Zeyrek, M. & Binan, C. Ş. (2026). Implementation and Design Issues at the Intersection of Architectural Components in the Classical Period Ottoman Mosques. *Korkut Ata Türkiyat Araştırmaları Dergisi*, 25, 162-181.

KORKUT ATA TÜRKİYAT ARAŞTIRMALARI DERGİSİ

Uluslararası Dil, Edebiyat, Kültür, Tarih, Sanat ve Eğitim Araştırmaları Dergisi

ISSN: 2687-5675

Sayı/*Issue* 25 (**Haziran**/*June* 2026), s. 162-181
Geliş Tarihi-*Received*: 06.05.2026
Kabul Tarihi-*Accepted*: 29.06.2026
Araştırma Makalesi-*Research Article*
DOI: 10.5281/zenodo.20735693

Implementation and Design Issues at the Intersection of Architectural Components in the Classical Period Ottoman Mosques*

Klasik Dönem Osmanlı Camilerinde Mimari Bileşenlerin Kesişim Noktalarındaki Uygulama ve Tasarım Sorunları

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Abstract

The major focus is the observable construction, design, and detailing issues of the Süleymaniye, Selimiye, and Kadırga Sokollu Mehmet Paşa Mosques, as well as the Davutpaşa and Sultanahmet Mosques, which are considered the pioneers and successors of the era. Although period structures are often examined for the flawless aspects of their aesthetic compositions, contrary to expectations, they are not the product of ideal design processes; rather, inconsistencies are evident that reflect on-site implementation practices. The objective of this study is to derive insights into the unexpected outcomes regarding the design and implementation processes in the Classical period of Ottoman architecture. As a result of observational and photogrammetric analyses, morphological anomalies that do not align with deterministic design models were identified within the main mass, outer portico, minaret, and annex intersections of the five monumental structures. These traces reflected on the facades and details (break in continuity of mouldings, overlapping or clashing of architectural components) indicate that a holistic design framework or concurrent construction processes could not be maintained continuously, or that deviations from the original layout occurred during subsequent, needs-based interventions, leading to various issues. Consequently, these traces demonstrate that Classical period Ottoman architecture operated through a flexible on-site implementation practice rather than a rigid and flawless template.

Keywords: Classical Ottoman architecture, historical construction traces, implementation issues, history of construction, design issues in historical buildings.

Öz

Bu çalışmanın temel konusunu; Klasik dönem olarak adlandırılan 16. yüzyıl ürünü olan Süleymaniye, Selimiye ve Kadırga Sokullu Mehmet Paşa Camileri ile dönemin öncülü ve ardılı olarak kabul edilen Davutpaşa ve Sultan Ahmet Camilerinin gözlemlenebilen yapım, tasarım ve detay sorunları oluşturmaktadır. Dönem yapıları estetik kompozisyonlarının kusursuz yönleriyle ele alınmasına karşın, beklendiği gibi ideal tasarım süreçlerinin ürünü olmayıp, sahadaki uygulama pratiklerine yansıyan tutarsızlıklar mevcuttur. Çalışmanın

* Bu çalışma, YTÜ FBE Rölöve-Restorasyon Anabilim dalında Prof. Dr. Can Şakir Binan danışmanlığında, Müberra Zeyrek tarafından hazırlanmakta olan doktora tez çalışmasından üretilmiştir (This article is based on the doctoral thesis currently being prepared by Müberra Zeyrek under the supervision of prof. Can Şakir Binan at the Department of Surveying and Restoration, Institute of Natural Sciences, YTÜ).

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amacı, Osmanlı İmparatorluğu'nun zirve dönemi olarak kabul edilen Klasik dönem Osmanlı mimarlık ortamındaki tasarım ve uygulama süreçlerine ilişkin beklenmeyen sonuçlara dair çıkarımlar yapmaktır. Yapılan gözlemsel ve fotogrametrik analizler sonucunda; incelenen beş anıtsal yapının ana kitle, son cemaat yeri, minare ve ek yapı birleşimlerinde deterministik (kurallı) tasarıma uymayan morfolojik sapmalar tespit edilmiştir. Cephe ve detaylara yansıyan bu izler (silmelerde ani kesintiler, mimari bileşenlerin üst üste binmesi veya çarpışması), bütüncül bir tasarım kurgusunun veya eşzamanlı inşa süreçlerinin sürekli işletilemediğini veya sonraki dönemlerdeki ihtiyaç odaklı müdahalelerde özgün kurgudan sapılarak çeşitli sorunların meydana geldiğini göstermektedir. Bu izler, Klasik dönem Osmanlı mimarisinin katı ve kusursuz bir yapıdan ziyade, sahada esnek bir uygulama pratiğine sahip olduğuna işaret etmektedir.

Anahtar Kelimeler: Klasik Osmanlı Mimarisi, tarihi konstrüksiyon izleri, uygulama sorunları, yapı tarihi, tarihi yapılarda tasarım sorunları.

Introduction

Regarding Classical Ottoman architecture, Mimar Sinan and the monumental Selatin mosques are universally recognized as the definitive examples of the era. While this statement is true, 16th-century Ottoman architecture consists of a wide range of structures and encompasses a broader spectrum and group of buildings, including early examples predating Sinan and works that continued after him. However, considering that the most important structures in the hierarchical order were mosques -and specifically the Selatin mosques built in the names of the sultans- we may accept that these structures represented the most advanced level of the period in terms of technique, technology, and aesthetics.

When it comes to 16th-century Ottoman architecture, there is a widespread perception that it embodies a spectacular grandeur—one that is intertwined with the personality of Mimar Sinan—and represents a milestone that cannot easily be achieved. For that reason, there are very few studies that clearly and critically examine the architectural practices of that era and the state of technological capabilities and technical limitations at the time; indeed, this topic remains largely under-researched.

Notably, in spite of the prevailing architectural approach of the period, which assumed that construction processes consisted of planned and sequential stages, and despite the assumption that architectural components—such as the main prayer hall (*harim*), outer portico, courtyard (*harem*), minaret, and various annex structures—were designed and built in a single phase, it becomes clear through empirical observations that a different approach was taken in practice.

In Ottomans structures, construction processes are based on rapid implementation rather than a long-term planned schedule. One consequence of this approach is the emergence of issues that are reflected in the quality of the building's construction. It is necessary to observe the construction issues in these buildings and to uncover the underlying causes by examining them. In this way, understanding the architectural, construction, technical and analytical insight of the period will become clearer (Tanyeli, 2021).

The 16th-century architectural world, also known as the Classical Period, is a period that must be prioritised for consideration, as it represents the most significant representative of traditional monumental architecture in terms of both the quantity and quality of its works. However, the inadequacy and ambiguity of the existing written records concerning this period constitute the most significant obstacle to a proper understanding of this architectural era from a contemporary perspective. This situation, in turn, paves the way for interventions in these buildings that are carried out without accurate analysis and the development of appropriate approaches.

- Considered in terms of their scale, do the 16th-century Ottoman monumental structures (primarily mosques) exhibit any construction defects or issues arising from the building process?
- Regarding the design and construction processes of mosques, are there any unpredictable consequences in the details of integrating architectural components?
- Why are these structures specifically not discussed in terms of their anomalies, even though their presence is so obvious?

The objective of this work extends beyond creating a contradiction; it seeks to synthesize the missing link that reconciles the architectural fragments into a coherent whole. The aim is to determine whether observable structural issues can be identified in monumental buildings of the Classical Period, with the focus here being on mosques. Delving into the details of the study's objective, the focus is on two main axes: design issues and implementation issues. The observable design-related anomalies and incongruities in Classical Period Ottoman monumental structures, followed by the examination of integration problems encountered in architectural components, subsequently, to examine any issues and construction flaws in the details of architectural elements and their integration points, and it is projected to yield substantiated findings of the existing issues.

1. Historiographical Perspectives on the Interpretation of Ottoman Architecture

Has Ottoman architecture been analyzed through a monolithic perspective, or has it been subjected to critical scrutiny?

A debate that has emerged regarding the research methods that have been used in the process of studying Ottoman architecture -or a methodological redundancy that leads to repetitive outcomes- has made it necessary to approach the literature from this perspective as a complementary alternative.

With his work A History of Ottoman Architecture, Godfrey Goodwin is regarded both as a reliable authority and a source of debate. Indeed, the book has a broad perspective, combining technical analysis, a comparative approach and an examination of the historical process within its own context. Whilst providing explanations at the level of structural elements through a technical analysis approach, it also notes their links to other structures. It also points out the material-related inaccuracies in the restorations (Goodwin, 1971/2012).

Noting that Ottoman architecture had been approached from a singular perspective up until then, Necipoğlu criticises this traditional formalist approach and states that her aim is to exceed this restrictive viewpoint. For this reason, she presents a study that approaches Ottoman buildings not merely through the technical aspects they offer—such as floor plans and domes—but through a 'holistic' approach that also considers the political, social and cultural context in which they were built (Necipoğlu, 2005/2017).

Through an orientalist approach to the history of Western-centric architectural discourse, Sinan's buildings are perceived as variations/repetitions derived from the Hagia Sophia. A related approach in nationalist historiography involves denying the influence of Hagia Sophia, and insisting that Ottoman architecture has solely Turkish origins, whilst casting Sinan into a specific mould—such as the 'Turkish Michelangelo'—and mythologising the figure (Kuban, 1993; Necipoğlu, 2005/2017).

In its work, Ernst Egli approaches Ottoman architecture from a cultural-anthropological perspective. It discusses the misconceptions found in Western literature

and the unique position of Turkish architecture within the broader context of Islamic architecture. Whilst referencing previous studies, it adopts a distanced and critical stance towards the views of both Western and local researchers. He criticises this approach, noting that the Western perspective has underestimated the contributions of Turks to Islamic art based on misconceptions and superficial knowledge (Egli, 1976/2009).

How is Ottoman architecture perceived and conceptualized in contemporary historiography?

In terms of its architectural components, Ottoman architecture follows a 'functional *külliye* (complex) system' and, regarding its layout, a 'geometric plan typology'. A distinctive pattern emerges in Sinan's architecture, striving to achieve 'central unity' from 'spatial fragmentation' during the Classical Period (Goodwin, 1971/2012). It is contended that a tendency to move away from Early Period architectural components steered the evolution of Classical architecture in this direction.

Goodwin (1971/2012) identifies the separation of the *tabhane* from the main part of the mosque as a structural turning point. Considered as a fundamental element of early mosques, these units evolved into independent structures situated alongside the courtyard starting from the pre-Classical Period.

Likewise, in his comprehensive work, Doğan Kuban provides highly detailed accounts regarding the development of Ottoman mosques. He describes the evolution and transformation of architectural components through the transitional phases between periods (Kuban & Emden, 2007).

The primary objective of Ottoman architecture transcends the singular building, focusing instead on the system of the *külliye* (socio-spatial complex) composed of interacting functional units (Goodwin, 1971/2012). However, the approach here relies on functional distinctions when classifying building components; whereas they should be evaluated through structural elements, whose formal differences and evolution are traceable both on the plan plane and across the facades.

Ottoman architecture is not merely based on a technical structural framework built in an aesthetic style; at the same time, it serves as a system that embodies political, social and cultural representation. In Ottoman architecture, design elements are not determined solely by the architect's discretion; instead, they are governed by fundamentally structured by normative religious and legal constraints (fatwas and waqfiyyas). Nevertheless, this does not imply an insular tradition isolated from global trends. On the contrary, Ottoman architecture actively engaged with contemporary cultures. Indeed, a complex relationship—characterized by both competition and dialogue—existed between the centralized-plan churches of the Italian Renaissance and Hagia Sophia (Naser Eslami, 2014; Necipoğlu, 2005/2017).

Turkish architecture is characterized by two fundamental spatial principles: an inward-to-outward expansion and the absence of rigid axiality. To comprehend Sinan's architectural logic, it is essential to gain insight into the state apparatus in which he was nurtured and its intricate internal structure. Ottoman architecture embodies the interaction between the institutions constituting the state structure—such as the Divan, the army and the navy—and the agents of spiritual life, such as religious orders and poets. Sinan reinterpreted monumental precursors like the Hagia Sophia as initial points of reference and proposed truly original and universal solutions (Egli, 1976/2009).

Güngör (1988) further notes that in Sinan's buildings, the features of the interior are reflected on the exterior, and there is no apparent need to conceal the structure.

Is there a contrary argument based on construction traces and implementation issues in Classical Period Ottoman structures?

The original and primary sources offering a close examination of the Classical Period remain scarce; furthermore, these records generally lack the data necessary to analyse technical and structural complexities. Nevertheless, in Sâî Mustafa Çelebi's celebrated memoirs (*tezkires*), it is reported that during the construction of the Süleymaniye, the public disparaged Sinan by saying, 'This building will never be finished' and 'The dome will never stand'; whilst Suleiman the Magnificent, exasperated by the perceived delay, accused Sinan of neglecting the project in a fit of rage (Meriç, 1965).

Goodwin (1971/2012) offers an explicit critique of the defects and flaws in 'transitional period' buildings, along with implementations that are devoid of their original essence following the Classical Period; he further interrogates the logistical gaps among construction teams and the systemic planning failures inherent in these transitional buildings. He indicates an unfitting connection where the courtyard walls of the Bayezid II Mosque in Edirne meet the tabhane walls, noting that independent working teams were not sufficiently attentive to aesthetic considerations. The author also adopts a critical stance toward Classical Period architecture in certain respects, states that Sinan's Hüsrev Pasha Mosque in Aleppo—one of his earliest major works—presents a somewhat careless appearance due to its hasty construction. In a similar vein, he points out that the asymmetrical irregularities in the internal arch joints of the Süleymaniye Mosque were skilfully concealed by extensive ornamentation and highly refined craftsmanship.

Aslanapa (1988) notes that the construction of the Sinan Pasha Mosque in Beşiktaş was carried out 'hastily, without showing much meticulousness'.

Drawing on tezkires and other primary sources of the period, Necipoğlu (2005/2017) recounts a construction error made during the construction of the Fatih Mosque (Mosque of Mehmed II) while discussing the structural and material defects prevalent in Classical Ottoman architecture. She states that the columns of the building were mistakenly shortened perceived as being too long, which was criticized as a technical flaw by the peers of the time. In addition, she reports that one of the large columns brought for the Süleymaniye Mosque cracked during transport, whilst another splintered at the same time. Furthermore, through the example of the Büyükçekmece Bridge, she explains that Sinan scrutinized the failures of architects who came before him.

To quote Egli (1976/2009), Mimar Sinan did not maintain direct oversight over every project to guarantee its flawless execution. For instance, an imperial decree concerning the Sultan Murad III Mosque in Manisa—attributed to Sinan—reveals that construction was periodically halted, the dome remained uncovered for a significant duration, and expenditures exceeded expectations despite the availability of low-cost local labour and materials. He attributes these issues to Sinan's advanced age of ninety, suggesting that the master had delegated his architectural responsibilities to a younger generation of practitioners.

Ernst Egli (1976/2009), in his examination of the Ottoman Classical Period structures addressed in this study, provides a constructive analysis of the inherent tensions between technical constraints, topographical imperatives, and aesthetic sensibilities—moving beyond the reductive perception of these buildings as flawless masterpieces. He argues that the imperial pressure regarding the construction timeline of the Süleymaniye Mosque, as well as the challenges posed by the sloping terrain of the Kadırga Sokollu complex, are vividly manifested in the structural traces and occasional

aesthetic dichotomies (such as the stark contrast between the monumental arches and the delicate ornamentation at Kadırga).

Kuban also mentions certain issues he observed in the structures. He noticed the relationship between the outer portico and the courtyard porticos of the Selimiye Mosque (Kuban & Emden, 2007).

Kocainan, on the other hand, criticises Renaissance practices in Western architecture, accusing them of being irrational for adding ancient architectural elements that convey no meaning to their buildings for purely decorative purposes; he argues that, throughout its development, Ottoman architecture established a unique architectural art form based on logical and rational principles and in harmony with local materials (Kocainan, 1939).

On the importance of the dome from a structural-historical perspective and its impact on Classical Ottoman architecture, Bilgiç (2017) discusses a phenomenon in which the aim of creating a central, well-lit space took precedence, whilst structural problems occasionally arose. In particular, she notes that transitional elements, buttresses, weight towers and even minarets were integrated into the structural systems of the era.

In her study on the history of construction technology during the Ottoman period, Tanyeli (2017) describes all the technical stages of building construction, starting with measurement methods and covering material procurement, foundation construction, the integration of superstructure elements (columns, piers, walls) into the structure, and the techniques used to build vaults and domes. Whilst the focus of this study is on how structural elements are combined, the study reveals a gap in the literature regarding this context by omitting the relations between functional architectural components and the issues arising at their points of intersection.

Whilst these sources provide a comprehensive and wide-ranging examination of Ottoman architecture, on occasion they identify issues in the structures; however, they do not treat this subject as part of the historical process of construction, neither do they delve deeply into it, nor do they examine in detail the causes and consequences of these issues. Therefore, this situation highlights a gap in the literature regarding the methodological analysis of architectural issues in Ottoman architecture.

2. Material and Method

The methodology involved evidence-based observation and comparative analysis of the identified monuments, with fieldwork carried out in October 2023 and November 2024. Visual inspection and photogrammetric documentation were conducted based on the issues observed at the points of intersection of the structures. The study was further supported by examination of architectural drawings and literature reviews. This study, situated at the intersection of conservation-restoration and architectural history, is limited to the parts of the structures that can be observed from the exterior. It is acknowledged that these historical buildings, particularly exemplified by the Davutpaşa Mosque, have been subject to cumulative interventions and repairs following seismic events over centuries. Consequently, the observed architectural incongruities are analyzed as part of the structures' current material state, acknowledging the potential influence of historical interventions that remain indistinguishable from original construction practices. Structural-level flaw analyses were excluded from the scope of the study.

The criteria taken into account when determining the samples included in the scope of the study are as follows:

- The structures must serve as representative cases capable of providing sufficient data regarding construction techniques and technology (A),
- They should reflect the specific construction practices of their respective eras (e.g., the inclusion of tabhanes in the early period) (B),
- To ensure a more precise analysis, the selected structures should be confined to a narrow chronological or thematic historical context (C),
- The scope should encompass the collective understanding of Ottoman architectural expression, rather than being limited exclusively to Sinan and his oeuvre (D).

16th-century Ottoman architecture, which we refer to as the Classical Period, is not a phenomenon that emerged in isolation during that specific century; rather, it represents the culmination of a long-standing evolutionary process in which pre-existing and emergent architectural principles were codified and systematized by Mimar Sinan and the rising cadre of architectural specialists of the period, thereby establishing a stable theoretical and structural foundation, and continued to exert its influence into the following century. Therefore, it has been determined that it is appropriate to periodize the development of Classical Ottoman architecture into three distinct phases: the formative transitional period beginning with the conquest of Istanbul; the Sinan era, representing the peak of systematization; and the post-Sinan period, characterized by the enduring legacy and continued influence of his architectural principles (Figure 1).

Figure 1. Chronological division and categorization of the micro-periods (Created by the Authors).

Whilst the Süleymaniye, Selimiye and Kadırga Sokollu Mehmet Paşa Mosques, built during the same period, are regarded as the most prominent structures of the Classical Period, the most significant building of the subsequent period is the Sultanahmet Mosque. In order to structure the sample scope in a manner that is more balanced and comparable, the Davutpaşa Complex—one of the first mosques built following the conquest of Istanbul yet also bearing traces of Early Period architecture—has been identified as one of the structures where fieldwork was conducted. In doing so, an evaluation would be possible that encompasses the transition between periods, without breaking the Classical Period away from its historical continuity, and which clarifies whether the origins of the defined criteria are systematic and, if so, highlights the period-specific variations more clearly. The identification data, selection criteria (Table 1), and locations of the monuments (Figure 2) are provided.

Table 1. Identification data and selection criteria of the selected mosques (Created by the authors)

Monument	Patron	Construction year(s)/Period	Selection criteria
Davutpaşa Mosque	Grand Vizier Koca Davud Pasha	1485 (The transitional period)	A, B, C, D
Süleymaniye Mosque	Sultan Suleyman I (the Magnificent)	1551-1558 (The Sinan era)	A, B, C
Selimiye Mosque	Sultan Selim II	1558-1567 (The Sinan era)	A, B, C
Kadırga Sokollu Mehmet Paşa Mosque	Grand Vizier Sokollu Mehmed Pasha	1571 (The Sinan era)	A, B, C
Sultanahmet Mosque	Sultan Ahmed I	1609-1617 (The post-Sinan period)	A, B, C, D

Figure 2. Locations of the monuments examined in the study (Source: Google Earth Pro).

2.1. Assessment Criteria

In establishing the research framework, priority was given to visually identifiable elements that offer compelling evidence regarding structural anomalies. Issues and anomalies in the structures under examination were assessed across three fundamental layers of analysis: (1) the points of intersection of architectural components, (2) structural details, and (3) the design framework. This classification aims to enable deviations in the structure to be interpreted not only in structural terms but also through spatial and component-based relationships.

In identifying the findings, assessments of anomalies were conducted based on morphological deviations such as interruptions of moldings, overlapping architectural elements, and inconsistencies and discontinuities between architectural components.

Accordingly, the analytical framework for these selected structures is established upon the relational network between the main prayer hall (*harim*) and other architectural components—specifically the outer portico (*son cemaat yeri*), the courtyard (*harem*), the minaret, and various annex structures (Figure 3). In addition to this relational analysis, the details and design-related anomalies observed in these components are addressed as two distinct investigative parameters.

The study was conducted exclusively on the selected case structures and does not claim to represent the entire practice of the period. Nevertheless, it is envisioned as a replicable methodological approach. This is because the three fundamental layers of analysis and the morphological deviation criteria proposed in this study offer a framework that can be objectively applied to other Ottoman monuments of similar or different periods and construction techniques.

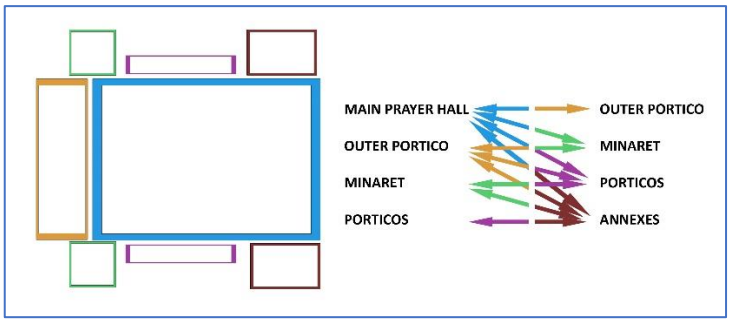

Figure 3. Schematic diagram of the relationships between architectural components (Created by the Authors).

3. Findings: Implementation Issues in Classical Ottoman Architecture

For each of the mosque complexes (*külliye*) examined during the fieldwork—namely Davutpaşa, Süleymaniye, Selimiye, Kadırga Sokollu Mehmet Paşa, and Sultanahmet—observations were conducted focusing on the intersections of architectural components, as well as structural details and design-related characteristics. Base plans (adapted from Aslanapa, 1986; Goodwin, 1971/2012; Kuran, 1987) are used as spatial references to mark the exact locations of the intersections discussed in the study.

3.1. Issues in the Integration of Architectural Components

From which perspective one approaches the question of what architectural elements constitute Ottoman mosques of the Classical Period is of great importance. Whilst mosques, madrasas, and imarets can be classified as architectural volumes designed to meet specific functional requirements, the focus of this study lies in the constituent components that form a complex or a place of worship. Although these components possess distinctive formal and functional identities, they remain fundamentally interrelated within the overall structural scheme.

The primary focus is not a functional classification, but rather the interconnectivity between architectural components that, despite their divergent characteristics and distinct construction sequences, constitute the structural whole. It has been determined that the fundamental point of inquiry is the continuity or discontinuity of structural elements; to this end, the continuity of mouldings has been examined as a key diagnostic tool. A break in continuity or misalignment in the mouldings was interpreted as evidence of either structural deformation or a subsequent architectural addition. Furthermore, in certain instances, the deformation of sections presumed to be finalized—caused by the superposition of later elements—prompted a critical inquiry into whether such occurrences stem from fundamental design-related anomalies.

3.2. Integration Issues between the Main Prayer Hall (Harim), Outer Portico, and Minaret

Several inconsistencies have been observed in the workmanship and detail resolutions at the junctions between the main prayer hall (*harim*) and the outer portico (*son cemaat yeri*). In contrast, despite the denser ornamental composition of interior spaces in Ottoman monuments, craftsmanship and construction execution appear to be more consistent. As noted by Goodwin (1971/2012) regarding arch-corner junctions, occurrences such as structural superposition, the arbitrary termination of mouldings, height discrepancies between components, and subsequent drainage failures result in deterioration or morphological distortions at the junction points.

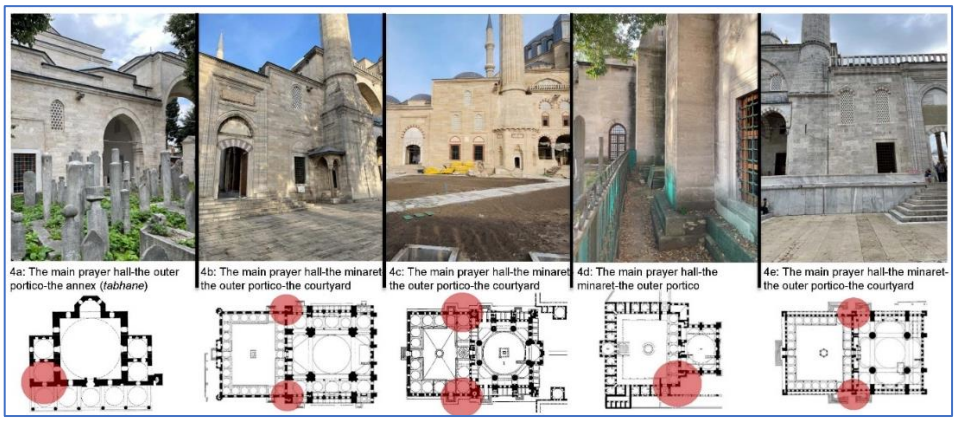

Figure 4 (a-e). Relationship of architectural components and the intersections in the selected mosques (Created by the authors; base plans adapted from Aslanapa, 1986; Goodwin, 1971/2012; Kuran, 1987).

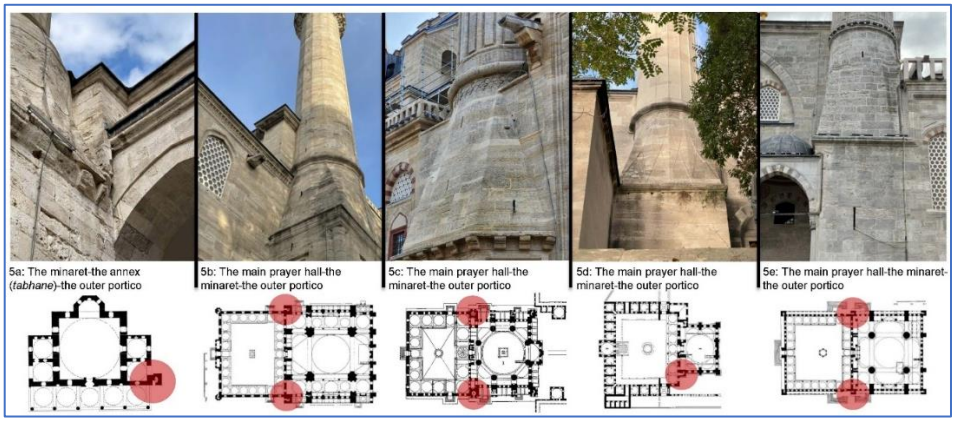

Figure 5(a-e). Integration of minarets within the architectural composition in the selected mosques (Created by the authors; base plans adapted from Aslanapa, 1986; Goodwin, 1971/2012; Kuran, 1987).

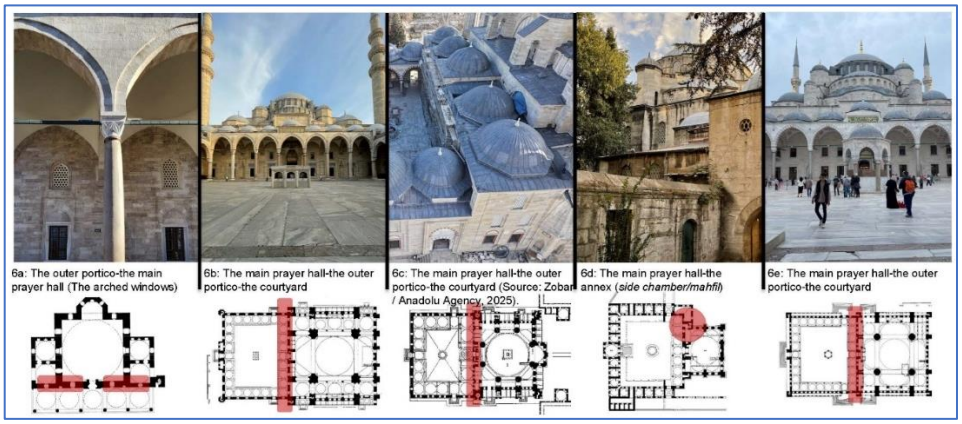

Figure 6(a-e). Relationship of the outer portico and annex with the main prayer hall in the selected mosques (Created by the authors; base plans adapted from Aslanapa, 1986; Goodwin, 1971/2012; Kuran, 1987).

Davutpaşa Mosque, a transitional monument between the Early and Classical periods, stands out as a conglomeration of independent structural components: the main prayer hall (*harim*), the outer portico (*son cemaat yeri*), and the *tabhane* (annex). Indeed, the outer portico does not form a holistic relationship with either the *harim* or the *tabhane* in terms of its proportional width and height (Figure 4a). The discontinuity observed at the junction where the mouldings meet the outer portico indicates a lack of structural continuity between these components. Similarly, at the points where the minaret

intersects with the main prayer hall and the outer portico, discontinuities in the mouldings were observed, creating the impression of a later addition. Furthermore, an unrefined structural superposition (clashing) was identified where the side arch of the *tabhane* overlaps with the minaret, resulting in a disorganized appearance (Figure 5a).

An examination of the outer portico, which protrudes from the main prayer hall, reveals that the arch profile of the window facing the *tabhane* deviates from those within the main prayer hall (*harim*) (Figure 6a). While the windows on the four primary walls of the mosque—excluding the *mihrab*—maintain a uniform shape, size, and elevation, such formal variations in an otherwise relatively simple-plan building suggest that the relationships between these architectural components point toward an underlying narrative of fragmented construction.

In Süleymaniye, the minarets integrated into the main prayer hall and the outer portico are positioned not merely as integral parts of the facade, but rather as protruding external elements along the facade axis. This arrangement—reminiscent of a structural component whose function was defined at a later stage—consequently disrupts the facade's tectonic unity (Figure 4b). This fluidity/continuity is notably disrupted where the mouldings of the main prayer hall (*harim*) and the courtyard intersect with the minaret. Indeed, the mouldings of both the *harim* and the outer portico abut the minaret abruptly, resulting in an unfinished and discordant appearance rather than a resolved architectural transition (Figure 5b). An analysis of the relationship between the stepped, domed massing of the Süleymaniye Mosque's *harim* and its attached outer portico reveals a distinct spatial compartmentalization, as if two independent architectural entities were brought together. For instance, the portico domes intersect with the *harim* windows situated behind them, illustrating a lack of alignment between these two elements (Figure 6b).

In the Selimiye Mosque, the relationship between the minaret, the main prayer hall (*harim*), and the outer portico reveals a more explicitly defined positioning. Unlike the sharp-edged protrusions seen in earlier examples, the minaret here is integrated into the facade through a softened polygonal form, suggesting a more resolved architectural transition (Figure 4c). The minaret maintains its individual identity while achieving a seamless integration with the facade. It is neither abruptly attached to the *harim* nor the outer portico walls. Consequently, the mouldings do not abut the minaret abruptly; instead, they are recessed and terminated behind the facade plane without clashing with the minaret (Figure 5c). In the outer portico, although the central bay is elevated, no window is positioned on the corresponding axis of the main wall—likely to avoid a direct overlap. However, despite the lower elevation of the lateral bays, the windows behind them are still partially obstructed, further highlighting the lack of vertical alignment between the portico's vaulting and the *harim*'s fenestration (Figure 6c).

The Kadırga Sokollu Mehmet Paşa Mosque, characterized by a minimalist rectangular plan, features a seven-bay outer portico where one bay on each side protrudes laterally beyond the main prayer hall. While the lower row of windows on the right side of this portico is pierced, the corresponding row on the left remains blind. The minaret is situated to the right of the main prayer hall (*harim*), adjoining both it and the outer portico (Figures 4d, 5d).

When examining the interaction between structural elements in the Sultanahmet Mosque, the intercomponent relationship reflects a morphological affinity with the architectural layout of the Süleymaniye Mosque. The minarets, positioned at the four corners of the main prayer hall (*harim*)—a mass supported by massive, salient buttresses—exhibit similar protrusions (Figure 4e). Furthermore, the outer portico, which aligns with the outer perimeter of the minaret, extends beyond the main body in a manner

consistent with the architectural schemes of the previously discussed structures. What is striking, however, is that although these three architectural components intersect, they appear as disjointed fragments brought together through a forced compromise at their points of contact, rather than a unified whole (Figure 5e). The fenestration on the facade of the *harim* is obstructed by the domes of the outer portico, resulting in inadequate natural lighting due to this spatial positioning (Figure 6e). The juncture where these lead-covered domes meet the primary mass reveals an inconsistent interface, indicating a lack of coherent integration between the portico's vaulting and the main wall's opening scheme.

3.3. Integration Issues between the Main Prayer Hall (Harim), Annexes, and Porticos

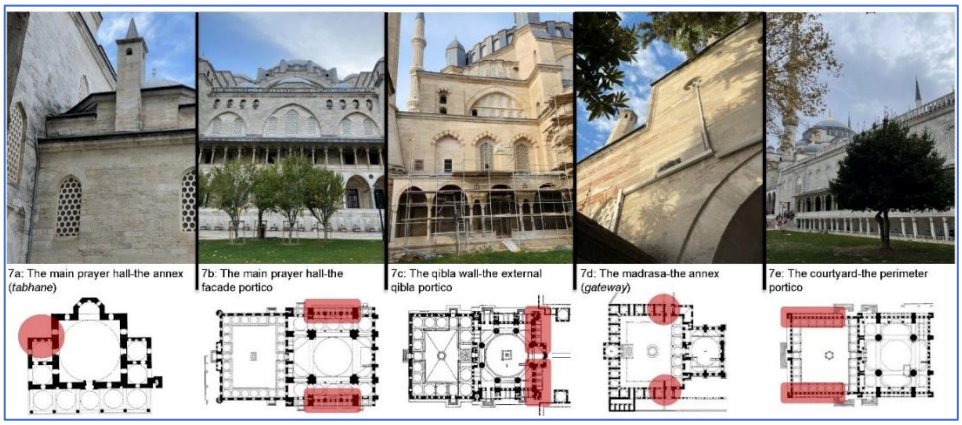

Figure 7(a-e). Relationship of the porticos and annexes with the main prayer hall in the selected mosques (Created by the authors; base plans adapted from Aslanapa, 1986; Goodwin, 1971/2012; Kuran, 1987).

In the case of the Davutpaşa Mosque, the tabhane boundaries appear to be determined solely by the existing window placements on the main wall. Consequently, the extension does not function as an integral part of the original design but rather as an ad-hoc patch, attached out of necessity. This lack of tectonic belonging is particularly evident at the peripheral junctions, where visible moisture and discolouration mark the junction points, highlighting the structural inconsistencies at the interface (Figure 7a).

In the Süleymaniye Mosque, the protruding presence of minarets and buttresses generates a dynamic rhythm on the facade; however, the subsequent integration of facade porticos has disrupted this flow, leading to a visually fragmented and complex appearance (Figure 7b).

In the Selimiye Mosque, the facade porticos do not exhibit a protruding presence; instead, the facade presents itself as a unified whole. This is achieved by positioning enclosed spaces above the porticos—which are not covered by domes or wooden roofs—thereby establishing a vertical continuity lacking in earlier examples. However, this cohesive arrangement is challenged by the external qibla porticos, which appear for the first time in this structure. Wedged between the mihrap protrusion and the minaret walls, these porticos seem to deform the structural alignment, leading one to question the underlying rationale for their placement within such a constrained interface (Figure 7c).

The main prayer hall (*harim*) of the Kadırga Sokollu Mehmet Paşa Mosque exhibits a prismatic and austere form, lacking the secondary annexes—such as *tabhanes*—characteristic of earlier examples like the Davutpaşa Mosque. However, on the left side of the main volume, a side chamber (*mahfil*) is situated symmetrically to the minaret. Given its distinct formal language, it is suggested that the mahfil was integrated as a discrete component, subsequently articulated onto the main volume (Figure 6d).

In the Sultanahmet Mosque, the arrangement of the facade porticos follows a similar logic to that of the Süleymaniye Mosque, particularly in the way domed units are positioned between minarets and buttresses above the entrances. Furthermore, this scheme extends along the outer boundary of the courtyard in the form of perimeter porticos, where projecting units covered with pedimented roofs house ablution fountains (*shadirvans*) beneath (Figure 7e).

3.4. Integration Issues between the Outer Portico (Son Cemaat Yeri), Annexes, and Porticos

As previously noted, the outer portico at the Davutpaşa Mosque—which protrudes beyond the main prayer hall (*harim*)—serves both to conceal the tabhane situated behind it and to define a separate zone distinct from the mosque's entrance. The fact that the windows of this outer portico differ formally from those of the *harim* underscores a tension that renders the relationship between the portico and the tabhane particularly worthy of closer analysis.

In the Süleymaniye Mosque, an examination of the outer portico in relation to the courtyard (*harem*) porticos reveals a distinct discrepancy in height. This stepping effect indicates a lack of discernible proportional correlation regarding the height difference between the main volume and the outer portico, as observed in the comparative photographic analysis.

A similar condition is observed in the Selimiye Mosque, where the outer portico functions as an independent volumetric entity, while the courtyard (*harem*) porticos maintain their own structural integrity. The outer portico is situated at a considerably higher elevation, causing the lower courtyard porticos to intersect abruptly—almost piercing—into its structure.

In the Kadırga Sokollu Mehmet Paşa Complex (*Külliye*), situated on a steep and narrow site, the entrance gateways function as the primary transitionary elements between the architectural components. These symmetrical vaulted gates serve as the physical nodes connecting the madrasa (set into the slope) with the main prayer hall (*harim*) and its outer portico (situated on an elevated, leveled platform). While these gates share the same material and height as the outer portico, the madrasa itself stands apart with its distinct material, form, and elevation, thereby asserting a discrete architectural identity (Figure 7d).

In the Sultanahmet Mosque, the height difference between the outer portico and the courtyard (*harem*) porticos—a common feature in earlier periods—is eliminated, with all porticos on all four sides sharing a uniform height.

3.5. Traces and Issues Observed in Details

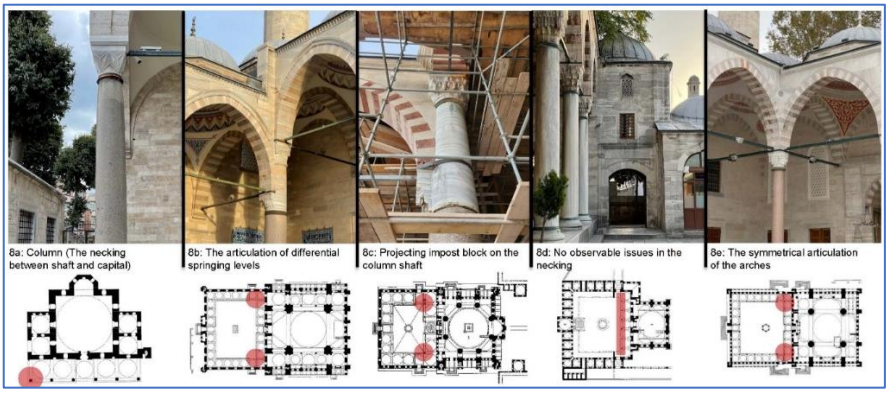

Figure 8(a-e). Column Articulations in the selected mosques (Created by the authors; base plans adapted from Aslanapa, 1986; Goodwin, 1971/2012; Kuran, 1987).

Column shaft-capital transitions; An examination of the outer portico columns in the Davutpaşa Mosque reveals variations in the way the shafts are connected to the column capitals; in some instances, the trimming appears incomplete or reflects careless workmanship (Figure 8a).

The column junction problem arising from the stepping caused by the elevation difference at the intersection of the porticos; The column situated at the intersection of the outer portico and the courtyard portico in the Süleymaniye Mosque is both shorter and has a thicker section compared to the other courtyard columns (Figure 8b).

The courtyard portico arch, which intersects the outer portico of the Selimiye Mosque at a considerably low elevation, is similarly integrated by being seated on an impost block carved into the column shaft (Figure 8c).

The transitions between the column shafts and capitals in the Kadırga Sokollu Mehmet Paşa Mosque are perfectly executed; the ornamental details are carefully executed, and a formal unity is achieved in both the dimensions and the materials of the columns (Figure 8d).

The stepping issue in the Süleymaniye and Selimiye mosques was resolved in the Sultanahmet Mosque by equalizing the portico heights and ensuring the symmetrical articulation of the arches. However, despite this alignment, the molding details of the outer portico and the courtyard porticos still do not coincide or exhibit continuity (Figure 8e).

3.6. Traces and Issues Observed on Facade Details

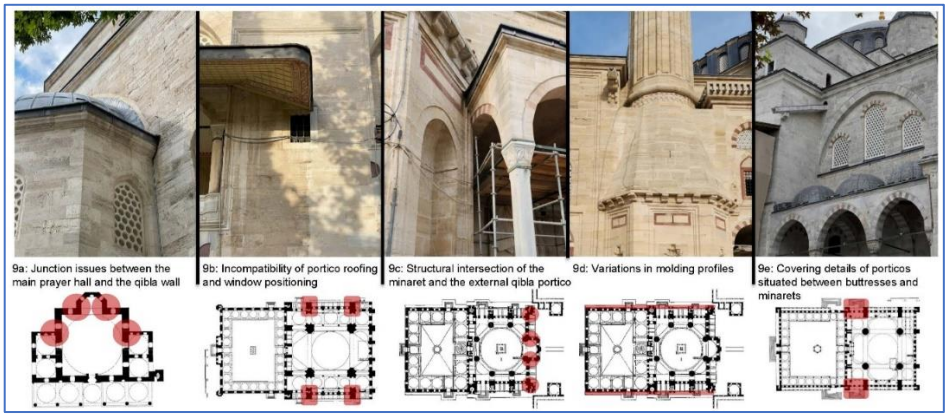

Figure 9(a-e). Various detail issues in the selected mosques (Created by the authors; base plans adapted from Aslanapa, 1986; Goodwin, 1971/2012; Kuran, 1987).

The junction where the tabhane and the qibla wall meet the main prayer hall of the Davutpaşa Mosque exhibits a lack of formal dialogue. These intersections are resolved with such simplistic pragmatism that the components appear almost 'plug-and-play,' as if two independent entities were merely pasted together rather than architecturally integrated (Figure 9a).

Incompatibility of portico roofing and window positioning; In the facade porticos of the Süleymaniye Mosque, which serve as shading elements between facade openings, it has been identified that the finishes of the timber coverings are not uniform. In certain instances, these coverings intersect with window alignments, causing significant issues regarding the drainage of rainwater from the facade (Figure 9b).

The extensive use of facade porticos in the Sultanahmet Mosque, and even their evolution into semi-open spaces forming upper-story balconies, may indicate that these porticos have become permanent architectural elements of the facade.

Structural intersection of the minaret and the external qibla portico; Among the structures examined in this study, the necessity behind the addition of the external qibla porticos, a feature encountered only in the Selimiye Mosque, remains unclarified. Based on their placement, it is observed that these porticos were not a premeditated element; they cause a deformation by cleaving into the corner of the minaret wall, leaving the portico arch partially embedded within the structure (Figure 9c).

Molding details; When tracing the molding profiles on the facade of the Selimiye Mosque, it is observed that the molding details on the main mass, the outer portico, the courtyard walls, and the minarets exhibit variations (Figure 9d).

Detailing issues in arch and covering details of porticos situated between buttresses; Upon examining the junction details of the portico arches and coverings leaning against the projecting buttresses and minaret walls on the facade of the Süleymaniye Mosque, it is observed that there is no smooth transition between the two architectural elements. The arch curve and the lead roofing of the dome are simply abutted against the wall with an ordinary finish.

Porticos covering the entrances are extensively utilized on the facades of the Sultanahmet Mosque. However, the abutment of the portico arches against the projecting minaret and buttress walls, along with the creation of notches in these walls, has led to various detailing issues (Figure 9e). Distinctively, in the Sultanahmet Mosque, the use of timber-roofed porticos is observed not only on the main prayer hall (*harim*) facade but also on the courtyard (*harem*) wall facade. This configuration creates a perception of a cluttered and fragmented perception on the facade.

3.7. Traces and Implications of Design

The architectural junction and detailing issues observed in the examined structures also encompass underlying design issues.

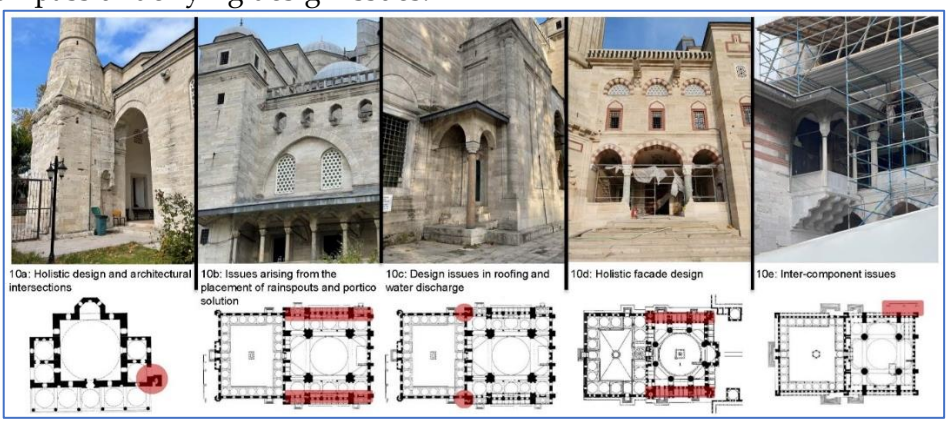

Figure 10(a-e). Design issues in the selected mosques (Created by the authors; base plans adapted from Aslanapa, 1986; Goodwin, 1971/2012; Kuran, 1987).

Holistic design and architectural intersections: buttresses, weight towers, arches, and annexes; As observed through the relationship between the main prayer hall, the minaret, and the annex (*tabhane*) in the Davutpaşa Mosque, while these individual components possess an internal structural integrity, their points of contact reveal issues such as overlapping, spatial conflicts, and the disruption of existing details that cannot be dismissed merely as inconsistent craftsmanship or detailing errors. This suggests that during the initial design stage, a clear conceptual framework regarding how these components would integrate—or even whether they would coexist—had not yet been fully established (Figure 10a).

One of the most striking aspects of the Süleymaniye Mosque is the prominence of massive structural supports—such as buttresses and weight towers, reminiscent of the later-added reinforcements of Hagia Sophia—which create expansive voids on the facade. The subsequent enclosure of these voids with porticos for shading and protection has resulted in a congested appearance within the overall facade composition.

Issues arising from the placement of rainspouts; The facade of the Süleymaniye Mosque exhibits a highly dynamic appearance, where the massive presence of minarets and buttresses creates expansive voids. These sections also serve as the entrances of the structure. To protect the congregation from rainwater discharged by the rainspouts located directly above these entrances, these areas were covered with arches, domes, and timber shading elements (Figure 10b). This approach not only facilitated the comfortable gathering of the congregation but also appears to be an ad-hoc solution to a problem that was not anticipated during the initial design stage.

In the Sultanahmet Mosque, it is observed that the rainspouts are recessed against the wall and extended forward, ensuring they do not align with the mosque entrances. This configuration prevents the water discharge from interfering with the entry points (Figure 9e).

Subsequent enclosure of facade porticos and minaret entrances; The incompatibility between the facade porticos and the overall facade of the Süleymaniye Mosque leads one to think that this is, in fact, a design issue. This raises the question: Were these porticos a pre-planned architectural choice, or were they an ad-hoc necessity shaped by practical needs during the construction process? A similar logic can be seen in the subsequent enclosure of the minaret entrances. The staining and darkening caused by dampness at the corner junctions today serve as physical evidence of these unresolved detailing conflicts (Figure 10c).

Inter-component issues; Unlike the fragmented design language encountered in the Süleymaniye Mosque, the facade of the Selimiye Mosque appears as a holistic entity from the very beginning. The main mass, minarets, porticos, and drainage systems are integrated from the outset within a unified architectural dialogue (Figure 10d).

The relationship between the Royal Pavilion (*Hünkâr Kasrı*) and the main mass of the Sultanahmet Mosque—forming a distinct appearance both in its form and its mode of connection—carries significant traces regarding the construction practices of the Classical Period (Figure 10e). Indeed, royal pavilions, which first emerged in the 17th century, began to be built in connection with mosques to serve as spaces for both rest and formal receptions, as sultans moved more frequently outside the palace and shifted toward a more withdrawn political role. By the 18th century, this became a tradition, and by the 19th century, these pavilions had become an inseparable part of the northwestern facades of mosques (Nar, 2001).

Discussion and Conclusion

The findings examined under three distinct headings essentially lead to common traces and issues. Indeed, the interrelationship between architectural components allows us to draw similar inferences regarding both detailing conflicts and the underlying design processes.

- When evaluated through the interrelationships of architectural components, the traces followed, the continuity of moldings, and the modes of junction in the early-period Davutpaşa, the classical-period Süleymaniye, Selimiye, and Kadırga Sokollu, and the late-classical Sultanahmet mosques, observations have been made suggesting that each architectural component was the product of an independent

construction activity. This implies that these components—whether built at long intervals or simultaneously—were completed as autonomous entities within themselves, resulting in overlaps, conflicts, and the disruption of prior details at the points where they finally met. While there is a notable lack of studies that address issues at the component level and link them to the autonomous attributes and construction processes of buildings; as Bilgiç (2017) also states, it is known that Mimar Sinan engaged in various structural experiments, reinterpreted existing practices, and certain structural issues emerged during this process.

- The facade portico solution, which creates a congested appearance particularly on the facade axis, seems to have been carefully reconsidered in the Selimiye Mosque, where the interrelationships of architectural components appear to have been defined from the very beginning. Indeed, in the Süleymaniye and Sultanahmet mosques, the primary facade axis remains recessed behind the minarets and buttresses. These massive structural supports were likely designed with an oversized scale from the outset—reminiscent of the reinforcement logic seen in Hagia Sophia—reflecting a dominant structural skeleton that forces functional elements like porticos to adapt to its rigid geometry. Güngör (1988), expressing a similar view, points out that the buttresses at the Şehzade Mosque, which appear to be retaining walls, are concealed by the facade porticos at the Süleymaniye Mosque. The problems observed at the junction points and points of contact occurred when these porticos were subsequently integrated to respond to functional needs within the spaces defined by these pre-existing, dominant structural elements. While these issues are repeated in the Süleymaniye and Sultanahmet mosques, in the Selimiye Mosque, such voids resulting from the positioning of buttresses and minarets were resolved by aligning them with the entire facade line from the outset, thereby achieving a refined and integrated appearance.

- Can the encountered detailing and design issues be viewed as a natural consequence of a lack of emphasis on comprehensive construction planning, as per the architectural understanding of the period? While drainage and water discharge issues are prevalent across all these monuments, similar issues have emerged at the intersection points of the annexes. It appears that the disregard for or elimination of details at the points where annexes are articulated, or the prioritization of the functional necessity of the added component alone, has led to such an outcome.

In light of the findings of the study, the issues observed in each monument and their impacts are summarised in Table 2.

Table 2. Identified issues and the impacts in the selected mosques (Created by the authors)

Monument	Point of issue	Observed anomaly	Nature of the anomaly	Technical consequence
Davutpaşa Mosque	Intersection of the main prayer hall-the tabhane-the outer portico	Elevation differences	Drainage dead-end	Water accumulation and corrosion risk
	The minaret-the tabhane-walls of the outer portico	Break in continuity of mouldings	Drainage of rainwater	Water staining, moderate soiling and visual deformation
	Intersection of the minaret-wall of the tabhane	Overlapping of details	Execution-based or workmanship error	Visual deformation/ anomaly
Süleymaniye Mosque	The main prayer hall-the outer portico-the minaret-facade porticos	Discontinuity of the facade axis	Architectural inconsistency	Water staining, moderate soiling and visual anomaly

	The main prayer hall-the minaret-courtyard walls	Break in continuity of mouldings	Execution-based or workmanship error	Visual differences
	The main prayer hall-the outer portico	Visual/Functional obstruction	Design incongruity	Inadequate natural lighting
Selimiye Mosque	Intersection of the minaret-the external qibla portico	Embedding into the component	Architectural inconsistency	Visual deformation/ anomaly
Kadırga Sokollu Mehmet Paşa Mosque	The main prayer hall-the minaret-the side chamber (*mahfil*)	Inadequate drainage system	Design and execution-based incongruity	Localized soiling
	The main mass facade-the side chamber (*mahfil*)	Synergistic degradation	Design and execution-based incongruity	Particulate deposition via water entrapment
Sultanahmet Mosque	The main prayer hall-the outer portico-the minaret-facade porticos	Discontinuity of the facade axis	Architectural inconsistency	Moderate soiling and visual anomaly
	The main prayer hall-the outer portico	Visual/Functional obstruction	Design incongruity	Inadequate natural lighting
	The main mass-Royal Pavilion (*Hünkâr Kasrı*) relation	Visual/Functional obstruction	Architectural inconsistency	Visual deformation/ anomaly

As a result of the observations, it is considered that an organic layout shaped by functional needs dictated the interrelationships of architectural components. Consequently, rather than comprehensive pre-planning, the practice focused on developing on-site applications and spontaneous detailing solutions to address emerging requirements.

One of the most striking aspects observed in these structures is that architectural development does not follow a linear trajectory. When the relationship between the architectural components of the Süleymaniye and Selimiye mosques—built in different cities and under different reigns despite their proximity in time—is examined in terms of holistic design, facade continuity, and the interrelationship of architectural components, the Selimiye Mosque clearly exhibits superior solutions. In contrast, it is thought-provoking that similar approaches and issues resurface in the Sultanahmet Mosque, which was built in the same city as Süleymaniye but after a nearly half-century interval.

Similarly, Erzen (1981) points out this periodical rupture, noting that the classical approach—which constructed buildings as stepped masses up to the Süleymaniye Mosque—turned towards new facade experiments, roof arrangements, and structural element variations with the Rüstem Pasha Mosque, but that these approaches were abandoned in the 17th century, resulting in a return to the patterns developed in 1570 and earlier.

Regarding the reasons behind this approach, Uğur Tanyeli (2021) employs the term 'Ottoman Presentism' (Osmanlı Şimdiciliği). According to him, this strategy—where the Ottomans disregarded the actual temporal and ethno-religious origins of all cultural data they claimed as their own, considering them all as belonging to the 'present' and to themselves—implies a conception of knowledge where nothing ever becomes obsolete. In this framework, cultural data remains perpetually contemporary and is constantly updated with every new production, yet its boundaries are never continuously expanded.

The precise craftsmanship evident in the interior decorations fails to manifest itself at the intersection points of architectural components, particularly in the junctions of annexes that appear to have been integrated at a later stage.

In these monuments, which are typically constructed using a fast-track, results-oriented approach, the presence of common issues at the points where architectural components intersect—such as problematic joints, overlapping, and workmanship deviations—leads to the conclusion that there was a lack of a holistic design concept.

The traces tracked at the junctions of the architectural components in these five monuments uncover how original flaws and hidden problems—often encountered during the construction process—manifested in the finer details. These observations clearly demonstrate what kind of systemic issues these traces point toward, particularly concerning the lack of pre-planning. While some annexes present in earlier practices were eventually phased out (such as *tabhanes/hospices*), others—specifically facade porticos—evolved beyond being mere temporary solutions to become a typological standard. Possessing permanent and integrated characteristics, these elements eventually became integral parts of the design schemes in subsequent monumental structures.

The technical evolution of correcting faulty implementations in these successive monuments does not follow a linear progression. Indeed, a previously resolved problem can re-emerge as a recurring issue in subsequent constructions. It is a frequent observation that even in architectural elements which have become permanent fixtures, there is a lack of consistent proficiency in execution and craftsmanship. However, whether this situation stems from a compressed construction schedule and labor insufficiency or is a consequence of the period's construction strategy-as noted by Tanyeli (2021)- necessitates a more detailed examination of the relevant construction ledgers. In this context, a systematic reassessment of primary sources, particularly the Süleymaniye construction ledgers published by Barkan (1972) along with recent thesis studies (Batır, 2022; Öten, 2017) on other monuments, is of vital importance for examining the origins of these anomalies from the perspective of construction processes.

The findings obtained from this study demonstrate that the questions raised at the outset are highly accurate. Within the examined monuments, there are tangible construction issues, deviations, and implementations that contradict the holistic design framework. Existing literature heavily underscores that Ottoman architecture, particularly in the case of Sinan, focuses on the structural characteristics of the baldachin system and the dome (Bilgiç, 2017; Erzen, 1981; Kuban, 1993), with the primary objective being to dismantle spatial fragmentation to create a unified space (Kuban, 1993). However, this historical preoccupation with the dome and interior space at the expense of other architectural components is the fundamental reason why these highly obvious anomalies have not been separately discussed in architectural historiography to date.

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