Contextual Compatibility and Adaptive Reuse Potential of Muvakkithanes in the Historic Peninsula of Istanbul, Türkiye

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Abstract

Muvakkithanes, the historical timekeeping houses associated with mosque-centered urban life, have largely lost their original functions as urban, technological and institutional conditions have changed. Their reuse is now in question: should not focus only on physical conditions, architectural values or possible new functions, because they depend on access, visibility, surrounding land uses and urban pressures. This paper[1] examines this issue in the Historic Peninsula of Istanbul, Türkiye.

The research focuses on ten muvakkithanes selected within 400 m catchment areas of major urban landmarks. Field surveys carried out in July 2024 were combined with open-source spatial data, municipal datasets and site management data. Information was organized in a GIS database to assess land use, public open space, transport access, parking conditions and environmental pressure. Buffer, overlay, proximity and area calculations were used to compare the surroundings of the sampled buildings.

The analysis shows that the selected muvakkithanes form five contextual types shaped by tourism, commercial activities, transport pressure, local mixed use and residential character. It also reveals that current assigned uses, such as storage, staff lodging, staff rooms, security offices and retail use, do not constitute conservation-oriented adaptive reuse. It concludes that these buildings can be reused compatibly only when the assigned functions respect their limited physical capacities and urban settings. It argues that future reuse decisions should not treat muvakkithanes as empty rooms to be filled, but as heritage structures whose functions must be selected through case-specific contextual assessments.

Keywords: Adaptive Reuse, Contextual Compatibility, Muvakkithanes, Urban Heritage, Spatial Indicators, Istanbul Historic Peninsula, Türkiye.

[1] "This article was derived from the unpublished PhD dissertation prepared by the corresponding author at the Institute of Graduate Programs, Karabük University, Türkiye.

Introduction

Historic urban settings are not formed only by monuments, major public buildings and large-scale heritage sites. They also contain smaller structures that once supported everyday social, religious, administrative or cultural practices. Many of these buildings lose their original functions when technologies, institutions and patterns of urban life change over time. Reuse may keep such buildings within contemporary life, but a new or assigned function is not automatically compatible with the building. Its suitability depends on the physical capacity of the structure, its heritage value and the urban setting in which it continues to exist.

In this respect, Bullen and Love (2011) argue that adaptive reuse can extend the life of heritage buildings and reduce the need for new constructions. The Department of the Environment and Heritage (2004) similarly frames adaptive reuse as a conservation strategy that allows historic buildings to remain useful while retaining their cultural significance. Yet a new function is never a neutral addition to an existing building. It may support continuity, but it may also introduce physical pressure, weaken historic character or disconnect the building from its surrounding urban life. For this reason, Elsorady (2014) and Arfa et al. (2022) emphasize that adaptive reuse requires the evaluation of physical, social, cultural,economic and environmental dimensions together rather than the selection of function alone.

The problem becomes sharper in small-scale historic buildings. Unlike large monuments, former industrial complexes or major public buildings, these structures usually have limited interior volumes, modest service capacities and low tolerance for intrusive interventions. Their reuse potential is therefore closely tied to the conditions immediately around them, such as pedestrian movements, public visibility, surrounding land uses, access to open spaces, transport pressures, parking conditions and the character of everyday urban use. In dense historic settings, these conditions may vary sharply even within short walking distances. In fact, a use that appears manageable in a quiet local setting may become unsuitable in a highly touristic, commercial or transport-oriented environment.

The relationship between heritage buildings and their surrounding context has already been recognized in urban conservation discourse. UNESCO (2011) approaches historic urban areas as layered settings shaped by social, cultural and spatial processes. ICOMOS (2011) also underlines the need to consider historic urban areas together with their spatial organization, uses, meanings and connections with the wider city. In this sense, the immediate surroundings of a historic building cannot be treated as a passive background. They influence how the building is accessed, perceived, used and conserved.

Geographic Information Systems (GIS) provide a useful basis for examining these relationships. In cultural heritage studies, GIS has been used for inventory development, documentation, spatial analysis, value assessment, monitoring and risk mapping (Morrish and Laefer, 2010; García-Esparza and Altaba Tena, 2020; Can, Tura and Kudde, 2019). Its value for adaptive reuse research lies not only in producing maps, but also in making different urban conditions visible, measurable and comparable. Studies on historic city centres also show that street configurations, pedestrian movements and centrality affect the vitality of historic areas and the continued use of valuable architectural heritage (Thinnakorn, Chanklap and Tongseng, 2023).

Recent studies on adaptive reuse further show that reuse decisions should be informed by the physical and historical integrity of the building as well as by the wider urban setting in which it is located. Vidyullatha, Kumar and Dileep (2023), for example, discuss adaptive reuse as a means of supporting sustainable urban regeneration when new functions are selected through careful assessments rather than arbitrary use assignment. This point is especially relevant for small historic buildings, where a new use may quickly exceed the spatial and physical limits of the structure if contextual pressure is not considered.

Yet one issue remains insufficiently addressed in the literature on adaptive reuse. Existing studies have developed valuable approaches based on heritage values, stakeholder priorities, intervention levels, multi-criteria assessments and conservation principles. However, the immediate urban setting of small-scale historic buildings is not always translated into comparable spatial indicators. This gap is particularly visible for buildings whose reuse

potential is limited by both their physical capacities and the pressures generated by their surrounding urban environments.

In fact, Muvakkithanes make this problem especially visible. These historical timekeeping houses were associated with the calculation of prayer times, the regulation of clocks and the daily temporal order of mosque-centered urban life (Ünver, 1975; Aydüz, 2000; King, 1998; Zorlu, 2014). They were usually located near the mosques, or other religious complexes, where the 'muvakkit' carried out timekeeping duties as part of the wider social and religious organization of the city. The broader inventory prepared for the doctoral research from which this paper is derived identifies sixty surviving muvakkithanes in Türkiye: forty in Istanbul and twenty in Anatolia and Thrace (Belge,2026). This distribution shows both the particular importance of Istanbul in this building tradition and the wider historical presence of muvakkithanes across the country.

This paper does not examine all the surviving muvakkithanes in Türkiye. It focuses on ten selected muvakkithanes in the Historic Peninsula of Istanbul, where the loss of the original timekeeping function has led to different current assigned uses and different degrees of urban pressure. The statement that these buildings are not situated within a single type of urban setting therefore refers specifically to the selected cases in the Historic Peninsula. Sultanahmet Mosque Muvakkithane and Ayasofya Mosque Muvakkithane are located in highly visible touristic-public settings; Nuruosmaniye Mosque Muvakkithane and Atik Ali Pasha Mosque Muvakkithane are embedded in dense commercial areas; Yeni Mosque Muvakkithane and Hatice Turhan Valide Sultan Mausoleum and Muvakkithane are shaped by transport-commercial pressure; Fuad Pasha Mosque Muvakkithane, Sokullu Mehmed Pasha Mosque Muvakkithane and Sultan Mahmud II Mausoleum and Muvakkithane are located in more locally balanced historic settings; and Sultan Murad V Sebil and Muvakkithane represents a lower-density residential context.

This research specifically examines how the current functional states, physical capacities and immediate urban settings of these ten muvakkithanes affect their contextual compatibility and the potentials of future adaptive reuse. The aim of the study is to develop a context-sensitive basis for evaluating future reuse decisions for muvakkithanes in the Historic Peninsula of Istanbul, so that assigned functions can respond to heritage sensitivity, physical capacity and surrounding urban conditions. The objectives of the research are:

- To construct comparable contextual profiles for the selected muvakkithanes by combining building-scale observations with GIS-based spatial indicators;
- To classify the selected cases according to the dominant urban conditions that shape their reuse potential;
- To define case-specific contextual compatibility issues that should guide future conservation-oriented adaptive reuse decisions.

Theoretical Framework

The theoretical basis of this research is formed by four related ideas: heritage conservation as the central frame, adaptive reuse as one conservation strategy, contextual compatibility as an evaluative principle, and the reuse limits of muvakkithanes in dense historic urban settings. Heritage conservation is the central frame, because the issue is not simply whether an unused or underused building can receive a new function, but whether that function can support the continuity of its cultural, architectural and spatial values. International conservation approaches emphasize that historic urban areas should be understood through their physical fabric, uses, meanings and relationships with the wider city (UNESCO, 2011; ICOMOS, 2011). In this sense, adaptive reuse is not treated here as an end in itself. It is one possible conservation strategy, and its appropriateness depends on how carefully a new or assigned use responds to the heritage value of the building, physical capacity and urban context. This is particularly important for muvakkithanes, whose small interior volumes and specific cultural meanings leave little room for functions that require heavy interventions, privacy, servicing or spatial subdivisions.

Adaptive Reuse

Adaptive reuse is understood in this study as a conservation-oriented process rather than a simple replacement of one function with another. Its main concern is not only to keep a historic building in use, but to ensure that the new use can be accommodated without weakening the architectural, cultural, and material values that make the building significant. In this regard, Bullen and Love (2011) relate adaptive reuse to the extension of building life and the reduction of new construction demand. Arfa et al. (2022) further show that adaptive reuse involves a wider model of practice in which physical, cultural, social and operational factors are considered together.

This position is especially important because a new function may both protect and endanger a historic building. In this regard, Zhang and Dong (2021) emphasize the role of minimum intervention in heritage preservation, while Çakır and Edis (2022) show that the relationship between a new function and the physical intervention can be examined systematically through building data. These arguments suggest that the success of adaptive reuse depends not only on whether a building can receive a new use, but also on how much intervention that use requires and whether such intervention is compatible with the heritage character of the building.

Contextual Compatibility

Contextual compatibility refers here to the degree to which a proposed or existing use corresponds to both the physical limits of a historic building and the spatial conditions of its surroundings. Elsorady (2014) discusses compatibility through the relationship between new uses and the values of heritage buildings. Sahraiyanjahromi and Olgaç Türker (2020) also show that heritage values can be organized as a decision-making tool, which is useful for understanding why adaptive reuse cannot be evaluated through functional efficiency alone.

In this study, compatibility is treated as a relational condition. A function may be physically possible within a building, but still be unsuitable if it requires high visitor circulation, heavy technical infrastructure, frequent service access, privacy, silence or spatial continuity that the building or its surrounding environment cannot support. Similarly, a use may respond to the surrounding urban demand but impose excessive pressure on the historic fabric. For this reason, contextual compatibility requires the joint reading of building capacity, heritage values and urban pressures.

This approach is also consistent with the urban conservation frameworks. UNESCO (2011) approaches historic urban landscapes as layered settings shaped by cultural, social and spatial processes. ICOMOS (2011) similarly underlines that historic urban areas should be understood through their spatial organizations, uses, meanings and relationships with the wider city. The immediate surroundings of a historic building are therefore not a passive background. They form part of the conditions through which the building is accessed, perceived, used and conserved.

Muvakkithanes in Dense Historic Settings

Muvakkithanes require a reuse logic that is sensitive to their limited interior volumes, modest service capacities and low tolerance for physical interventions. Their interior volumes ar usually limited, their service capacities modest and their tolerance for physical interventions is low. These limits make them sensitive to functions that require heavy equipment, large user groups, extensive spatial subdivisions or continuous logistical support.

In fact, in dense historic settings, this sensitivity increases. The same type of building may be located in very different urban conditions: a touristic core, a commercial centre, a transport node, a locally balanced neighbourhood or a low-density residential setting. Urban morphology studies show that land use, street configurations and pedestrian movements are closely related to the ways in which the urban spaces are experienced and used (Ozbil, Peponis and Stone, 2011; Ye and van Nes, 2014). For small historic buildings, these conditions affect not only visibility and accessibility, but also the kinds of functions that can be sustained without creating additional conservation pressures.

Muvakkithanes make this issue particularly visible. Their original functions have been linked to timekeeping, religious practices and the everyday rhythm of Ottoman urban life. Ünver (1975), Aydüz (2000), King (1998) and Zorlu (2014) identify them as a specific building group associated with the institutional and cultural organization of time. Once this original role disappeared, many muvakkithanes became vacant, underused or assigned to secondary functions. Their adaptive reuse therefore requires more than finding an available use. It requires a careful reading of how each building now relates to its immediate urban context.

The theoretical position of this paper is that adaptive reuse decisions for muvakkithanes should begin with contextual compatibility rather than with a predetermined function. Spatial analysis is used in this study not as an end in itself, but as a means of making the urban conditions around each building visible and comparable.

The theoretical model developed from this framework positions heritage conservation as the main field within which adaptive reuse decisions are made. Adaptive reuse is understood as a conservation tool rather than a simple functional replacement. Its success depends on contextual compatibility, which is produced through the interaction of three conditions: the physical capacity of the building, its heritage sensitivity and the pressures of its immediate urban setting. For muvakkithanes, these conditions are closely linked because their limited interior volumes and cultural specificity leave little tolerance for functions that require technical additions, domestic facilities, intensive servicing or privacy. A function that appears possible in plan may still be incompatible if it requires technical additions, domestic facilities, intensive servicing or privacy that the building and its context cannot support. Similarly, a use that responds to surrounding urban demand may still weaken the cultural meaning or material legibility of the structure. The model therefore presents reuse potential as a relational judgement, not as a direct outcome of building size, location or current use alone.

The theoretical relationship between these concepts is summarized in the Fig. 1. It shows how heritage conservation, adaptive reuse and contextual compatibility are conceptually related in evaluating the future reuse potentials of the muvakkithanes. In this study, this relationship is examined through selected cases in the Historic Peninsula of Istanbul.

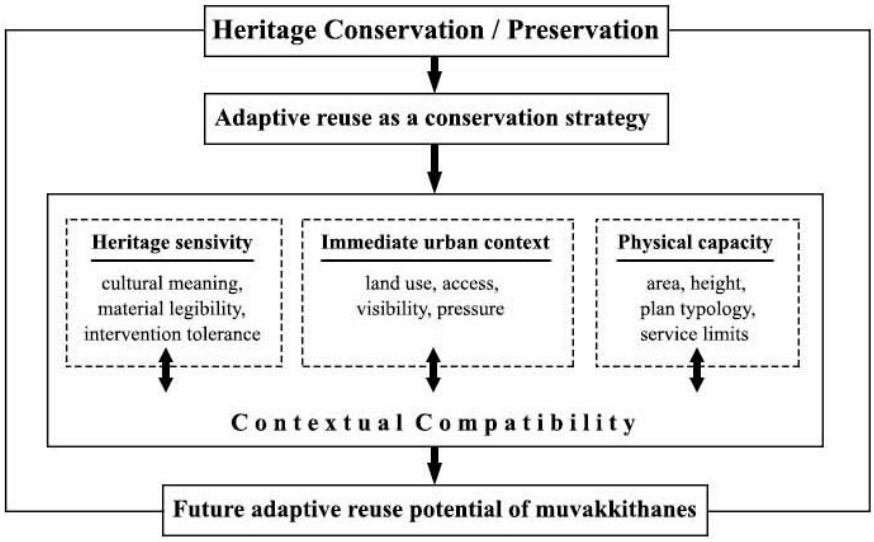

Fig. 1: Theoretical model for evaluating contextual compatibility in the adaptive reuse potential of muvakkithanes
Source: Authors, 2026

Review of Literature

Adaptive reuse has been discussed in heritage studies as a way of keeping historic buildings active after their original functions have weakened or disappeared. Bullen and Love (2011) argue that adaptive reuse extends the life of heritage buildings and reduces the environmental burden of demolition and new construction. The Department of the Environment

and Heritage (2004) also presents reuse as a conservation strategy, but its emphasis is not simply on occupancy. It stresses that continued use should protect the cultural significance of the building. These positions show that adaptive reuse is not only a practical response to vacancy. It is also a decision about how much change a historic building can accept.

Several studies develop this point by examining the relationship between new uses, heritage values and physical interventions. In this regard, Elsorady (2014) shows that the compatibility of a new use depends on its ability to respect the character and values of the heritage building. Zhang and Dong (2021) approach the same issue through the principle of minimum intervention and argue that preservation decisions should avoid unnecessary physical alterations. Sahraiyanjahromi and Olgaç Türker (2020) shift the discussion towards heritage values and propose that values can be organized as a tool for decision-making. Arfa et al. (2022) similarly treat adaptive reuse as a model of practice in which physical, social cultural and operational factors interact. These studies agree that a new function cannot be evaluated only by asking whether it fits within an existing building. It should also be judged by the pressure it places on the building and the values it is expected to protect.

Other research focuses more directly on decision-making tools. For example, Wang and Liu (2021) evaluate the adaptability of historic buildings through complex adaptive system theory and show that reuse potentials depend on several interacting variables rather than a single criterion. Abastante et al. (2020) place stakeholders at the centre of revitalization decisions and use multi-criteria assessment to structure the reuse of historic districts. Çakır and Edis (2022) examine the relation between function and intervention in industrial heritage through a database approach, making visible how new uses correspond to physical changes. These studies are valuable because they move adaptive reuse away from intuitive decision-making. Yet they tend to focus either on building-level attributes, stakeholder preferences or intervention patterns. The immediate urban setting of small-scale historic buildings is less often transformed into a comparable analytical basis.

A second body of work comes from GIS-based heritage studies. Morrish and Laefer (2010) show that digital inventories can improve access to architectural heritage information and support more systematic management. García-Esparza and Altaba Tena (2020) use GIS to appraise historical, architectural and social values in historic urban cores, demonstrating that spatial tools can help interpret heritage value at the urban scale. Can, Tura and Kudde (2019) examine the preservation state of Istanbul's Historic Peninsula through geospatial data, which is especially relevant for the local context of the present study. Üstün and Bilgin Altınöz (2025) also position GIS as a tool for managing multilayered urban heritage by linking past and present spatial information. Taken together, these studies show that GIS is already well established in heritage documentation, inventory and value assessment. However, its use in adaptive reuse decisions is still more limited, especially when the task is to compare the everyday urban pressures surrounding small historic buildings.

Other GIS-related studies move towards documentation, monitoring and risk assessment. Lezzerini et al. (2016) combine laser scanning and GIS for thematic mapping of façade stonework, while Masciotta et al. (2023) integrate laser scanning and 360-degree photography for digital documentation and heritage management. Dionizio and López-Chao (2025) extend this digital direction through HBIM and WebGIS for the documentation and management of modern architectural heritage sites. Agapiou et al. (2015), Wang (2015), Campanaro et al. (2016), Rapone et al. (2018) and Poletaev et al. (2020) show that GIS and related spatial technologies can also be used for monitoring, vulnerability assessment, flood risk, restoration workflows and archaeological preservation. These works confirm the analytical strength of spatial methods. At the same time, they mostly address documentation, risk, conservation management or digital representation. They do not fully answer how the urban setting can guide the selection or evaluation of new uses for small-scale historic buildings.

Urban morphology and accessibility studies help to fill part of this gap. Lynch (1960) explains how landmarks, nodes, paths and districts structure the image of the city. His approach remains useful for understanding why some buildings become more visible and publicly meaningful than others. Ozbil, Peponis and Stone (2011) show that street connectivity, land use

and pedestrian flows are closely related. Ye and van Nes (2014) also demonstrate that mixed use, urban form and spatial configuration can be evaluated together within a GIS-based framework. Perry (1929), Calthorpe (1993) and Gehl (2010) approach the neighbourhood and walkable urban environment from different positions, but all point to the importance of distance, pedestrian scale and daily accessibility. These studies are not written specifically for adaptive reuse, yet they provide an important basis for reading the surroundings of small historic buildings through movement, access and public use.

Vidyullatha, Kumar and Dileep (2023) examine adaptive reuse in relation to sustainable urban regeneration and argue that new uses should be selected through informed decisions rather than arbitrary functional assignment. Their discussion is relevant here because it links reuse with the physical and historical integrity of heritage buildings. Thinnakorn, Chanklap and Tongseng (2023) approach historic city centres through the factors that support preservation, including street networks, movement patterns and urban centrality. Although their focus is not adaptive reuse in the narrow sense, their findings help explain why small historic buildings should not be evaluated as isolated objects. Their continued use is shaped by the everyday spatial conditions around them.

The literature on muvakkithanes is more limited and follows a different line. Ünver (1975), Aydüz (2000), King (1998) and Zorlu (2014) discuss muvakkithanes through their relation to timekeeping, prayer times, scientific knowledge and institutional history. These studies are essential because they define the cultural and historical specificity of the building group. They show that muvakkithanes are not generic small buildings, but structures connected with the organization of time, religious practice and daily urban rhythms. However, this literature generally does not examine their present urban settings or their reuse potential through measurable spatial indicators. It explains what muvakkithanes were, but less often asks how they can remain part of contemporary historic urban life.

The literature therefore offers three useful foundations: adaptive reuse research explains the need for compatible new functions; GIS-based heritage studies show how spatial data can support documentation, value assessment and management; and urban morphology studies clarify how land use, accessibility, visibility and pedestrian movement shape urban experience. The gap lies between these bodies of knowledge. There is still a need for a method that brings them together for small-scale historic buildings whose reuse potential depends on both limited physical capacity and immediate urban conditions.

This gap is particularly visible in Istanbul's Historic Peninsula. The area contains different degrees of tourism, commercial intensity, transport pressure, public open space and local residential use within a compact historic fabric. Muvakkithanes located in this setting belong to the same building group, but they do not share the same urban condition. For this reason, this study examines them not as isolated heritage objects, but as small-scale historic buildings whose adaptive reuse should be evaluated through their physical and historic context.

Research Methods

This research uses a case-study-based spatial assessment method combining field observation and GIS-based measurements. The study does not assign a final new function to each building. Instead, it examines the physical and contextual conditions that may support or limit future adaptive reuse decisions for selected muvakkithanes in the Historic Peninsula of Istanbul. The method was designed to make the immediate urban settings of the selected buildings visible, measurable and comparable.

Case Selection and Spatial Threshold

The sample was defined through a landmark-based selection process. First, fifteen major urban landmarks in the Historic Peninsula were identified as reference points. These landmarks were selected because they concentrate public visibility, visitor movement, religious and cultural significance, commercial activity or everyday urban circulation. The purpose of using landmarks was to identify muvakkithanes located within active urban settings where contextual pressures are more clearly visible.

A 400 m catchment area was drawn around each selected landmark. This distance was used as a pedestrian-scale threshold for identifying muvakkithanes located within the immediate surroundings of the landmarks. The muvakkithanes falling inside these catchment areas were included in the study, while those outside this spatial frame were excluded from the comparative analysis. This process produced a sample of ten muvakkithanes. The same 400 m threshold was later used around each sampled muvakkithane to analyse land use, public open space, road hierarchy, transport access, parking conditions and environmental pressure within a comparable spatial extent.

Data Gathering Techniques

Three data gathering techniques were used: in situ field survey, open-source and web-based spatial data collection, and official dataset collection. Each technique provided a different layer of information and was later integrated into the GIS database.

First, the in situ field survey was carried out between 1 and 26 July 2024. The interiors of the sampled muvakkithanes were accessed, and their floor area, interior height, plan typology, physical condition and current functional status were recorded. Measurements were taken on site, using a laser distance meter where necessary. Current functional status was identified through interior observation, visible use patterns and information obtained from users or staff when available. Physical condition was assessed visually, not as a structural damage survey, but as an adaptive-reuse-oriented field classification based on maintenance condition, traces of current use, non-original additions, unqualified repairs, interior alterations and restoration status.

Second, open-source and web-based spatial data were used to record current urban elements around the sampled buildings. OpenStreetMap contributors (2025) and Google (2025) were consulted for road networks, pedestrian links, public transport connections, parking areas and current small-scale urban elements, since some everyday urban conditions are not always represented in official base maps. The information obtained from these platforms was checked against field observations before being included in the GIS database.

Third, official datasets provided the institutional spatial framework of the study. Data were obtained from Istanbul Metropolitan Municipality Directorate of Mapping (2024) and Istanbul Historic Areas Site Directorate (2018). Municipal base maps were received in DWG format for the requested study area and used to construct the base spatial layers. Site management data provided conservation boundaries, heritage-related spatial information and the Historic Peninsula context. Together, these official datasets formed the stable spatial framework of the research, while field observations and open-source/web-based data updated the current functional and contextual conditions observed around the buildings.

Table 1: Data sources, procedures and outputs of the contextual assessment framework
Source: Authors, 2026

Data source / technique	Procedure	Output for contextual assessment
In situ field survey	Interior access, dimensional measurements, visual observation and recording of current use	Floor area, height, plan typology, physical condition, current functional status and observed intervention level
Open-source and web-based spatial data	Collection and field-checking of road, pedestrian, transport and parking information from OpenStreetMap and Google Maps	Current accessibility, movement, parking and everyday urban pressure indicators
Official datasets	Use of DWG base maps and site management data obtained from official institutions	Base maps, conservation boundaries, land-use layers and heritage-related spatial framework
GIS processing	Georeferencing, layer construction, buffer, clip, overlay, proximity and area calculations	Comparable spatial indicators for land use, open space, transport access, road hierarchy and parking conditions

GIS Data Processing and Spatial Analysis

All spatial data were organized in ArcGIS Desktop 10.5 (Esri, 2016). The layers were converted to the WGS84 UTM Zone 35N coordinate system to maintain spatial consistency across datasets. Point, line and polygon layers were created for urban landmarks, sampled muvakkithanes, road networks, tram and ferry connections, public open spaces, parking areas and land-use categories.

GIS operations were carried out in two stages. In the first stage, landmark-based 400 m buffers were used to identify the sampled muvakkithanes. In the second stage, 400 m buffers were drawn around each sampled muvakkithane to define comparable analytical areas. Within these areas, buffer and clip operations defined the study extent; overlay and area calculations measured land-use distribution and public open space; and proximity calculations assessed distance to tram lines, ferry terminals, major roads and parking areas. These operations produced a set of indicators related to land use, public visibility, accessibility, transport pressure, parking provision and environmental pressure.

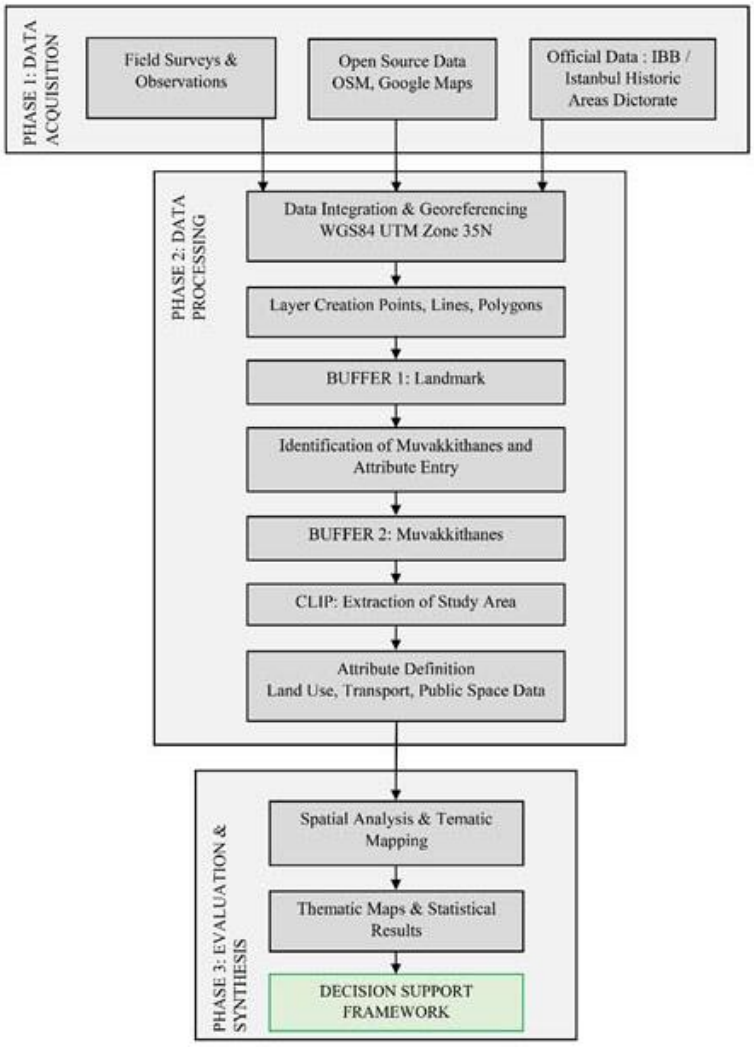

Fig. 2: Research workflow for data gathering, GIS processing and contextual compatibility assessment
Source: Authors, 2026

Interpretation of Contextual Compatibility

The indicators were interpreted together rather than separately. A high level of public visibility, for example, was not treated as automatically positive; it was read together with building size, current functional status, transport pressure, parking conditions and conservation

sensitivity. Similarly, a quieter urban setting was not interpreted as weak reuse potential, but as a different contextual condition that may support lower-intensity or locally oriented functions. This combined reading produced contextual profiles for the selected muvakkithanes and formed the basis for identifying case-specific compatibility issues.

The Case Study

The case study is located in the Historic Peninsula of Istanbul, a layered historic urban area where monumental religious buildings, commercial districts, public open spaces, transport nodes, archaeological zones and everyday urban uses coexist within a compact geography. This diversity allows the selected muvakkithanes to be examined under different contextual conditions within the same historic area.

The study focuses on ten muvakkithanes selected through the landmark-centered sampling procedure and the 400 m spatial threshold explained in the Research Methods section. The sample does not represent all surviving muvakkithanes in Istanbul or Türkiye; it represents a context-defined group of cases exposed to different urban pressures in the Historic Peninsula. For this reason, the case study is structured around the selected muvakkithanes rather than the reference landmarks used in the sampling process.

The selected cases differ in size, physical condition, current functional status and surrounding urban setting. This variation provides the basis for comparing how different contextual conditions influence the adaptive reuse potential of the same building type. The selected muvakkithanes and their associated urban reference contexts are listed in Table 2, and their spatial distribution is shown in the Fig. 2.

Table 2: Selected muvakkithanes and their landmark-based urban reference contexts
Source: Authors, based on field survey data and GIS datasets, 2026.

Muvakkithane	**Associated landmark-based reference context**	**Location note**
Sultanahmet Mosque Muvakkithane	Sultanahmet Mosque / Sultanahmet Square	Highly visible public and touristic setting
Ayasofya Mosque Muvakkithane	Ayasofya Mosque / Sultanahmet Archaeological Park	Highly visible public and touristic setting
Nuruosmaniye Mosque Muvakkithane	Grand Bazaar / Çemberlitaş axis	Dense commercial surroundings
Atik Ali Pasha Mosque Muvakkithane	Çemberlitaş / Beyazıt–Divanyolu axis	Dense commercial surroundings
Yeni Mosque Muvakkithane	Yeni Mosque / Eminönü Square	Commercial and transport-oriented surroundings
Hatice Turhan Valide Sultan Mausoleum and Muvakkithane	Yeni Mosque / Eminönü waterfront	Commercial and transport-oriented surroundings
Fuad Pasha Mosque Muvakkithane	Küçük Ayasofya Mosque context	Mixed local historic setting
Sokullu Mehmed Pasha Mosque Muvakkithane	Küçük Ayasofya / local historic fabric	Mixed local historic setting
Sultan Mahmud II Mausoleum and Muvakkithane	Çemberlitaş / Divanyolu corridor	Mixed historic corridor
Sultan Murad V Sebil and Muvakkithane	Local residential context	Lower-density residential surroundings

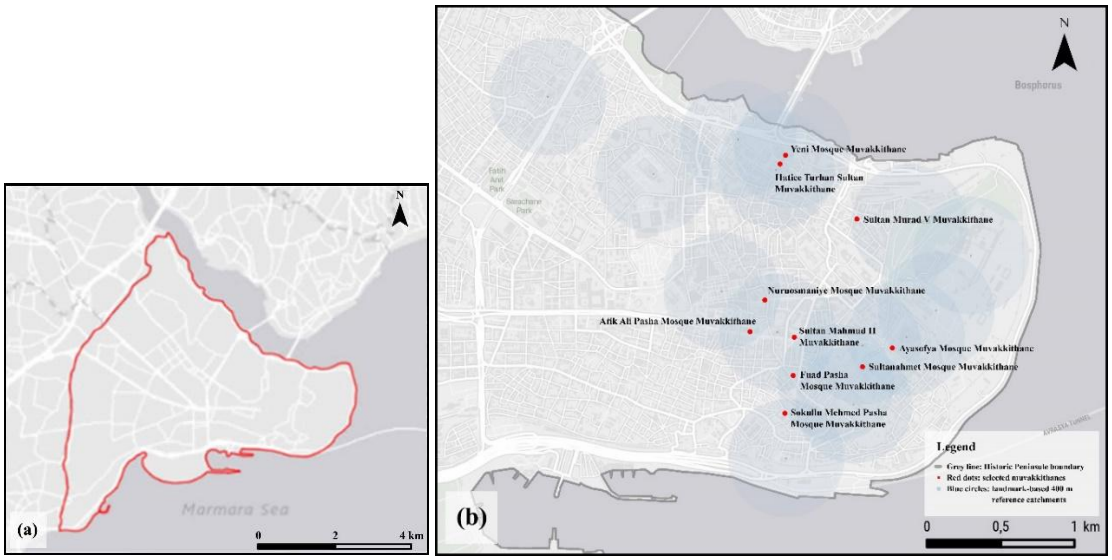

Fig. 2: (a) Delineation of the Historic Peninsula study area. (b) Spatial distribution of the selected muvakkithanes within the landmark-based 400 m reference catchments
Source: Authors, based on field survey data and GIS datasets, 2026

The selected sample therefore represents a context-defined group of cases located within the active urban environments of the Historic Peninsula, rather than all the surviving muvakkithanes in Istanbul or in Türkiye in general.

Data Analysis and Findings

This section presents the data and findings used to identify the contextual compatibility issues observed in the selected muvakkithanes. The analysis does not treat the current uses as completed adaptive reuse projects; rather, it records them as existing functional states and evaluates how they relate to the physical capacity, heritage sensitivity and immediate urban context of each building. The purpose is therefore not only to show that the sampled muvakkithanes are located in different urban settings, but to clarify how these differences produce specific compatibility problems in each case. The findings are presented in sequence: first, the field survey data for each muvakkithane; second, the spatial indicators derived from open-source and official datasets; third, the case-specific compatibility issues; and finally, a concise list of significant findings to be discussed in the following section.

The field survey inventory in Table 3 shows that the sampled muvakkithanes have limited and varied physical capacities. Their floor areas range from 11.30 m² to 56.25 m², and their current functional states include storage, mosque staff lodging, staff room, security office, NGO office, retail use and restoration. These uses are not evaluated as completed adaptive reuse projects. They are recorded as existing functional states because the available evidence does not indicate that they were assigned through a prior contextual compatibility assessment.

This distinction is central to the analysis. The problem is not only that the original timekeeping function has disappeared, but also that several buildings are now occupied by uses that may not correspond to their spatial limits, heritage sensitivity or surrounding urban character. For this reason, the current functional status of each muvakkithane is read together with its physical condition and the dominant character of its 400 m urban setting. The next stage therefore presents the GIS-derived indicators used to identify these contextual conditions, including land use, public open spaces, road and pedestrian networks, transport access and parking provisions.

Table 3: Field survey inventory of the sampled muvakkithanes
Source: Authors, based on in situ field survey data and photographs, July 2024.

Muvakkithane name	Floor area (m^2)	Storeys height (m)	Plan typology	Physical condition	Current functional status	Image of muvakkithane
Atik Ali Pasha Mosque Muvakkithane	11.30	2.41	Rectangular	Poor	Mosque staff lodging	
Sultan Mahmud II Mausoleum and Muvakkithane	21.45	4.42	Rectangular	Fair	NGO office	
Fuad Pasha Mosque Muvakkithane	29.90	3.18	Rectangular	Poor	Mosque staff lodging	
Sultanahmet Mosque Muvakkithane	43.00	4.35	Unique	Restored	Storage	
Ayasofya Mosque Muvakkithane	56.25	9.45	Square	Restored	Under restoration	
Sultan Murad V Sebil and Muvakkithane	12.75	3.25	Rectangular	Poor	Retail (clothing)	
Yeni Mosque Muvakkithane	35.90	3.45	Unique	Poor	Staff room	
Hatice Turhan Valide Sultan Mausoleum and Muvakkithane	27.77	8.32	Square	Fair	Storage	
Sokullu Mehmed Pasha Mosque Muvakkithane	14.00	5.75	Square	Poor	Security office	
Nuruosmaniye Mosque Muvakkithane	17.26	4.51	Rectangular	Poor	Mosque staff lodging	

GIS-Derived Spatial Indicators and Analysis

The spatial indicators presented in the Table 4 were produced in the GIS environment by combining open-source spatial data, official base maps and site management data. Road networks, pedestrian routes, parking areas and transport-related layers were derived from OpenStreetMap and verified through Google Maps and field observations (Google, 2025; OpenStreetMap contributors, 2025). The official base-map framework was obtained from the Istanbul Metropolitan Municipality Directorate of Mapping. The required study areas were requested from the municipality, and the existing base drawings were received in DWG format. These drawings were used as the main official cartographic base in the GIS environment. In addition, the map images and spatial information available from Istanbul Historic Areas Site Directorate were georeferenced and overlaid with the other spatial layers (İstanbul Alan Yönetimi Başkanlığı, 2018; Istanbul Metropolitan Municipality Directorate of Mapping, 2024).

Through this process, open-source data, official base maps and site-management information were checked against each other before the final analytical layers were produced. Land-use areas, public open-space values, road and pedestrian network measurements, parking areas and transport-distance indicators were then calculated within the 400 m buffer area of each sampled muvakkithane.

The Table 4 reports the GIS-derived indicators used to define the contextual profile of each case. The selected indicators are not presented as isolated technical measurements. Land-use and open-space values describe the dominant functional setting; movement-network data indicate whether the surrounding area is shaped mainly by pedestrian, local-street or transport pressure; transit proximity shows the level of public accessibility; and parking/service access values indicate practical constraints that may affect future reuse.

The spatial patterns summarized in the Table 4 are visualized in the Figs. 3–5. The Fig. 3 shows the analytical buffer areas and dominant land-use patterns. The land-use values indicate clear differences among the cases: Sultanahmet and Ayasofya have the highest open-space values, while Nuruosmaniye and Atik Ali Pasha are dominated by commercial use. Yeni Mosque and Hatice Turhan Valide Sultan are distinguished by the overlap of commercial and transport-related land uses.

The Fig. 4 supports the movement-network and transport indicators. The pedestrian network is especially strong around Nuruosmaniye, Atik Ali Pasha, Hatice Turhan Valide Sultan and Yeni Mosque, while Sokullu Mehmed Pasha is more strongly related to a local street pattern. The rail-distance values also show important differences, ranging from very close rail access in Sultan Murad V and Atik Ali Pasha to weaker rail proximity in Sokullu Mehmed Pasha.

The Fig. 5 presents the parking facilities identified within the buffer areas. The parking data shows that Nuruosmaniye and Sultan Mahmud II have no parking areas within the 400 m buffer, while Sultan Murad V has the highest total parking area. Atik Ali Pasha has a very limited parking area, which becomes significant when read together with its commercial surroundings and small physical capacity.

These spatial indicators are used in the next section to identify the contextual compatibility issue of each muvakkithane by reading current functional status, physical condition and surrounding urban context together.

Table 4: GIS-derived spatial indicators and contextual profiles of the sampled muvakkithanes
Source: Authors, based on open-source spatial data, official datasets and GIS analysis, 2026.

Contextual type	Muvakkithane	Dominant land-use and open-space values within 400 m buffer (m²)	Movement network character	Transit proximity	Parking / service access condition
Touristic–Public Core	Sultanahmet Mosque Muvakkithane	Open space: 127.211; religious: 86.177; commercial: 82.552	Mixed pedestrian network: footway 5.399 m; pedestrian 4.576 m	Rail: 105 m; ferry: –	Avg. parking distance: 264 m; total parking area: 6.955 m²
Touristic–Public Core	Ayasofya Mosque Muvakkithane	Open space: 103.564; religious: 79.072; commercial: 64.294	Mixed pedestrian and local street network: footway 4.756 m; pedestrian 3.864 m; residential 4.072 m	Rail: 74 m; ferry: –	Avg. parking distance: 240 m; total parking area: 4.105 m²
Commercial-Oriented Center	Nuruosmaniye Mosque Muvakkithane	Commercial: 233.835; transport: 109.072; religious: 41.609; open space: 0	Pedestrian-dominant network: pedestrian 11.129 m; footway 547 m	Rail: 242 m; ferry: –	No parking area within 400 m buffer
Commercial-Oriented Center	Atik Ali Pasha Mosque Muvakkithane	Commercial: 230.262; transport: 121.320; religious: 41.194; open space: 525	Commercial pedestrian network: pedestrian 9.252 m; residential 5.038 m; footway 748 m	Rail: 16 m; ferry: –	Avg. parking distance: 378 m; total parking area: 207 m²
Transport–Commercial Node	Yeni Mosque Muvakkithane	Transport: 235.587; commercial: 208.396; open space: 26.002	Pedestrian and primary-road pressure: pedestrian 8.826 m; footway 3.342 m; primary/primary link 3.403 m	Rail: 136 m; ferry: 246 m	Avg. parking distance: 206 m; total parking area: 5.401 m²
Transport–Commercial Node	Hatice Turhan Valide Sultan Mausoleum and Muvakkithane	Commercial: 225.169; transport: 212.684; open space: 24.036	Pedestrian and primary-road pressure: pedestrian 9.520 m; footway 3.120 m; primary/primary link 3.233 m	Rail: 173 m; ferry: 306 m	Avg. parking distance: 322 m; total parking area: 5.770 m²
Locally Balanced Historic Setting	Fuad Pasha Mosque Muvakkithane	Commercial: 108.752; open space: 50.324; residential: 46.002; education: 45.331	Local mixed network: residential 7.050 m; pedestrian 2.472 m; footway 2.144 m	Rail: 231 m; ferry: –	Avg. parking distance: 241 m; total parking area: 1.060 m²
Locally Balanced Historic Setting	Sokullu Mehmed Pasha Mosque Muvakkithane	Residential: 84.047; commercial: 65.015; open space: 52.580; education: 46.030	Local-street dominant network: residential 7.843 m; footway 2.143 m; pedestrian 746 m	Rail: 339 m; ferry: –	Avg. parking distance: 199 m; total parking area: 2.343 m²
Locally Balanced Historic Setting	Sultan Mahmud II Mausoleum and Muvakkithane	Commercial: 147.761; transport: 124.449; religious: 33.383; open space: 30.569	Historic corridor network: residential 5.196 m; pedestrian 4.464 m; footway 1.397 m	Rail: 18 m; ferry: –	No parking area within 400 m buffer
Residential Low-Density Context	Sultan Murad V Sebil and Muvakkithane	Commercial: 145.872; administrative: 62.952; open space: 51.770; tourism: 26.260	Mixed local and transit-edge network: footway 4.908 m; residential 4.100 m; pedestrian 3.878 m	Rail: 4 m; ferry: 396 m	Avg. parking distance: 182 m; total parking area: 18.531 m²

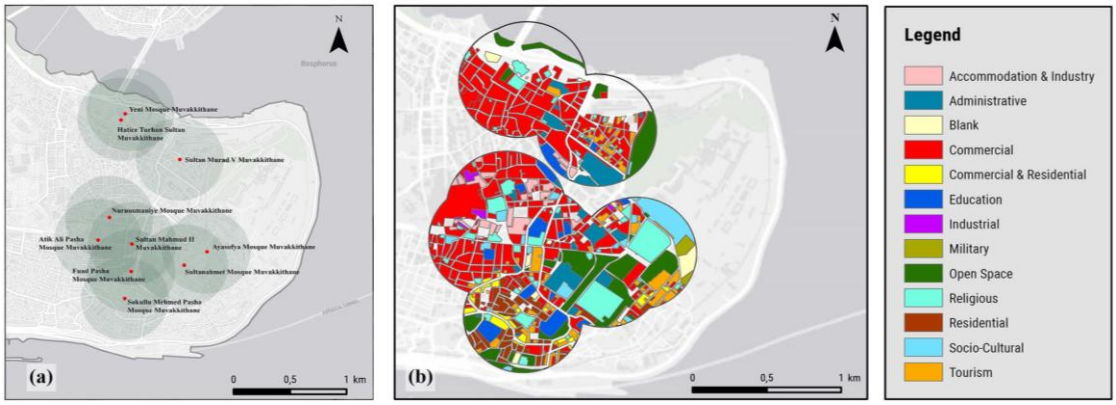

Fig. 3: (a) Analytical areas around the sampled muvakkithanes (b) Dominant land-use patterns within their 400 m catchment areas
Source: Authors, based on field survey data and GIS analysis, 2026

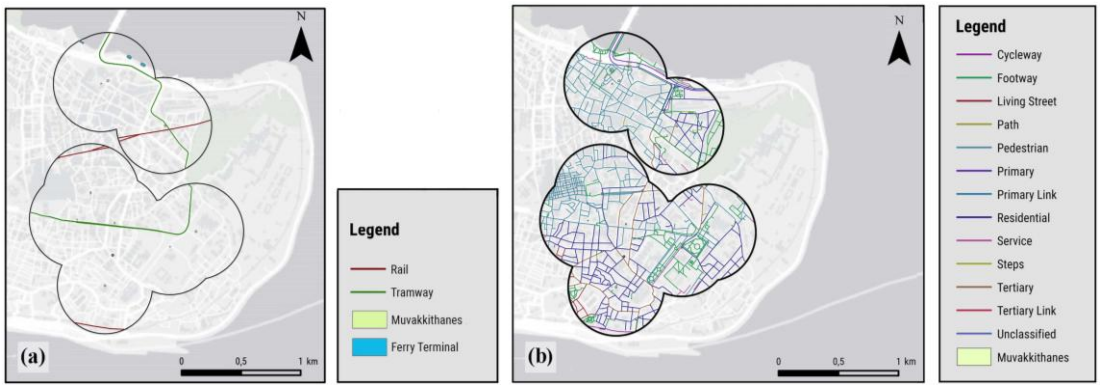

Fig. 4: (a) Transport infrastructure (b) Street-network structure within the 400 m catchment areas
Source: Authors, based on field survey data and GIS analysis, 2026

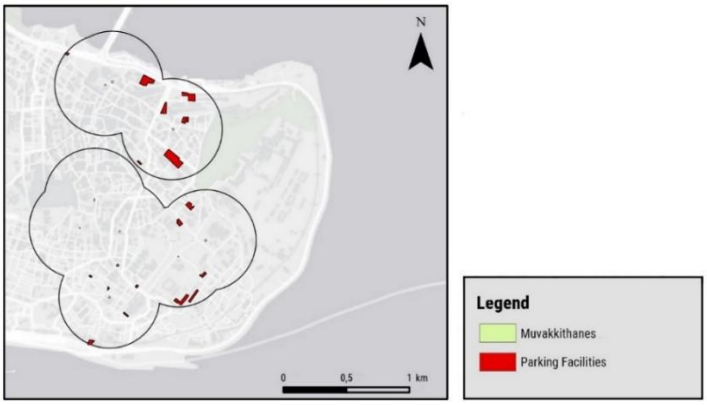

Fig. 5: Parking facilities within the 400 m catchment areas of the sampled muvakkithanes
Source: Authors, based on field survey data and GIS analysis, 2026

Case-Specific Contextual Compatibility Analysis

The following case-specific reading uses the indicators summarized in the Table 4 and visualized in the Figs. 3–5 to explain how contextual compatibility problems appear in each muvakkithane. Each case is interpreted by bringing together its current functional status, physical capacity, observed condition and surrounding spatial indicators. The aim is not to treat the contextual types as general categories, but to show how the compatibility issue is manifested in each building.

Sultanahmet Mosque Muvakkithane is located in the Touristic–Public Core, where the open space reaches 127.211 m² within the 400 m buffer, together with strong religious and commercial uses. Its pedestrian network is also substantial, with 5.399 m of footways and 4.576 m of pedestrian routes. This supports the reading of Sultanahmet as a walkable touristic-public core, where visitors encounter historic buildings through pedestrian movement and open-space experience. The building is restored, has a floor area of 43.00 m² and is currently used for storage. The compatibility issue is the mismatch between a highly visible public setting and an inward-looking storage function that does not support the cultural visibility of the building.

Ayasofya Mosque Muvakkithane has the largest floor area among the sampled cases, 56.25 m², and is located in another highly visible touristic-public setting. Its 400 m buffer includes 103.564 m² of open space, 79.072 m² of religious use and 64.294 m² of commercial use. It is also close to the rail line, at 74 m. Since the building was under restoration during the field survey, the main finding is future-oriented. The combination of open-space provision, religious-touristic surroundings and rail proximity indicates high public encounter potential. However, its restored condition requires future use to avoid service-heavy facilities, permanent interior subdivision or functions that would increase physical intervention. The compatibility issue is therefore the need to match public visibility with a low-intervention function that protects the restored character of the building.

Nuruosmaniye Mosque Muvakkithane is embedded in a Commercial-Oriented Center. Commercial land use reaches 233.835 m² within its buffer, while no public open space or parking area is recorded. The pedestrian network is very strong, with 11.129 m of pedestrian routes, indicating dense movement around the building. The muvakkithane itself is small, with a floor area of 17.26 m², and is currently used as mosque staff lodging. This use conflicts with the surrounding commercial-pedestrian intensity because lodging requires privacy, domestic facilities and interior adaptation. The compatibility issue emerges from the overlap between a small historic volume, poor physical condition and a highly active commercial context.

Atik Ali Pasha Mosque Muvakkithane presents a similar but more spatially constrained condition. It has the smallest floor area in the sample, 11.30 m², and is in poor physical condition. Its buffer is dominated by commercial use, 230.262 m², and transport-related land use, 121.320 m². The pedestrian network is strong, with 9.252 m of pedestrian routes, while parking provision is very limited, with only 207 m² recorded within the buffer. The current use as mosque staff lodging is weakly compatible both physically and contextually. It imposes domestic and privacy-related requirements on a very small historic structure located in a dense commercial and movement-oriented setting.

Yeni Mosque Muvakkithane is part of the Transport–Commercial Node. Its buffer is dominated by transport-related land use, 235.587 m², and commercial use, 208.396 m². It is also linked to both rail and ferry access, with the ferry terminal at 246 m. The current use is a staff room, while the field survey recorded poor physical condition and service-oriented additions. The contextual issue is that a secondary staff use occupies a building located in one of the most visible and accessible urban nodes of the study area. In a setting shaped by intense pedestrian movement, public transport and short-duration urban encounters, the building remains functionally closed to its surroundings. This creates a mismatch between the public character of the node and the inward-looking nature of the current use.

Hatice Turhan Valide Sultan Mausoleum and Muvakkithane is also located in the Transport–Commercial Node. Its buffer includes 225.169 m² of commercial use and 212.684 m² of transport-related land use, with rail access at 173 m and ferry access at 306 m. These values indicate strong public movement and high encounter potential. In such a context, the building could support a low-intervention public or interpretive function, such as orientation or heritage information, yet it is currently used for storage. This case is also sensitive because stored objects were observed near interior surfaces with heritage value. The compatibility issue is therefore twofold: the current use remains closed to an active public setting and may create conservation risk for the building itself.

Fuad Pasha Mosque Muvakkithane is located in a Locally Balanced Historic Setting. Its buffer contains commercial use, 108.752 m², together with open space, 50.324 m², residential use, 46.002 m², and education, 45.331 m². This produces a more mixed and local context than the commercial or transport-dominated cases. However, the building is in poor condition and is currently used as mosque staff lodging. The field survey recorded domestic additions and a non-original added floor. The contextual data do not indicate excessive tourist or transport pressure; instead, they show a setting where a modest local or semi-public use could be considered. The observed lodging use is incompatible because it has introduced domestic facilities and vertical alteration into the historic volume.

Sokullu Mehmed Pasha Mosque Muvakkithane is also located in a Locally Balanced Historic Setting, but with a stronger residential character. Residential land use reaches 84.047 m², while the pedestrian route length is relatively low, 746 m, and rail access is farther than in most cases, at 339 m. The current use is a security office. Although this use may appear low-intensity in terms of visitor load, the field survey shows that it has generated technical and spatial pressure through cabling, an added mezzanine and storage above the mezzanine. The compatibility issue is therefore not high urban intensity, but the way a service-security function alters the small interior volume and weakens the legibility of original elements.

Sultan Mahmud II Mausoleum and Muvakkithane is located along a historic corridor with commercial and transport-related pressures. The buffer includes 147.761 m² of commercial use, 124.449 m² of transport-related land use and 30.569 m² of open space. Rail access is very close, at 18 m, but no parking area is recorded within the 400 m buffer. The building is in fair condition and is currently used as an NGO office. This use is less problematic than storage, lodging or retail because it can remain semi-public and limited in intensity. However, the absence of parking and the corridor condition limit functions requiring frequent service access, large visitor turnover or permanent interior subdivision. The compatibility issue is therefore the need to keep the use modest, reversible and compatible with the building's constrained access context.

Sultan Murad V Sebil and Muvakkithane represents the Residential Low-Density Context, although its buffer still includes 145.872 m² of commercial use, 62.952 m² of administrative use and 51.770 m² of open space. It has the highest total parking area in the sample, 18.531 m², and very close rail access, at 4 m, indicating strong visibility along a movement corridor despite its lower-density local setting. The building itself is small, with a floor area of 12.75 m², and is in poor condition. Its current use as a clothing shop creates a clear compatibility problem. As visible in the photographic record, the historic surfaces and façade are visually occupied by commercial display elements. This weakens the legibility and representative value of the building, turning a culturally specific historic structure into a retail unit.

These case-specific readings show that contextual compatibility cannot be reduced to the surrounding urban condition alone. In each muvakkithane, the issue emerges from a different combination of current functional status, physical capacity, heritage sensitivity and immediate urban context. A use may appear modest in intensity, yet become problematic when it requires domestic adaptation, technical equipment, storage pressure or commercial display within a small historic volume. Conversely, a highly visible or accessible setting does not automatically make every public-facing function suitable if that function would increase servicing, visitor load or physical intervention. For this reason, the findings should be read as case-specific results rather than as generalized rules beyond the sampled muvakkithanes. The main findings derived from these readings are summarized below.

The case-specific readings are summarized in Table 5. The table brings together the current functional status, the main field and spatial evidence, and the contextual compatibility issue identified for each muvakkithane.

Table 5: Case-specific contextual compatibility issues derived from field survey and GIS indicators
Source: Authors, based on field survey data and GIS-derived spatial indicators, 2026

Muvakkithane	Current functional status	Key field and spatial evidence	Contextual compatibility issue
Sultanahmet Mosque Muvakkithane	Storage	Restored; 43.00 m²; open space: 127.211 m²; footway: 5.399 m; pedestrian routes: 4.576 m	Storage is inward-looking and does not respond to the high public visibility, pedestrian encounter potential and restored condition of the building.
Ayasofya Mosque Muvakkithane	Under restoration	Largest case, 56.25 m²; open space: 103.564 m²; religious use: 79.072 m²; rail access: 74 m	The future use must remain low-intervention and publicly meaningful; service-heavy, private or storage-oriented functions would be weakly compatible with its restored/public setting.
Nuruosmaniye Mosque Muvakkithane	Mosque staff lodging	17.26 m²; poor condition; commercial use: 233.835 m²; pedestrian routes: 11.129 m; no open space or parking	Staff lodging requires privacy, domestic facilities and interior adaptation, which conflict with the small historic volume and intensive commercial-pedestrian setting.
Atik Ali Pasha Mosque Muvakkithane	Mosque staff lodging	Smallest case, 11.30 m²; poor condition; commercial use: 230.262 m²; pedestrian routes: 9.252 m; parking area: 207 m²	Lodging imposes domestic and privacy-related requirements on a very small structure located in a dense commercial and movement-oriented setting.
Yeni Mosque Muvakkithane	Staff room	35.90 m²; poor condition; transport use: 235.587 m²; commercial use: 208.396 m²; ferry access: 246 m	The building remains functionally closed in a highly visible transport-commercial node, and the staff-room use does not respond to the public movement potential of the setting.
Hatice Turhan Valide Sultan Mausoleum and Muvakkithane	Storage	27.77 m²; fair condition; commercial use: 225.169 m²; transport use: 212.684 m²; ferry access: 306 m	Storage keeps the building closed to a highly active public setting and may create conservation risk for interior surfaces with heritage value.
Fuad Pasha Mosque Muvakkithane	Mosque staff lodging	29.90 m²; poor condition; open space: 50.324 m²; residential use: 46.002 m²; education: 45.331 m²	Lodging has introduced domestic additions and a non-original added floor, making the use incompatible with the building's spatial and conservation tolerance despite the more balanced local context.
Sokullu Mehmed Pasha Mosque Muvakkithane	Security office	14.00 m²; poor condition; residential use: 84.047 m²; pedestrian routes: 746 m; rail access: 339 m	The security-office use creates technical and spatial pressure through cabling, mezzanine addition and storage, rather than responding to the lower-intensity local setting.
Sultan Mahmud II Mausoleum and Muvakkithane	NGO office	21.45 m²; fair condition; commercial use: 147.761 m²; transport use: 124.449 m²; rail access: 18 m; no parking	The NGO office is relatively more compatible than storage, lodging or retail, but it remains sensitive to permanent interior changes, service access needs and visitor intensity.
Sultan Murad V Sebil and Muvakkithane	Retail clothing	12.75 m²; poor condition; rail access: 4 m; parking area: 18.531 m²; commercial use: 145.872 m²	Retail display visually occupies the façade and historic surfaces, weakening the legibility and representative value of a small, culturally specific historic structure.

These case-specific results are not intended as fixed reuse prescriptions. They show how different combinations of current use, physical condition and spatial indicators produce different compatibility issues in the sampled muvakkithanes. The main findings derived from these readings are summarized below.

Significant Findings

The case-specific analysis leads to six significant findings.

1. The main incompatibility is not the loss of the original function alone, but the way current functions occupy the buildings.The field survey shows that the sampled muvakkithanes are not simply unused structures. They are occupied by storage, mosque staff lodging, staff room, security office, NGO office and retail use, while one case was under restoration during the survey. These current functional states create different compatibility issues. In Sultanahmet Mosque Muvakkithane, storage conflicts with the restored condition and high public visibility of the building. In Nuruosmaniye Mosque Muvakkithane, Atik Ali Pasha Mosque Muvakkithane and Fuad Pasha Mosque Muvakkithane, staff lodging introduces domestic and privacy-related requirements into limited historic volumes. In Sultan Murad V Sebil and Muvakkithane, retail use turns the façade and interior surfaces into display areas. Thus, the first finding is that the current function itself becomes the starting point of the compatibility problem.

2. Spatial indicators gain meaning only when they are read with current use and building capacity. The analysis does not show that open space, pedestrian movement, rail proximity or parking provision are positive or negative by themselves. In Sultanahmet Mosque Muvakkithane, 127.211 m² of open space and a substantial pedestrian network support the reading of a public encounter setting; this makes storage weakly compatible because the building remains closed to the public character of its surroundings. In Nuruosmaniye Mosque Muvakkithane, commercial land use of 233.835 m² and pedestrian routes of 11.129 m indicate an intensive commercial-pedestrian environment, while the absence of public open space and parking shows limited support for privacy, domestic routines or service access. These conditions make staff lodging problematic because the use requires a degree of privacy and domestic adaptation that the surrounding context and the small building volume do not support. In Sultan Murad V Sebil and Muvakkithane, rail access at 4 m and the highest parking area in the sample, 18.531 m², increase visibility and accessibility, but the current retail use turns this visibility into commercial display rather than heritage legibility.

3. The five contextual types are useful because they show which indicators become more decisive in each case, not because they prescribe functions. In the Touristic–Public Core cases, Sultanahmet Mosque Muvakkithane and Ayasofya Mosque Muvakkithane, the decisive indicators are public visibility, open-space relationship and pedestrian encounter. These indicators matter because both buildings are located in settings where historic structures are encountered through walking, open-space experience and visitor movement; therefore, passive or service-heavy uses become difficult to justify. In the Commercial-Oriented Center cases, Nuruosmaniye Mosque Muvakkithane and Atik Ali Pasha Mosque Muvakkithane, commercial density, pedestrian intensity, lack of open space and limited or absent parking become more decisive because the current lodging uses require privacy, domestic adaptation and service conditions that are weakly supported by this setting. In the Transport–Commercial Node cases, Yeni Mosque Muvakkithane and Hatice Turhan Valide Sultan Mausoleum and Muvakkithane, multimodal accessibility, ferry/rail proximity and short-duration movement

become more relevant because inward-looking staff or storage uses do not respond to the public movement potential of the node. This finding shows that the importance of an indicator changes according to the current use and the dominant contextual condition of each case.

4. Lower urban pressure does not automatically mean higher compatibility. Fuad Pasha Mosque Muvakkithane and Sokullu Mehmed Pasha Mosque Muvakkithane are located in more locally balanced settings than the commercial or transport-dominated cases. However, the field survey shows that their current uses still create building-level problems. In Fuad Pasha, staff lodging is associated with domestic additions and a non-original added floor. In Sokullu Mehmed Pasha, the security-office use has introduced cabling, a mezzanine and storage pressure. Therefore, the issue in these cases is not high urban intensity, but the way the assigned function modifies the small historic volume.

5. Small floor area makes functions requiring subdivision, servicing, display equipment or domestic facilities unsuitable. This finding is most visible in the smaller cases by floor area: Atik Ali Pasha Mosque Muvakkithane, 11.30 m²; Sultan Murad V Sebil and Muvakkithane, 12.75 m²; and Sokullu Mehmed Pasha Mosque Muvakkithane, 14.00 m². The observed uses in these cases are not compatible with the limited physical capacity of the buildings. Staff lodging, retail display and security-office use require privacy, display systems, technical equipment or interior subdivision. Since these buildings have very limited interior volumes, such requirements tend to produce physical changes, attachments or spatial partitions rather than remaining as reversible and low-impact uses. This makes them unsuitable for functions that depend on domestic facilities, commercial display equipment or technical subdivision, especially where the physical condition is already poor.

6. Restored or larger buildings still require case-specific limits for future reuse. Ayasofya Mosque Muvakkithane and Sultanahmet Mosque Muvakkithane have larger floor areas and restored or restoration-related conditions, but the data do not support unrestricted public or service-oriented reuse. Ayasofya combines the largest floor area in the sample, 56.25 m², with 103.564 m² of open space and rail access at 74 m. This indicates public encounter potential, but its restoration status requires future use to avoid service-heavy facilities, permanent subdivision and interventions that could weaken the restored character. Sultanahmet combines a restored building of 43.00 m² with 127.211 m² of open space and strong pedestrian routes, yet it is currently used for storage. This shows that restoration alone does not produce contextual compatibility if the subsequent function remains closed to the public value and visibility of the setting.

These findings are case-specific results and not fixed reuse prescriptions. The analysis does not produce a universal function list for all muvakkithanes or all small-scale historic buildings. It identifies how contextual compatibility problems appear in the ten sampled muvakkithanes when current use, physical condition and spatial indicators are read together. These findings therefore provide the basis for discussion, rather than a generalized prescription.

The findings are discussed in the following section in relation to conservation-oriented adaptive reuse, contextual compatibility and GIS-based heritage assessment.

Discussion

The significant findings reported above show that contextual compatibility in the sampled muvakkithanes is shaped by the relationship between current functional status, physical capacity, heritage sensitivity and immediate urban context, rather than by any single

spatial indicator. The discussion therefore focuses on the sampled muvakkithanes in the Historic Peninsula of Istanbul. Present uses also create different compatibility problems depending on size, condition, visibility and surrounding urban pressure. This section discusses these case-specific findings in relation to conservation-oriented adaptive reuse, contextual compatibility, GIS-based heritage assessment and urban morphology.

The findings support the argument that adaptive reuse decisions for the sampled muvakkithanes require more than building-scale assessment. This is consistent with Bullen and Love (2011), who present adaptive reuse as a way of extending the life of heritage buildings, and with Arfa et al. (2022), who approach reuse as a practice shaped by physical, cultural, social and operational factors. The present study adds a spatial reading to this discussion. In Sultanahmet Mosque Muvakkithane, storage leaves a highly visible public setting inactive; in Nuruosmaniye Mosque Muvakkithane and Atik Ali Pasha Mosque Muvakkithane, staff lodging conflicts with dense commercial-pedestrian surroundings because it requires privacy and domestic adaptation within small historic volumes.

This also clarifies the role of compatibility in adaptive reuse. Elsorady (2014) argues that the suitability of a new use depends on its relationship with heritage values and the physical character of the building. Zhang and Dong (2021) discuss this issue through minimum intervention and emphasize the need to avoid unnecessary alteration. The findings of the present study are close to these arguments, but they show that physical compatibility and contextual compatibility do not always coincide. A function may appear modest in scale, but still become incompatible if it requires domestic facilities, technical equipment, storage pressure or commercial display within the limited historic volume of each muvakkithane. This is visible in Fuad Pasha Mosque Muvakkithane through domestic additions and a non-original added floor, in Sokullu Mehmed Pasha Mosque Muvakkithane through cabling and mezzanine-related pressure, and in Sultan Murad V Sebil and Muvakkithane through retail display that weakens historic surface legibility.

The results further relate to studies that use decision-support methods in adaptive reuse. Wang and Liu (2021) show that the adaptability of historic buildings depends on interacting factors rather than a single criterion. Abastante et al. (2020) similarly emphasize structured assessment in historic district revitalization. The present study follows this multi-variable logic, but its emphasis is different. Instead of ranking buildings through a general adaptability score, it uses spatial indicators to reveal how each current use interacts with the building and its 400 m urban setting. Open space, pedestrian movement, rail proximity or parking provision cannot be read as automatically positive or negative; they become relevant only when interpreted together with current use, building capacity and heritage sensitivity.

The GIS component of the study is connected to earlier heritage research that uses spatial data for inventory, documentation, assessment and management. Morrish and Laefer (2010) show the value of digital inventories for architectural heritage, while García-Esparza and Altaba Tena (2020) use GIS to evaluate historical, architectural and social values in historic urban cores. Can, Tura and Kudde (2019) and Üstün and Bilgin Altınöz (2025) also demonstrate the relevance of geospatial data for understanding multilayered urban heritage. The present study is in line with these works, but it uses GIS for a more specific purpose. The spatial indicators are not used only to document where the muvakkithanes are located. They are used to compare the immediate conditions that affect compatibility: land use, public open space, movement network, transit proximity and parking/service access. This makes the GIS analysis a preparatory layer for reuse assessment, rather than a complete decision model.

The urban morphology literature helps explain why these spatial indicators matter. Lynch (1960) shows that landmarks, nodes, paths and districts shape how urban environments are perceived. Ozbil, Peponis and Stone (2011) and Ye and van Nes (2014) also show that land use, street configuration and pedestrian movement are closely related. The findings of the present study support this relational understanding, but at the scale of the sampled muvakkithanes. The sampled muvakkithanes are not differentiated only by their architectural characteristics. They are also differentiated by how they are positioned within combinations of open space, commercial activity, pedestrian movement, public transport and parking

constraints. This is why the same building type produces different compatibility questions in different parts of the Historic Peninsula.

The relative position of the five contextual typologies in relation to urban pressure, public visibility and spatial accessibility is summarized in Fig. 7. The figure should not be read as a function-allocation diagram. It is a comparative reading of the contextual positions identified in the sampled cases. Its role is to show why the indicators reported in the findings cannot be interpreted with the same weight in every setting.

In the Touristic–Public Core, represented by Sultanahmet Mosque Muvakkithane and Ayasofya Mosque Muvakkithane, public visibility, open-space relationship and pedestrian encounter are the decisive indicators. The findings show that inward-looking uses such as storage fail to respond to the public character of Sultanahmet, while Ayasofya's restoration condition requires future use to remain low-intervention. This reading is consistent with Vidyullatha, Kumar and Dileep (2023), who argue that adaptive reuse can support urban regeneration when functions are selected through informed decisions rather than arbitrary assignment.

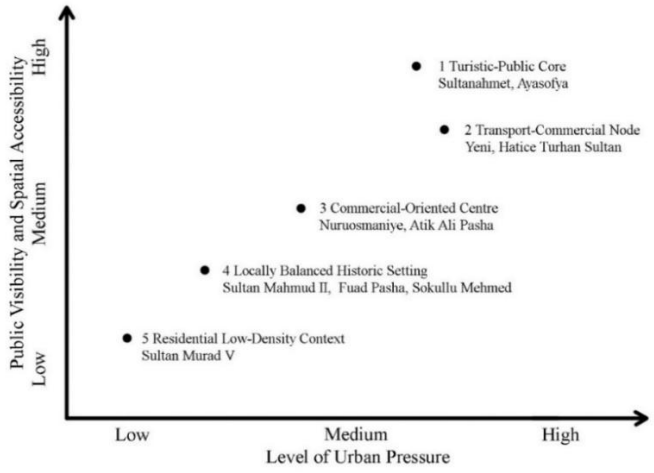

Fig. 7: Relative position of the contextual typologies according to urban pressure, public visibility and spatial accessibility
Source: Authors, 2026

In the Commercial-Oriented Center, represented by Nuruosmaniye Mosque Muvakkithane and Atik Ali Pasha Mosque Muvakkithane, commercial density and pedestrian intensity become more decisive than open-space potential. The findings partly correspond with Thinnakorn, Chanklap and Tongseng (2023), who emphasize the role of movement patterns and centrality in sustaining historic urban environments. Yet the sampled cases show that centrality also creates pressure. In Nuruosmaniye and Atik Ali Pasha, staff lodging conflicts with dense commercial-pedestrian surroundings because it requires privacy, domestic facilities and interior adaptation. Thus, reuse should not simply imitate the surrounding commercial character; it must remain low-impact within the physical limits of the building.

In the Transport–Commercial Node, represented by Yeni Mosque Muvakkithane and Hatice Turhan Valide Sultan Mausoleum and Muvakkithane, accessibility is not automatically advantageous. The overlap of commercial and transport-related land uses produces visibility and contact, but also short-duration movement, congestion and service constraints. For Yeni Mosque, the staff-room use leaves the building closed within a highly active node. For Hatice Turhan, storage use does not respond to the public movement potential of the setting and may create conservation risk for interior surfaces.

In the Locally Balanced Historic Setting, represented by Fuad Pasha Mosque Muvakkithane, Sokullu Mehmed Pasha Mosque Muvakkithane and Sultan Mahmud II Mausoleum and Muvakkithane, urban pressure is moderated by residential fabric, education, open space and local movement. This reading is close to the Historic Urban Landscape

approach of UNESCO (2011), which treats heritage as part of wider social and spatial relationships, and to ICOMOS (2011), which emphasizes the relationship between historic urban areas, uses and meanings. Yet Fuad Pasha and Sokullu Mehmed Pasha remain problematic because their current uses have introduced domestic, technical or spatial pressures. Sultan Mahmud II appears more compatible as an NGO office, but only if the use remains modest, reversible and limited in intervention.

In the Residential Low-Density Context, represented by Sultan Murad V Sebil and Muvakkithane, lower urban intensity does not automatically mean weaker reuse potential. The clothing-store use benefits from visibility and access but weakens legibility through commercial display, supporting Sahraiyanjahromi and Olgaç Türker's (2020) argument while showing that the problem is the mismatch between market-oriented occupation and the cultural meaning of the building.

These findings suggest that the sampled muvakkithanes require a reuse evaluation logic sensitive to scale, intervention tolerance and immediate context, because their limited interior volume and culturally specific meaning distinguish them from larger monuments, former industrial buildings or museum-scale heritage sites. This is why the study does not propose a single best reuse function. Instead, it shows that each case requires a prior compatibility reading that clarifies which forms of occupation would conflict with the building's physical capacity, heritage sensitivity and contextual setting.

The findings also show why GIS-based contextual assessment should be understood as a preparatory decision-support layer, not as a complete decision model. GIS can make land use, accessibility, open space, movement pressure and parking conditions visible and comparable, but it cannot determine the final function by itself. Economic feasibility, structural risk, ownership, management capacity, user expectations and conservation permissions remain decisive. Therefore, the framework developed here should be used before detailed design or implementation decisions, as a way of making contextual constraints visible at an early stage and reducing function assignment not supported by building-scale and urban-scale evidence.

Taken together, the findings connect adaptive reuse, compatibility, GIS-based heritage analysis and urban morphology through the sampled muvakkithanes as a culturally specific building group with limited spatial capacity. The study shows that their adaptive reuse potential cannot be evaluated only through architectural characteristics or current availability, but through the interaction between current use, physical capacity, heritage sensitivity and immediate urban context. Its specific contribution is to show how this interaction produces different compatibility issues in each sampled case, rather than a single reusable function model for the whole building type.

Conclusions

This study examined the contextual compatibility issues affecting the adaptive reuse potential of selected muvakkithanes in the Historic Peninsula of Istanbul. The findings show that the problem is not only the loss of the original timekeeping function, but also current occupation without clear evidence of prior contextual compatibility assessment. Storage, staff lodging, staff rooms, security-office use, NGO-office use and retail occupation create different compatibility problems when read together with each building's physical capacity, heritage sensitivity and immediate urban context.

The case-specific results show that each sampled muvakkithane produces a different compatibility issue. In Sultanahmet Mosque Muvakkithane, storage conflicts with the restored condition and high public visibility of its touristic-public setting. In Ayasofya Mosque Muvakkithane, restoration creates future reuse potential, but only for a low-intervention function that does not increase physical pressure. In Nuruosmaniye Mosque Muvakkithane and Atik Ali Pasha Mosque Muvakkithane, staff lodging conflicts with small interior volumes, poor physical condition and intensive commercial-pedestrian surroundings. In Yeni Mosque Muvakkithane and Hatice Turhan Valide Sultan Mausoleum and Muvakkithane, secondary staff or storage uses leave highly active transport-commercial settings functionally unanswered. In Fuad Pasha Mosque Muvakkithane and Sokullu Mehmed Pasha Mosque Muvakkithane, the

main issue is the building-level impact of domestic, technical or spatial interventions. In Sultan Mahmud II Mausoleum and Muvakkithane, the NGO office appears relatively more compatible, provided that the use remains modest and reversible. In Sultan Murad V Sebil and Muvakkithane, retail use weakens the legibility and representative value of the structure through commercial display.

The analysis also shows that the sampled muvakkithanes do not share a homogeneous reuse condition, although they belong to the same historical building type and historic urban area. Land use, public open space, pedestrian movement, transport access, parking provision and public visibility gain meaning only when read together with current function and physical condition. The five contextual typologies are therefore not fixed function-allocation categories; they clarify which spatial conditions become more decisive: public visibility and pedestrian encounter in touristic-public cases; commercial density, pedestrian intensity and limited open space or parking in commercial-oriented cases; mobility pressure and short-duration movement in transport-commercial cases; building-level intervention in locally balanced cases; and heritage legibility in the residential low-density case.

A further conclusion is that contextual compatibility and conservation compatibility are related but not identical. A function may respond to surrounding urban demand but still exceed the physical or material tolerance of a muvakkithane. Conversely, a use may fit inside the building but remain unsuitable for its public visibility, access conditions or local urban character. Future adaptive reuse decisions for muvakkithanes in Istanbul should therefore begin with a case-specific reading of what the building and its immediate surroundings can support without weakening heritage value, spatial legibility or conservation sensitivity.

The main strength of the study is its combined use of field survey data and GIS-derived spatial indicators. The field survey recorded physical capacity, current functional status and observed condition, while GIS analysis made land use, open space, accessibility, transport pressure and parking conditions comparable within 400 m buffer areas. This combination allowed the study to move beyond a descriptive inventory and to identify how contextual compatibility problems emerge in each sampled case.

The study also has limitations. The sample is limited to ten muvakkithanes in the Historic Peninsula of Istanbul and should not be read as representing all muvakkithanes in Türkiye. The analysis does not include structural assessment, material diagnostics, ownership conditions, economic feasibility, management capacity, user expectations or conservation permission processes. These factors may strongly affect final reuse decisions.

Future research can extend this work in three directions: applying the contextual assessment to other surviving muvakkithanes in Istanbul, Anatolia and Thrace; combining GIS-based contextual reading with structural, material and conservation-risk assessments; and including stakeholder interviews, user scenarios, management models and multi-criteria decision-making methods to test feasible low-intervention functions for specific muvakkithanes.

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