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Research Article

From Via Militaris to Ottoman Times: A Brief History and A Restoration Proposal for the Büyükkarıştıran Bridge

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Abstract

The settlements in Thrace have hosted various communities since prehistoric times. From 600 AD, the Roman Empire ruled the region, leaving behind numerous architectural structures. Among these, the one that stands out is Via Militaris, a military road connecting Rome to Constantinople via Belgrade (Singidunum). This route remained in use for nearly 2,000 years and was later repaired and maintained by the Ottoman Empire. Travelers' records from the 13th and 14th centuries confirm that Via Militaris was well-preserved, with bridges built and repaired over time. Given the strategic importance of Thrace, bridge construction likely started early, especially across rivers in the Ergene Basin. The Büyükkarıştıran Bridge, reflecting classical 16th-century Ottoman architectural features, is attributed to Sinan the Architect in monument inventories. However, a reevaluation suggests its origins might predate Sinan's era due to the region's military and economic significance. Its complex structure indicates major renovations during the 16th century. This study documents the bridge's deterioration that have been altered by interventions carried out during different periods and presents a restoration project designed to guide future conservation efforts. The restoration project aims to preserve the structure's original characteristics, ensuring they are passed on to future generations.

Keywords: *Büyükkarıştıran Bridge, Restoration, Sinan the Architect, Via Militaris, Cultural Heritage*

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Via Militaris'ten Osmanlı Dönemine: Büyükkarıştıran Köprüsü İçin Kısa Bir Tarihçe ve Restorasyon Önerisi

Öz

Trakya'daki yerleşimler, tarih öncesi dönemlerden itibaren farklı topluluklara ev sahipliği yapmıştır. MS 600 yılından itibaren bölgeyi yöneten Roma İmparatorluğu, birçok mimari yapı bırakmıştır. Bunların arasında öne çıkan, Via Militaris olarak bilinen ve Roma'dan Konstantinopolis'e Belgrad (Singidunum) üzerinden uzanan askeri yoldur. Yaklaşık 2.000 yıl boyunca kullanılan bu güzergâh, Osmanlı İmparatorluğu tarafından da onarılmış ve korunmuştur. 13. ve 14. yüzyıla ait seyyah kayıtları, Via Militaris'in iyi durumda olduğunu, köprülerin inşa edilip belirli dönemlerde onarıldığını göstermektedir. Trakya'nın stratejik önemi göz önüne alındığında, köprü inşaatlarının erken dönemde başladığı ve özellikle Ergene Havzası üzerindeki nehirler boyunca köprülerin inşa edildiği düşünülebilir. Büyükkarıştıran Köprüsü, klasik 16. yüzyıl Osmanlı mimari özelliklerini yansıtmakta olup, anıt envanterlerinde Mimar Sinan'a atfedilmektedir. Ancak, yapılan değerlendirmeler, köprünün yalnızca mimari üslubuna dayanarak değil, bölgenin askeri ve ekonomik önemine bağlı olarak Sinan öncesi döneme ait olabileceğini düşündürmektedir. Köprünün karmaşık yapısı, 16. yüzyılda kapsamlı onarımlar geçirdiğine işaret etmektedir. Bu çalışma, köprünün hasarlı ve farklı dönemlerde yapılan müdahaleler sonucu değişime uğramış bölümlerini belgeleyerek, gelecekteki koruma çalışmalarına rehberlik edecek bir restorasyon projesi ortaya koymaktadır. Restorasyon projesi ile yapının özgün niteliklerinin korunarak gelecek kuşaklara aktarılması hedeflemektedir.

Anahtar kelimeler: *Büyükkarıştıran Köprüsü, Restorasyon, Mimar Sinan, Via Militaris, Kültür Varlığı*

1. Introduction

Historical bridges represent a vital component of the built heritage, offering insight into the architectural capabilities, infrastructural planning, and settlement patterns of past civilizations. Ottoman bridges, in particular, reflect not only technical and architectural accomplishments but also the sociopolitical and economic mechanisms through which the empire connected its administrative and commercial networks. Despite their recognized cultural value, many of these structures today face various forms of deterioration due to environmental factors, neglect, and incompatible restoration efforts (Feilden, 2003).

The Büyükkarıştıran Bridge, situated in the Thrace region of Turkey along the historic Via Militaris route, is among these neglected monuments. Although often attributed to Mimar Sinan in heritage inventories, no definitive documentary evidence supports this claim. Strategically located between Istanbul and the Balkan hinterland, the bridge has served as a key transportation link for centuries. Nevertheless, a comprehensive academic study or technically grounded restoration proposal has not yet been developed.

While international literature on the conservation of historic bridges increasingly emphasizes the integration of structural diagnostics, historical context, and stakeholder participation (Feilden & Jokilehto, 1998; ICOMOS ISCARSAH, 2005), heritage structures located in transitional or peripheral zones—such as Thrace—remain underrepresented in scholarly discussions.

In response to this gap, the present study proposes a modern restoration framework for the Büyükkarıştıran Bridge, grounded in both historical inquiry and technical analysis. The investigation is structured around two main components:

- literature-based research that contextualizes the bridge within Ottoman infrastructure and conservation theory;
- an on-site architectural survey that documents its current condition. Together, these components form the basis for an evidence-based restoration proposal aligned with international conservation standards.

This research ultimately aims to address the following question: "How can the Büyükkarıştıran Bridge be conserved in a way that respects its historical context while ensuring long-term structural and perceptual sustainability"

2. Research Aim and Methodology

This study undertakes a comprehensive evaluation of the Büyükkarıştıran Bridge as both a tangible cultural heritage asset and a structural artifact embedded within its geographical, historical, and architectural context. The primary objectives of the research are:

- to elucidate the historical significance of the bridge through systematic archival inquiry and critical literature analysis;
- to document and assess the current architectural and material condition of the structure through advanced surveying technologies;
- to identify patterns of deterioration, structural vulnerabilities, and past interventions that may have compromised the bridge's original fabric;
- to formulate a set of restoration and conservation strategies aligned with internationally recognized heritage charters; and
- to enhance the bridge's perceptual visibility and cultural relevance within its contemporary urban-industrial setting.

To fulfill these objectives, the study adopts a multidisciplinary methodological framework that integrates historical research, architectural survey, visual documentation, and diagnostic analysis. The archival investigation encompassed both national and international repositories, including the Turkish State Archives, the Edirne Regional Council for the Conservation of Cultural Heritage, the Bibliothèque Nationale de France, the Library of Congress (USA), the Atatürk Library of the Istanbul Metropolitan Municipality, the University of Toronto Library, and the Istanbul Technical University Faculty of Architecture Library. In addition, Ottoman-era cartographic materials were consulted to contextualize the structure within its broader infrastructural network.

The fieldwork component was carried out between February 18 and 21, 2017, utilizing high-resolution digital measurement tools such as the Leica Total Station (theodolite) and Faro 3D Laser Scanner. These technologies facilitated the production of precise architectural documentation, including three-dimensional models and plan-elevation sections. Visual inspection and photographic documentation were employed to record surface damage, material loss, and incompatible repairs. The analytical findings informed the development of a restoration proposal structured in accordance with the principles of the Venice Charter (1964) and the Nara Document on Authenticity (1994), with particular emphasis on reversibility, material compatibility, and minimal intervention.

3. Discussion

To propose contemporary restoration plans effectively, it is imperative to analyze the bridge's current condition thoroughly. This discussion encompasses geographical, historical, and morphological examinations, drawing insights from both literature research and on-site survey findings.

3.1. Geographical Condition

The Büyükkarıştıran Bridge is situated in the Büyükkarıştıran town of the Lüleburgaz district, within the Kırklareli province, adjacent to the Yuvalı Creek. Administratively, the town is affiliated with the Lüleburgaz district, approximately 25 kilometers away. Access to Büyükkarıştıran town is facilitated via the TEM (European Highway) from the north, as well as the D-100 (Istanbul-Edirne Highway) (see Fig. 1).

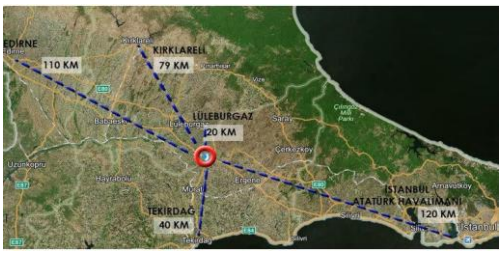

Figure 1. Highways and Location Map (Min. of Environment and Urbanization).

Figure 2. Aerial photo showing the location of the bridge within the district.

Within this settlement plan, the Büyükkarıştıran Bridge is located on the east-west axis. To the west and east of the Büyükkarıştıran Town, industrial facilities are present. Historically, the bridge was actively utilized along a trajectory parallel to the D-100 highway until the 1970s; however, its traffic volume diminished following the construction of the D-100 highway. Notably, Yuvalı Creek experiences periodic overflow, particularly during winter months, inundating the vicinity, including the bridge. In 2012, the town center endured significant damage due to extensive flooding in the region, as documented by the Ministry of Environment and Urbanization in 2016. Consequently, berm walls were erected, and elevation differences were heightened, making the bridge appear smaller than its original dimensions. Moreover, alterations in the original elevation levels have led certain bridge sections to submerge below ground level. Restoration efforts to address these submerged arches appear to compromise the bridge's original architectural integrity, as evidenced by comparison with historical photographs (see Fig. 23, 24, 25).

3.2. Pre-Roman Era

Archaeological research indicates that the Thracian lands did not exhibit evidence of hosting historical settlements until the corresponding period from the late Chalcolithic Period to the Early Bronze Age (around late 4000 B.C.) (Beksaç, 2007). While Thracian traces of permanent settlements are discernible through the invasions of Thracian colonies, the Büyükkarıştıran region does not bear such traces. Thracian colonies, mentioned as allies of the Trojans in Homer's Iliad, are known

to have established settlements in various regions during the period spanning approximately 1000-800 B.C. According to Beksaç (2007), among these colonies, the most notable are Astaies and Odrys.

Yıldırım contends that the Astaies established settlements in the northern part of the region, specifically around the Yıldız Mountains. Byze (Vize) city emerges as a significant economic hub of the Astai civilization. Conversely, the Odrysians settled in the southern part of the region, spanning between the Tunca Valley and the seashore, designating Heraion Teichos city as their capital (Yıldırım, 2008).

The Büyükkarıştıran region, known as Druispara in ancient maps, assumed significance as the road connecting the two major centers, Byzye and Heraion Teichos, traversed through Büyükkarıştıran (Drusipara) (see Fig.4). Alongside remnants of ancient buildings dating to this period, the area also features tumuli believed to belong to the princes of the Odrysians (Demir, 2016).

Figure 3. Büyükkarıştıran Tumulus (Heritage Records, Ministry of Culture).

Figure 4. Regional map of the 6th Century (Singleton,1989).

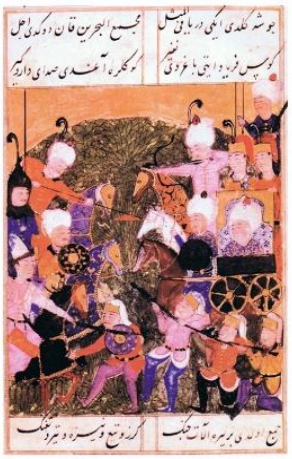

Figure 5. Miniature of the Karışdıran War (Topkapi Palace Museum, Treasury 1597-8,44a).

The first Greek colonies emerged in the region around 800-700 B.C., leading to a decline in Thracian influence. By 514 B.C., the region fell under Persian domination. With the establishment of a feudal structure by the Thracians, the region came under Macedonian rule in 333 B.C., following the departure of the Persians. Thrace remained under Macedonian control following its occupation during Alexander the Great's eastern expedition, persisting until the Roman period (Beksaç, 2007).

3.3. Roman Empire Period

Following the Macedonian civilization, the Roman Empire controlled the region until the 6th century, despite periodic Thracian uprisings. According to Singleton (1989), the construction of the Via Militaris, dating back to the 1st century, played a pivotal role in enhancing socio-economic activities in the surrounding cities by establishing a direct connection to Rome. The Romans standardized travel time and distance along the Via Militaris, ensuring uniformity throughout the route. Rest centers were strategically positioned at 18 Roman mile intervals, serving as safe accommodation areas and horse change stations (Beksaç, 2007). In his book "Belgrade Istanbul Roman Military Road," Dr. Konstantin Yosif Ireçek asserts that "Narcum was reached from the transfer stop to Durusipara (or Drizipera), a nearby fourth night mansion. It was reached in a village on an old and often cited hill near today's Büyükkarıştıran, where the hunting lodges of the old sultans were located. During the time of Emperor Maximilian, St. Alexander, a Roman soldier who was tortured, died in Druzipara. Later, his body was buried in a magnificent church and was highly respected by all Thracian faithholders. (...) The name Druzipara perhaps only meant 'City of The Odris'. (...) 40 creeks and river crossings until Druzipara, 85 creeks and river crossings until Istanbul, all of which are equipped with beautiful bridges in the Roman era." (İreçek, 1990) The covering of the Via Militaris Road with asphalt presents challenges in identifying authentic traces in the Thracian segment of the road today. However, Greek, Macedonian, and Serbian researchers have conducted academic studies to ascertain the structural layout and measurements of the road on a local scale.

3.4. Ottoman Empire Period

During the Ottoman period, Büyükkarıştıran retained its significance inherited from Roman times. It served as an essential accommodation center, leveraging the utilization of Roman roads throughout the Ottoman era. The Ottomans established the Via Militaris, one of the three primary routes used in European voyages, with Büyükkarıştıran as a pivotal point. Ottoman administrations consistently repaired and utilized existing roads until the mid-19th century, often augmenting them with additional features or reinforcements to maintain the integrity of the Roman route (Kılıç, 2014). Çorlu, encompassing Büyükkarıştıran and Lüleburgaz, was conquered in 1357 by Orhan Gazi with Suleyman Pasha (Uzunçarşılı, 1996). Following Sultan Bayezid I's covenant not to declare a crown prince by abstaining from choosing between Şehzade Selim and Şehzade Ahmet, the Janissaries and the populace exhibited divisions based on the cities they supported.

Literary sources indicate that the Karıştıran region hosted numerous significant battles during the Ottoman Period, particularly the battle known as the "Karışdıran War" that took place between the Sultan's sons in 1511 (see Figure 5) (Uzunçarşılı, 1996). However, it remains unclear whether this tragic

battle definitively bestowed the name Büyükkarıştıran upon the region.

Due to the active utilization of Edirne Palace in tandem with Istanbul following the conquest and ongoing expeditions to the Balkans facilitated by the remnants of the Via Militaris, the Roman-era accommodation function in Büyükkarıştıran persisted into the Ottoman period, accompanied by the construction of a hunting palace. Although the precise construction date of the hunting palace remains uncertain, the earliest archival source related to zoning activities dates back to 1540-1550 (Güven and Hergüner, 1999). In his renowned journals, Evliya Çelebi notes that Karıştıran is a well-established village originally named Karıştıran Hanı Village, boasting 100 houses, one accommodation building (Khan), and a mosque. He also provides insights into the soil composition, describing it as exceedingly sticky, to the extent that even the strongest animals, such as elephants, Adana buffalo, and Anatolian, cannot avoid becoming stuck (Kahraman and Dağlı, 2003). Evliya Çelebi's accounts, while primarily based on observations and oral legends, may not be considered definitive scientific evidence regarding the origin of the region's name. However, acknowledging the significance of oral traditions as integral components of cultural heritage, we can view his claim as valuable evidence pertaining to the historical heritage of the region. While not scientifically verifiable in the strictest sense, such oral accounts contribute to our understanding of the cultural and historical context surrounding Büyükkarıştıran and its evolution over time.

Numerous claims exist regarding the original name of the region. Claude Ptolemy depicts Karıştıran town as Drusira on his map dated 1535 (see Figure 6), while Gerard Mercator's map from 1584 refers to the region as Durusipara (see Figure 7). Additionally, Thracian Veteris labels the town as Durusipara on his 1585 map, indicating military usage with a symbol near the town (see Figure 8). Furthermore, Illyricum Orientis' updated map also shows a significant mosque near the military range (BNF, n.d.). These historical maps provide valuable insights into the various names associated with the region throughout history.

Figure 6. Ptolomee's map dated 1535 (BNF, 1535, 1b52504494).

The name Karisdiran first appears on Gottfried Jacob Haupt's map dated 1737, which features the same range/fortress icon (see Fig. 9), similar to Hauptmans's map in 1787 (see Fig. 10). However, Johann Gottlieb refers to the town as Bolovana in his 1750 map (see Fig. 11).

Figure 7. Mercator' map dated 1584 (BNF, 1584, 1b59639433).

Figure 8. Veteris' map dated 1585 (BNF, 1585, 1b59621494).

Conversely, Tabula Peutingeriana names Büyükkarıştıran as Brysıpara in a map from 1753, which also depicts traces of the Via Militaris (see Figure 12).

Figure 9. Orientis map dated 1590 (BNF,1b5973175k).

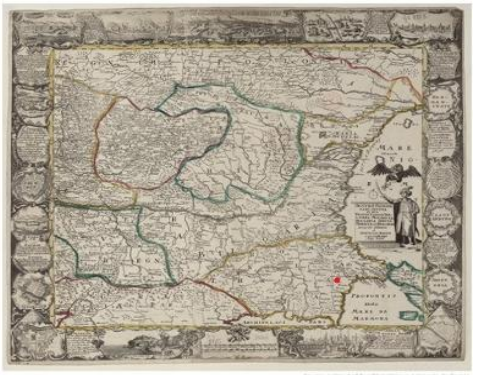

Figure 10. Haupt's map dated 1787 (BNF, 1737, 1b53093440).

Figure 11. Gottlieb's map dated 1750 (BNF, 1750, 1b5309340).

These various maps provide additional perspectives on the historical names associated with Büyükkarıştıran throughout different periods.

In the Austria map dated 1832, Büyükkarıştıran is referred to as Karischtiran (see Fig. 13). Subsequently, it is finally named Karıştıran in the Ottoman railway map of 1895, marking the first instance of this name (see Fig. 14) (Erkan-ı Harbiyye-i, 1887). The name Karıştıran is also encountered in the Ottoman Military map dated 1901 (BOA, HRT 2174). These maps document the evolution of the name associated with Büyükkarıştıran over time.

Literary sources indicate that following the Second Balkan War, Balkan-Turkish refugees immigrated to Istanbul via Büyükkarıştıran, where they also temporarily accommodated in the town. This indicates that the old military accommodation center belonging to the region continued to be utilized into the early 20th century (Baldwin, 1913).

Figure 12. Peutıngeriana's Map dated 1753 (BNF, 1753, 1b5962147).

Figure 13. Austria Map dated 1832 (BNF, 1832, 1b596342).

Figure 14. Ottoman Railways Map dated 1895 (State archives, HRT-2174).

3.5. The Turkish Republic Period

In 1937, a portion of the military exercises was conducted in Büyükkarıştıran and its surrounding areas as part of the Great Thrace Manuevers (Demir, 2016). Mustafa Kemal Atatürk, the esteemed leader of the Turkish Republic, utilized the Büyükkarıştıran primary school as a commanding center for military operations and visited Büyükkarıştıran on numerous occasions (Cumhuriyet Newspaper, 18.08.1937).

The European (London) motorway, planned and built between 1960 and 1970, was designed on a new route. Until this date, the road was actively used for various repairs, as in the Ottoman period.

By altering the route, the bridge has relinquished its primary function of transportation, which it has served for centuries. Consequently, it has diminished in significance and has been left in a state of disrepair.

3.6. Surrounding Historical Buildings

Under this heading, structures built in the vicinity of the bridge in different periods and which could not maintain their integrity are examined under certain sub-headings.

3.6.1. The Hunting Mansion

Hunting, a favored pastime among the Sultans and their contemporaries, including high-ranking soldiers and

bureaucrats, contributed to the allure of the Thrace region. Its proximity to abundant hunting grounds and proximity to both palaces rendered it particularly appealing. It is noted that short-term hunting trips often led to Çatalca and Büyükkarıştıran, while longer-term royal hunts typically extended to Edirne (Güven and Hergüner, 1999).

Despite the uncertainty surrounding its construction date, discussions persist regarding the existence of historical hunting lodges in Karıştıran. However, concrete evidence indicates the establishment of a genuine hunting palace by Sultan Avcı Mehmet in 1681. Archive records reveal that this palace remained in use until 1840 and underwent periodic repairs over time (Güven and Hergüner, 1999).

3.6.2. Rüstem Pasha Zoning

It is evident that Rustem Pasha commissioned the construction of a mosque, a caravanserai, a large inn, a guest house (tabhane), and a hammam building in Büyükkarıstıran due to the town's strategic location as a crossing point to the Edirne Palace and the Balkan-European lands (see Fig. 15). However, the caravanserai, innyard, and guesthouse have been periodically demolished for reasons unknown, leaving no trace of these buildings except in literary sources (Küçükkaya, 1990). Additionally, the mosque fell into ruin by 1938-40, and a new mosque was constructed by reusing some of the main walls of the original mosque.

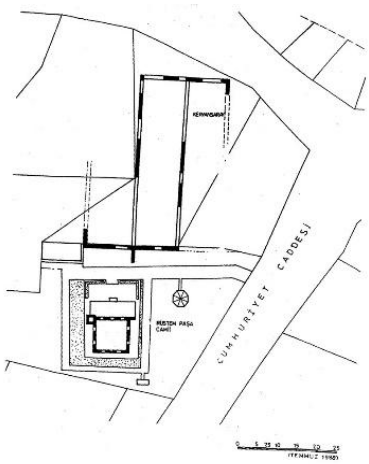

Figure 15. Plans of Rüstem Pasha Guesthouse (Kervansaray) with its mosque (Küçükkaya, 1990).

Figure 16. Water gauges in Büyükkarıştıran (Ayberkin, 2016).

Furthermore, relics belonging to three water gauges have been discovered, indicating the water transmission to the hammam building during surveys (see Fig. 16).

Archival records indicate that renovation efforts were periodically undertaken to reconstruct the Rustem Pacha caravanserai and waterways (Demir, 2016). However, it is asserted that the Horhor Fountain, located in the town, is a rebuilt version of the original

Rustem Pacha fountain. Survey studies reveal that the fountain was constructed by the Ministry in 1938, as indicated by its epigraph.

3.6.3. The Water Gauges

Water gauges are structures designed to distribute the water flowing towards the city with the natural slope of the waterways, adjusting the pressure and flow rate in a controlled manner. Typically constructed using rubble stone and lime mortar, they form narrowing towers. Water gauges, which are an essential part of the historical Byzantine waterway, carry water to the Capital, İstanbul, and they are located on the southeast side of the town. The stone masonry of these towers has significantly deteriorated over time. Dating back to the 3rd to 4th centuries, these structures were officially recognized as heritage sites by the Heritage Board of Edirne in 1991 (Edirne Board of Cultural Heritage, 2017).

4. Architectural Characteristics of the Bridge

The Büyükkarıştıran Bridge is constructed with seven arches and boasts a total length of 45.32 meters and a total width of 5.40 meters. The bridge slabs are curved with a 5% slope on both sides, and the height of the largest arch varies from 3 meters to 4.50 meters. The arches are built 7 cm inwards from the spandrel walls. However, it is noted that the parapets of the bridge have been improperly renovated with concrete, resulting in a height of 0.45 meters (see Fig. 17).

Figure 17. Büyükkarıştıran Bridge Northern side view (Ayberkin, 2017).

In historical photographs of the bridge, the floor slab/roadway was depicted as being paved with marble, whereas today, it is covered with asphalt (see Fig. 22-24). Stone gutters are present on both the downstream and upstream façades; however, their authenticity cannot be definitively determined. Additionally, recently added wing walls have been installed at the east and west ends of the bridge. Deformations are evident on the roadway and asphalt surface, with structural cracks observed inside the arches and vaults (see Fig. 18-19). Despite exhibiting characteristic features of classical Ottoman architecture, precise data regarding the year of construction remains elusive. However, owing to these distinctive features, there exists a possibility that the bridge underwent comprehensive repairs or reconstruction between the 15th and 16th centuries.

4.1. The Arches/Barrels

The bridge span comprises seven arches/barrels constructed with ashlar and rubble backing stonework, bonded with lime mortar joints. These arches/barrels are constructed in a semicircular form. However, some concrete joints are present because of improper repair work.

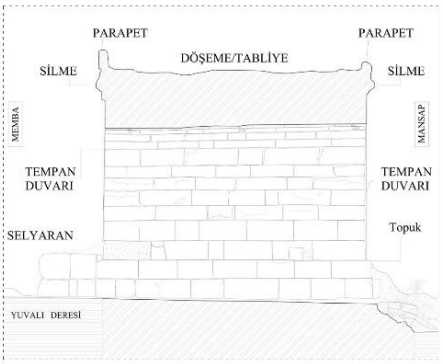

Figure 18. The architectural details of Büyükkarıştıran Bridge (Ayberkin, 2018).

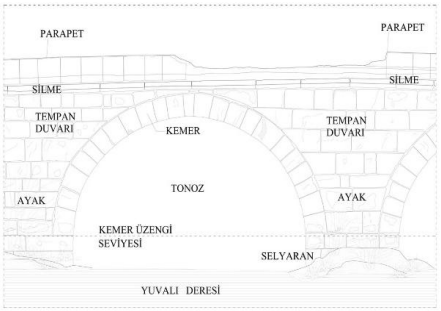

Figure 19. The arch details of Büyükkarıştıran Bridge (Ayberkin, 2018).

Within the arch vaults/barrels, carbon deposits, cement repairs, and signs of vandalism are observed. The arches/barrels are also numbered on the West to East axis (see Fig. 17, 20).

4.1.1. Arch/Barrel – 1

Arch/Barrel-1, located at the western end of the bridge, is the first arch in the sequence. The span of the arch measures 5.24 meters, with an arch radius ranging from 1.33 to 1.71 meters. The dimensions of the voussoir stones vary between 0.50 meters and 0.30 meters. The rise between the springing line and the keystone is 2.4 meters. The floor slab between the piers is covered with cobblestone.

4.1.2. Arch/Barrel – 2

Arch/Barrel-2, situated as the second arch at the western end of the bridge, has an arch span measuring 4.87 meters and an arch radius of 2.67 meters. It comprises nineteen voussoir stones, with dimensions ranging from 0.35 meters to 0.70 meters. The rise between the springing line and the keystone is 3.05 meters. Similar to Arch/Barrel-1, the floor slab between the piers is covered with cobblestone.

4.1.3. Arch/Barrel – 3 (Main Arch – 1)

Arch/Barrel-3, positioned as the third arch at the western end of the bridge, features an arch span measuring 5.86 meters and an arch radius ranging from 2.83 to 3.57 meters. The rise between the springing line and the keystone is 3.05 meters. Unfortunately, the floor slab covering could not be detected due to the water level of Yuvalı Creek

4.1.4. Arch/Barrel – 4 (Main Arch – 2)

Arch/Barrel-4, positioned as the fourth arch at the western end of the bridge, has an arch span measuring 5.92 meters and an arch radius ranging from 2.57 to 3.48 meters. The rise between the springing line and the keystone is 3.48 meters. Unfortunately, similar to Arch/Barrel-3, the floor slab covering could not be detected due to the water level of Yuvalı Creek.

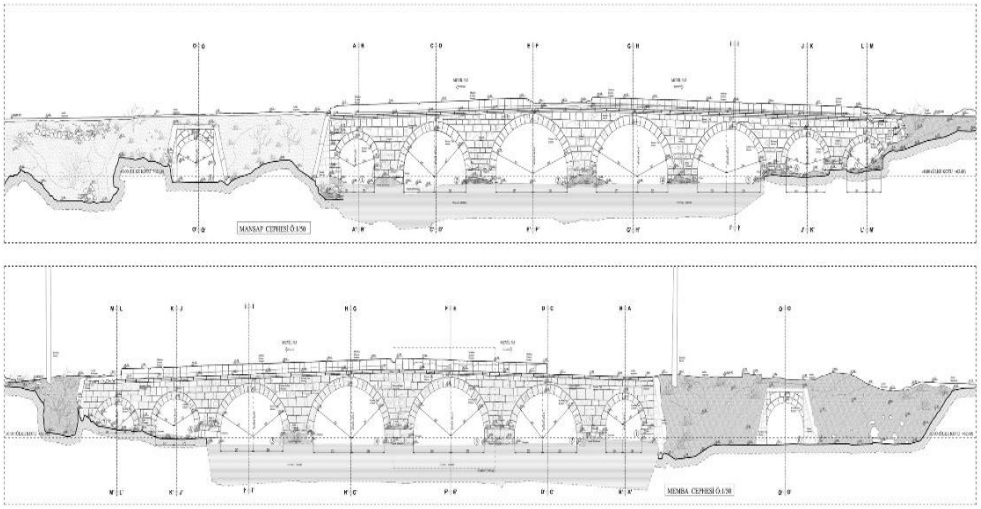

Figure 20. Façade drawings of Büyükkarıştıran Bridge (Ayberkin, 2018).

4.1.5. Arch/Barrel – 5

Arch/Barrel-5, positioned as the third arch at the eastern end of the bridge, features an arch span measuring 5 meters and an arch radius ranging from 2.4 to 2.82 meters. The rise between the springing line and the keystone is 3.16 meters. Unfortunately, similar to the previous arches, the floor slab covering could not be detected due to the water level of Yuvalı Creek.

4.1.6. Arch/Barrel – 6

Arch/Barrel-6, situated as the second arch at the eastern end of the bridge, has an arch span measuring 3.23 meters and an arch radius of 1.68 meters. The rise between the springing line and the keystone is 2.3 meters. Similar to the western end arches, the floor slab between the piers is covered with cobblestone. Additionally, soil accumulation has been detected on the floor slab.

4.1.7. Arch/Barrel – 7

Arch/Barrel-7, positioned as the first arch at the eastern end of the bridge, features an arch span measuring 2.88 meters and an arch radius of 1.59 meters. The rise between the springing line and the keystone is 1.69 meters. Similar to the other arches, the floor slab between the piers is covered with cobblestone. Furthermore, soil accumulation and vegetation have been detected on the floor slab of this arch.

4.1.8. Arch/Barrel – 8 (Flood Arch)

Arch/Barrel-8, situated as the only flood arch at the western end of the bridge, has an arch span measuring 3.02 meters. The rise between the springing line and the keystone is 2.11 meters. Similar to the other arches, the floor slab between the piers is covered with cobblestone. However, soil accumulation and vegetation have been detected on the floor slab of this arch. Additionally, town sewage has erroneously been

connected through this barrel, indicating potential structural issues.

4.2. Piers

The piers serve as the primary support structures of the bridge, working in conjunction with the arches/barrels and vaults to carry the roadway load. Cutwaters have been added to the upstream facade of the piers, enhancing their resistance to water pressure. However, due to the alluvium formed by Yuvalı Creek, some of the piers remain partially underground.

4.3. Cutwater / Starling

Cutwaters, also known as starlings, take the form of triangular prisms adjacent to the piers on the upstream facade of the bridge. On the downstream facade, there are genuine triangular prism easewaters and periodically added square-shaped easewaters adjacent to the piers. These cutwaters are subjected to soil deposits and flood debris, leading to some of them losing their integrity due to water pressure. Constructed with ashlar with rubble backing stonework and lime mortar joints, the cutwaters vary in length from 2.3 meters to 2.58 meters and in width from 1.34 meters to 2 meters. Among them, two cutwaters have fully retained their integrity.

4.4 Parapets

The parapets of the bridge are constructed from reinforced concrete material, which has been recently added. Unfortunately, the exact date of this addition is unknown. The parapets have an average width of 0.24 meters and a height of 0.42 meters.

4.5. King Post Stones

The original king post stones are no longer in place. However, genuine details of the post stones were identified from the old photographs.

4.6. Roadway / Deck

The roadway/deck, with an area of 311 square meters, features a slope of 5% on the east-west axis. While it is currently covered with asphalt, historical evidence suggests that the genuine overlay was marble, as reconstituted based on a photograph dated 1912.
At the intersections of the parapets and roadway, observed on both the upstream and downstream sides, soil deposits and plant formations are present. Additionally, load-related deformation has been noted on the roadway, likely resulting from heavy tonnage vehicles accessing surrounding facilities. Furthermore, frost cracks, attributed to atmospheric effects, are predominantly observed on the spandrel walls due to harsh winter weather conditions.

4.7. Façades

4.7.1. Upstream Façade (North Facade)

The spandrel wall comprises seven semicircular arches constructed with ashlar and rubble backing stonework, joined with lime mortar. The upstream facade exhibits more damage compared to the south facade, likely due to weather

conditions. Accumulation of carbon crust, cement interventions, frost cracks, surface losses, vandalism, and biological formations are notably present. Structural cracks visible on the facade raise concerns regarding the structural integrity of the wall.

The voussoirs or ring stones are positioned within seven centimeters from the surface of the spandrel wall or upstream facade. Additionally, a stone ornament is situated on the belt course, which is believed to be authentic. Cement and reinforced concrete interventions are observed in the joint between the wing wall and abutment/spandrel walls.

4.7.2. Downstream Facade (South Facade)

The spandrel wall is composed of seven semicircular arches constructed with ashlar and rubble backing stonework, held together with lime mortar joints. The downstream facade exhibits less damage compared to the north facade. However, a high density of carbon crust accumulation, cement interventions, frost cracks, surface losses, vandalism, and biological formations are observed on the north facade. Structural cracks visible on the facade raise concerns regarding the structural strength of the wall.

The voussoirs or ring stones are positioned within six centimeters from the surface of the spandrel wall or upstream facade. Additionally, a stone ornament is situated on the belt course, which is believed to be genuine. Cement and reinforced concrete interventions are observed in the joint between the wing wall and abutment/spandrel walls.

5. Restoration

The restoration work was categorized into three main sections: reconstition, intervention methods, and restoration suggestions, each accompanied by detailed drawings to provide comprehensive support.

Figure 21. General front view of the Büyükkarıştıran Bridge (Ayberkin, 2017)

5.1. Damage Analysis

While precise details regarding renovations are lacking, variations in stone dimensions, textures, and mortar/joint materials suggest that the bridge underwent repairs or renovations at various points in time. Utilizing historic photographs enables the

detection of interventions and facilitates comparison between past and present conditions. Damage analysis projects have identified atmospheric effects, algae and carbon formations, surface cavities, improper interventions, and structural cracks across upstream and downstream façades and other sections of the bridge.

Both upstream and downstream façades, voissors, barrels/arches, and spandrel walls exhibit false interventions, soil deposits, and vandalism. Prefabricated concrete parapets have been installed in place of genuine marble/ashlar stone parapets. The roadway/deck shows significant deformation caused by heavy-tonnage vehicles crossing for access to surrounding industrial facilities. Plant and biological formations are predominantly found on the façades.

While no significant structural damage was observed in the building, minor structural cracks and deformations have been detected.

5.2. Reconstitution

There is no information regarding the original status of the building, and the date of construction could not be determined. Limited information and documents were obtained through research. Although Büyükkarıştıran Bridge is attributed to Sinan the Architect in heritage records, there are no exact records to support this claim.

In the 16th century, no records have been found in the Tezkiret-ul Bünyan and Tuhfet'ül Mimarin, written by Sai Çelebi, who was a friend of Sinan the Architect (Meriç, 1965).

It is known that Via Militaris, the Roman military road, passed through Büyükkarışan. This road facilitated transportation, communication, and military activity between Istanbul (Byzantion) and Belgrade (Singindunum) (İreçek, 1990).

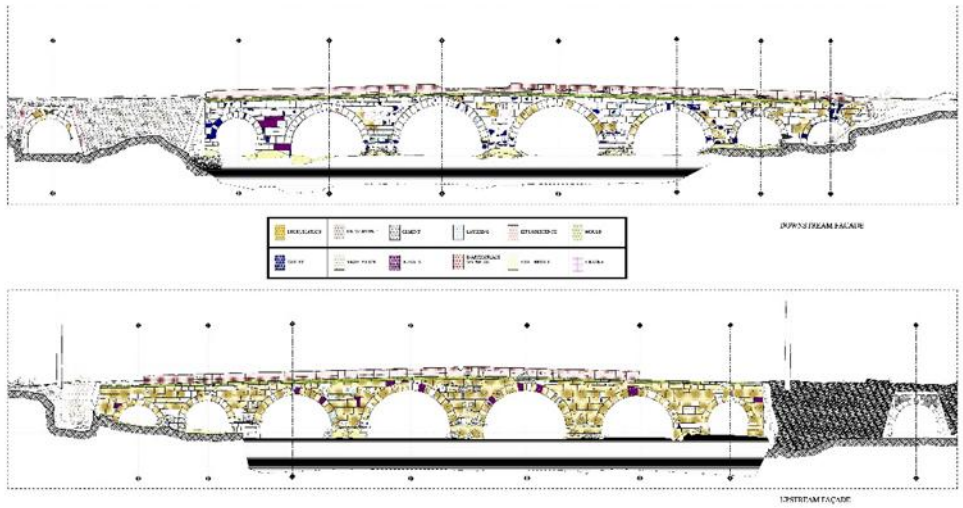

Figure 22. Damage Analysis of the Büyükkarıştıran Bridge (Ayberkin, 2018)

Due to Büyükkarışan's location on Via Militaris, the Roman military route, and the presence of a horse exchange area between the two centers Çorlu (Syrallo) and Lüleburgaz (Bergvle), coupled with the existence of the Yuvalı (Arzus) Creek, it is speculated that the bridge may have been constructed to fulfill the needs of previous civilizations (Güven and Hergüner, 1999).

It is estimated that during the pre-conquest period, Ottoman military troops utilized the same route from Edirne to Istanbul, and later, during the campaigns of Mehmet II, Murat II, Beyazıt II, and Kanuni Sultan Süleyman in the Rumeli region (Kılıç, 2014).

From John Covel's book "Ottoman Diary of a Priest," (2011) written between 1670-1679, we learn that the name of the town comes from the mixing or kneading of the soil, which consists of a spongy clay land. In his diary, he also describes the bridge, mentioning that Karistiran town has a bridge over the Yuvalı River, which is an eight-barrel bridge and a hundred steps long. He notes that the Yuvalı River constantly floods the bridge during winter. He also mentions a fountain and an aqueduct built by Rustem Pasha, which is very close to the bridge.

According to the royal almanac dated 1567, which was determined in archival works, there was an order for repairing bridges on the road or building bridges in places where there were none before the sultan's return from Edirne to Istanbul. Based on this order, if repairs were made to the bridge in accordance with this directive, it could be a reason for attributing the construction to Sinan the Architect, who was the head of the royal architects at that time. (BOA, Book No. 7 Mühimme H:975).

The Büyükkarıştıran Bridge maintained its role as a primary transportation axis from Istanbul to the Balkans for over 2000 years until the construction of the D-100 highway between 1960 and 1970. It is conceivable that civilizations preceding the Ottomans, which conducted various zoning activities along this axis, may have constructed the bridge (Demir, 2016).

The Büyükkarıştıran Bridge may have incurred damage from battles in the region and the 1509 Great Istanbul earthquake, which affected areas as far as Edirne and Gallipoli. It is plausible that the bridge's construction predates the era of Sinan, and it is estimated that Sinan may have overseen its repair due to the damage incurred (Ambrasey and Finkel, 2006).

The first visual documentation of the structure dates back to a photograph from 1909, captured during the Balkan Wars.

Figure 23. Büyükkarıştıran in 1909 (Demir,2016).

Figure 24. Büyükkarıştıran in 1913 (Baldwin,1913).

Figure 25. Büyükkarıştıran in 1913 (Baldwin,1913).

Comparing the old photos with the current situation,

- Some parts of the bridge in the west direction are under the ground today,
- Cutwaters were complete,
- Parapets have been changed,
- The original marble floor coverings of the bridge were replaced,
- The elevation of the bridge's surroundings has been altered due to construction activities, leading to changes in the water level and subsequent soil accumulation around the bridge.
- Arches/Barrels are not deformed yet,
- The north facade (Upstream Facade) has different stones from today and thus undergoes a repair between 1912 and today,
- It was found that the first arch in the west direction of the Surveying Project, which is called Arch 1, did not have the arch spring profile in 1912, but it was added later.

5.3. Restoration Proposal

The restoration project of the Bridge has been meticulously planned with careful consideration given to international conservation statutes and principles. Throughout the process of making conservation decisions and implementing the restoration project, the Athens Charter (1931) and the Venice Charter (1964) have served as guiding frameworks, providing established principles for the protection of cultural heritage. These principles have been further informed by the directives outlined in the Amsterdam Declaration (1975). Based on the damage analysis projects conducted in accordance with the aforementioned protection principles, it has been determined that there is no imminent structural damage to the bridge warranting immediate intervention. Nevertheless, it is imperative to address several maintenance tasks, including removing material contents within the structure, eliminating soil deposits, cleansing pollutants, and mitigating plant-algae formations that have developed on the facades and arch vaults.

As stated in the restoration projects, the following revisions were targeted:

- Removal of joints with cement mortar, reconstruction of joints with lime mortar in accordance with the genuine mortar mixture,
- Cement repairs, removal of stone imitations, and repair of the original stone and missing stone blocks in the facades and vaults,
- Repair of surface losses and surface
- Removal of prefabricated reinforced concrete parapets, asphalt pavement, and reinforced concrete gutters from the structure and replacement with genuine materials, structure.
- Filling the structural cracks with suitable materials and closing the gaps,
- Integration of destroyed structural elements (flood barriers, heel, etc.),
- Surface cleaning of facades and vaults/barrels by micro sandblasting,
- Cleaning the plant formations in the façade and vaults and eliminating the damage they cause,
- Cleaning the closed barrels and cleaning soil deposits from the bridge,
- Removal of soil deposits around barrels and flood barriers,
- Regular monitoring is recommended by placing crack monitors in the The Büyükkarıştıran Bridge (2018)

In addition to the interventions above, a critical issue regarding the protection of the Büyükkarışan Bridge is its lack of visibility or detectability.

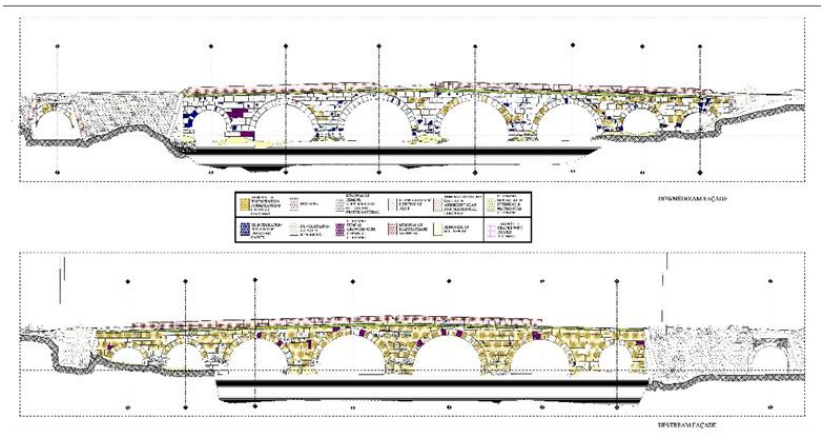

Figure 26. Restoration Interventions of cavities with the appropriate mixture of stone material.

Restricting vehicular access to the bridge, thereby allowing only pedestrian usage, will serve two crucial purposes. Firstly, it will alleviate the bridge's

structural load, potentially extending its longevity and reducing the risk of wear and tear. Secondly, this measure will enhance the bridge's visibility and perception, as it will remain accessible exclusively to pedestrians, particularly those visiting the adjacent industrial facility.

6. Conclusions

The historical evolution of the bridge can be categorized into four distinct periods: the prehistoric era, the Roman Empire era, the pre-roman era, and the Republic era. Research into the pre-roman era commenced around 1000-800 BC, revealing evidence of Thracian settlements in the Ergene Basin. The significance of the region grew as it served as a crucial thoroughfare connecting trade centers, particularly evidenced by Drusipara's role along this route. During the Roman Empire, investigations indicated that Drusipara emerged as a prominent stop along the Via Militaris, a strategic road linking Istanbul and Belgrade.

Research findings indicate that during the Ottoman Empire period, the Büyükkarışan region continued to serve as a pivotal stop along the Via Militaris route. Additionally, efforts were made to enhance the area's significance, including constructing a hunting palace to accommodate travelers and dignitaries. Furthermore, historical documentation from both the State Archives and international repositories, as well as various dated maps, reveal that different names have referred to Büyükkarışan over time.

During the Great Thrace Maneuvers, a segment of the operation was conducted in and around Büyükkarıştıran. Newspaper records attest that the revered leader Gazi Mustafa Kemal Atatürk utilized the primary school in Büyükkarıştıran as an operational center in 1937. The transformation of the Via Militaris Road during the early Republic period saw its integration into the modern D-100 highway, which was rerouted through a new pathway. Consequently, this change resulted in the loss of the bridge's former role as a distinctive passageway. Historical landmarks were surveyed and categorized in the surrounding area under three primary headings: the hunting palace, the Rustem Pasha zoning, and the water gauges.

The survey project aims to comprehensively measure the Büyükkarıştıran bridge and thoroughly document all instances of damage and deterioration. Notably, no prior technical studies have been conducted on the bridge. Despite its obscured origins, the Büyükkarıştıran bridge has provided vital service to its environs for centuries, representing an exemplar of stone bridge construction tailored to the region's needs.

The architectural style of the Büyükkarıştıran Bridge exhibits features typical of Ottoman architecture from the classical period of the 16th century. While heritage records have previously attributed its construction to Sinan the Architect, a notable architect of the Ottoman Empire, there are no mentions

of the Büyükkarıştıran Bridge in Tezkiret'ul Bunyan and Tuhfet'ul Mimarin, Sinan's biographical and architectural treatises, respectively. However, it is believed that seismic activities in the region, coupled with the flooding of Yuvalı Creek, necessitated repairs to the bridge during the 16th century, possibly undertaken by Sinan the Architect.

Consequently, in adherence to the principles of international conservation, the Büyükkarıştıran Bridge holds unquestionable monumental value. Restoration proposals have been formulated to safeguard this heritage for posterity, ensuring its protection and transmission to future generations.
The research question— How can the Büyükkarıştıran Bridge be conserved in a way that respects its historical context while ensuring long-term structural and perceptual sustainability —has been systematically addressed through a multi-layered conservation approach. This approach prioritizes minimal intervention, reversibility, and material compatibility, informed by internationally accepted charters such as the Venice Charter (1964), the Burra Charter (2013), and the Nara Document on Authenticity (1994).

The damage assessment revealed that the structure has been compromised by hydrological erosion, inappropriate materials, biological invasion, and vehicular overuse. The proposed restoration responds with evidence-based methods that respect the authenticity while enhancing accessibility and public interpretation. In doing so, the study illustrates how thoughtful conservation can reactivate neglected infrastructure as valued cultural heritage within regional memory and identity.

Declaration of Ethical Standards

The authors declare that they comply with all ethical standards.

Credit Authorship Contribution Statement

Author 1: Resources, Research, Experimentation, Writing – original draft Visualization, Writing – original draft

Author 2: Resources, Research, Experimentation, Formal analysis, Validation, Methodology, Visualization, Writing – original draft,

Declaration of Competing Interest

The authors have no conflicts of interest to declare regarding the content of this article.

Data Availability

All data generated or analyzed during this study are included in this published article.

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