbul's heritage while serving the community as a meaningful, engaging urban space.

Table 3. Opportunities for placemaking interventions in the Haliç Metro Köprüsü

Opportunity	Proposed Intervention	Expected Impact
Improved Pedestrian Amenities	Add seating, shading structures, and pedestrian-friendly pathways.	Increased usability, longer pedestrian stay, and improved comfort for visitors and residents.
Public Art Installations	Incorporate art inspired by Golden Horn's history, such as murals and sculptures.	Strengthened cultural identity, visual appeal, and deeper connection to the heritage context.
Waterfront Activation	Host cultural events, open-air markets, art exhibitions, and recreational programming.	Enhanced community engagement, economic activity, and vibrancy in underutilized spaces.
Heritage-Inspired Design	Integrate Ottoman-era motifs or materials into the bridge's design and surrounding areas.	Improved visual harmony with heritage landmarks and reduced aesthetic dissonance.
Green Spaces and Landscaping	Add green spaces along pedestrian pathways and in adjacent areas.	Creation of inviting public spaces that encourage relaxation and environmental sustainability.

Table 3, outlines key opportunities for placemaking interventions on the Haliç Metro Köprüsü and its adjacent spaces. The proposed strategies, including improving pedestrian amenities, activating waterfront areas, and integrating heritage-inspired design, aim to address current challenges while transforming the bridge into a vibrant and culturally significant public space. These interventions would enhance usability, foster cultural resonance, and encourage community interaction, ensuring the bridge fulfills its potential as both modern infrastructure and a meaningful contributor to Istanbul's heritage fabric.

3.4 Placemaking as a TOD strategy

Transit-Oriented Development (TOD) serves as a powerful urban planning approach that integrates public transit infrastructure with sustainable urban growth. In the case of the Haliç Metro Köprüsü, TOD principles provide a foundation for reimagining the bridge as more than a functional transit corridor, but as a vibrant public space that enhances place identity, cultural integration, and social interaction. By applying placemaking as a TOD strategy, the bridge and its adjacent spaces can address current challenges—such as underutilization and cultural dissonance—while fostering community engagement, economic activity, and environmental sustainability.

Placemaking focuses on transforming public spaces into people-centered environments that reflect local culture and community needs. The strategic location of the Haliç Metro Köprüsü, connecting historical districts like Galata, Eminönü, and Balat, positions it as a natural hub for social and cultural activities. Through placemaking, the bridge can capitalize on its accessibility and visibility to create an inclusive urban space that highlights Istanbul's rich historical identity while meeting modern urban demands.

Fig. 5. Functional role and structural design of Haliç Metro Köprüsü

The images in Fig. 5 depict the Haliç Metro Köprüsü's dual role as a key transportation infrastructure and architectural element in Istanbul. The left image showcases the bridge's structural design spanning the Golden Horn, while the right image highlights its function as part of the M2 metro line, providing efficient transit across the city.

Several opportunities for implementing placemaking strategies emerge through analysis, such as enhancing pedestrian experiences, activating adjacent waterfront areas, and integrating heritage-inspired design elements. TOD-driven placemaking encourages walkability, reduces reliance on private vehicles, and promotes community ownership of public spaces. In turn, these strategies align with Istanbul's broader urban development goals while addressing the visual and spatial disconnect of the bridge within its heritage context.

The strategies outlined in Table 4 illustrate how placemaking can address the functional and cultural challenges of the Haliç Metro Köprüsü while aligning with TOD principles. By prioritizing enhanced pedestrian experiences and waterfront activation, the bridge can become a destination for social and economic activity, rather than merely a transit link. For instance, transforming underutilized spaces into areas for open-air markets and cultural programming can foster stronger community interactions and attract visitors to the Golden Horn. Cultural integration through public art and heritage-inspired design

allows the bridge to reflect its surrounding historical character, addressing the current aesthetic dissonance. Incorporating visual references to Ottoman-era motifs or narratives from the area's rich past can help align the modern infrastructure with its cultural context, fostering a greater sense of place. Improving multi-modal connectivity ensures that the bridge fulfills its role as a TOD project by seamlessly linking various forms of public transportation. This strategy supports sustainable urban mobility while encouraging greater access to Istanbul's historical districts, further revitalizing the Golden Horn as a cultural and economic hub (Goodchild et al., 2022).

Table 4. Placemaking Strategies as Part of TOD for Haliç Metro Köprüsü

Placemaking Strategy	Key Action	Expected Outcome
Enhanced Pedestrian Experience	Improve pathways with seating, shading, and greenery.	Increased walkability, comfort, and prolonged pedestrian activity.
Waterfront Activation	Host cultural programs, open-air markets, and recreational spaces.	Foster economic activity, community engagement, and a dynamic public atmosphere.
Cultural Integration	Install public art, historical plaques, and heritage-inspired design.	Strengthen place identity and enhance cultural connection to the Golden Horn's history.
Multi-Modal Connectivity	Improve pedestrian links between metro, tram, ferry, and bus lines.	Seamless urban mobility, reduced congestion, and greater accessibility to heritage landmarks.
Heritage-Sensitive Design	Integrate architectural motifs or materials that reflect Ottoman-era structures.	Visual harmony with surrounding heritage sites, reducing design dissonance.

Through thoughtful placemaking strategies, the Haliç Metro Köprüsü holds significant potential to transform into a dynamic and inclusive urban space, effectively balancing modern infrastructure with the preservation of heritage. By integrating Transit-Oriented Development (TOD) principles with context-sensitive design and community-driven interventions, the bridge can evolve beyond its current functionality into a socially and culturally vibrant space. These efforts would ensure the long-term sustainability of the area while reinforcing Istanbul's cultural continuity and historical identity (Paköz et al., 2019).

Figure 6 below, highlights the underutilized waterfront spaces adjacent to the Haliç Metro Köprüsü, which, despite their strategic location and scenic views, remain largely inactive. These areas represent prime opportunities for placemaking interventions, such as improved pedestrian amenities, cultural programming, and public activities. By activating these waterfront spaces, the bridge can serve as a focal point for community interaction, attracting residents and visitors to engage with the Golden Horn's rich heritage. Transforming these underused areas into vibrant public spaces would foster inclusivity, economic activity, and a deeper connection between modern infrastructure and historical context.

Fig. 6. Underutilized waterfront space adjacent to Haliç Metro Köprüsü

Fig. 6 illustrates the waterfront spaces near the Haliç Metro Köprüsü, which remain largely underutilized despite their scenic location and potential. These areas represent

opportunities for placemaking interventions, such as improved pedestrian amenities, cultural programming, and public activities, to transform them into vibrant and inclusive public spaces.

4. Conclusions

The study of the Haliç Metro Köprüsü reveals both the challenges and opportunities of integrating modern infrastructure within the heritage-sensitive context of Istanbul's Golden Horn. While the bridge has successfully improved urban mobility, regional connectivity, and access to historically significant neighborhoods, its current form and functionality fall short in addressing the cultural and social needs of the surrounding area. The challenges, including design dissonance, underutilized waterfront spaces, and a lack of cultural integration, highlight the complexities of urban development in heritage cities. However, this research uncovers significant placemaking opportunities that can transform the Haliç Metro Köprüsü into a dynamic public space, capable of balancing modern infrastructure with heritage preservation.

To ensure that the bridge fulfills its potential as a culturally integrated transit hub, policymakers and urban planners should implement targeted placemaking interventions that enhance its spatial and social role. Design modifications, such as incorporating heritage-inspired architectural elements and public art, can help the bridge visually and symbolically align with the surrounding historical fabric. Activating waterfront spaces through pedestrian-friendly promenades, outdoor markets, and community gathering areas can strengthen local economic activity while fostering cultural continuity. Additionally, policy measures to regulate tourism flows and encourage mixed-use development around transit nodes can mitigate overcrowding and enhance the bridge's role as a sustainable urban connector.

The novelty of this study lies in its proposed framework for using Transit-Oriented Development (TOD) as a placemaking strategy to revitalize infrastructure projects in heritage cities. By integrating pedestrian-friendly amenities, heritage-inspired design elements, and cultural programming, the bridge can evolve into a space that enhances place identity, fosters cultural continuity, and supports sustainable urban development. The underutilized waterfront areas represent untapped potential to create inclusive spaces for community engagement, economic activities, and environmental sustainability. These findings offer a replicable model for other heritage cities worldwide, demonstrating how TOD principles can be adapted to protect and celebrate cultural heritage while meeting modern urban demands.

In the context of the Sustainable Development Goals (SDGs), this research contributes directly to SDG 11 (Sustainable Cities and Communities) by promoting sustainable urbanization and enhancing public spaces that are inclusive, safe, and culturally significant. By addressing the challenges of cultural dissonance and spatial underutilization, the study emphasizes the need for heritage-sensitive placemaking as a tool for achieving urban sustainability. Furthermore, activating the bridge and its adjacent areas through green spaces and community-driven interventions aligns with SDG 13 (Climate Action) by reducing carbon footprints through pedestrianization and encouraging environmentally friendly urban mobility.

Looking forward, heritage cities worldwide can adopt the Haliç Metro Köprüsü framework as a model to harmonize infrastructure projects with historical preservation. Integrating TOD with placemaking strategies offers an innovative pathway for ensuring that modern urban development does not compromise cultural identity but rather enhances it. To facilitate this, policymakers should prioritize cross-sectoral collaboration between heritage conservation agencies, transportation authorities, and local communities. Establishing participatory urban design processes, including public consultations and co-creation workshops, will ensure that infrastructure projects align with community needs and historical narratives. Additionally, adaptive reuse policies and financial incentives for heritage-sensitive developments can encourage investment in sustainable urban

regeneration. This research highlights the importance of inclusive planning that engages local communities, celebrates heritage narratives, and creates sustainable urban spaces that align with global sustainability goals. By bridging the gap between heritage conservation and modern urban needs, cities can evolve into vibrant, resilient, and sustainable environments that stand as a testament to their rich historical legacies.

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