

# Conservation Proposal for Traditional Masonry Structures In Çatalca, Istanbul

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## ABSTRACT

*This study addresses the challenges and proposed solutions for the conservation of traditional masonry structures located in Çatalca, a historical district in the western part of Istanbul that has hosted various civilizations throughout history. Constructed with local materials such as stone, brick, and wood, these structures not only reflect the aesthetic and technical knowledge of their time but also embody the cultural identity of the region. However, rapid urbanization, natural disasters, lack of maintenance, and inappropriate interventions threaten their long-term sustainability.*

*The research was conducted through literature review, field observations, and analysis of current practices, identifying three main areas of deterioration: material decay, structural issues, and human-induced damage. The findings highlight the critical role of material authenticity, structural integrity, functional continuity, and environmental compatibility in the conservation of traditional masonry buildings. Accordingly, restorative repair, adaptive reuse, consolidation, and stabilization are proposed as key strategies. In addition, energy efficiency, the use of environmentally friendly materials, and raising community awareness are prioritized to ensure long-term sustainability.*

*In conclusion, the conservation of traditional masonry structures in Çatalca requires not only technical interventions but also an integrated approach that considers cultural, social, and environmental dimensions. The study proposes a holistic and sustainable conservation model, aiming to contribute to the transmission of cultural heritage to future generations.*

**KEYWORDS:** Çatalca, traditional masonry, conservation methods, sustainability, restoration

Date of Submission: 25-09-2025

Date of acceptance: 05-10-2025

## I. INTRODUCTION

Çatalca, a settlement area dating back to approximately 2500 BCE, has been established on a land shaped by various civilizations. Located to the west of Istanbul, which connects Asia and Europe, Çatalca has historically witnessed migrations, invasions, and attacks due to its strategic significance. This historical context has contributed to a dynamic process of settlement and cultural development in the region. Evidence from nearby İnceğiz Village, which today holds touristic importance, indicates that Çatalca and its surroundings have been inhabited since the era of the Thracians, the first indigenous people of Thrace (c. 2000 BCE).

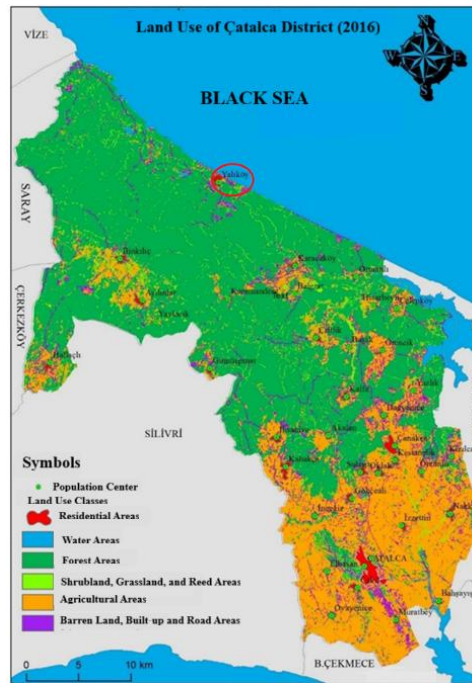


Figure 1.1. Land Use Map of Çatalca District (1987) [1].

Traditional masonry structures represent significant heritage assets, reflecting the architectural styles, construction technologies, and cultural identities of different historical periods. Constructed with natural and local materials such as stone, brick, and mortar, these structures embody not only the aesthetic understanding of their time but also the accumulated technical knowledge [2]. Today, they serve as a bridge to the past while remaining key elements in maintaining the identity of urban environments.

However, rapid urbanization, inappropriate interventions, natural disasters, and maintenance deficiencies threaten the authenticity and integrity of these traditional masonry buildings. Preservation of such structures involves not only maintaining their physical integrity but also safeguarding their historical, cultural, and social context for future generations [3]. Internationally, the Venice Charter (1964) and ICOMOS principles, along with local regulations such as the Law on the Protection of Cultural and Natural Assets (No. 2863), provide fundamental guidelines for intervention and conservation processes.

This study aims to examine the challenges related to the conservation of traditional masonry structures and to develop practical and sustainable solutions. The research evaluates both existing conservation theories and contemporary approaches, focusing on material restoration, functional continuity, and the preservation of intrinsic values, thereby contributing to the maintenance of cultural heritage and the strengthening of conservation awareness.

## II. RESTORATION METHODS AND ADAPTIVE REUSE

The foundation of cultural heritage conservation begins with maintenance, followed by repair. The primary objective is to prevent deterioration through careful attention. When this is not achievable, buildings must be repaired in a manner that preserves their original characteristics [4]. While efforts to conserve heritage date back centuries, their scientific examination emerged in the early 19th century. Earlier practices were influenced by personal opinions or prevailing architectural movements. Today, restoration is guided by established principles rather than subjective trends, and it is defined not merely as repair or fixing, but as a multidisciplinary effort based on analytical data and research [5].

Documentation, or "rölöve," records a building's current condition through precise measurements and visual representations, detailing physical attributes, deterioration, and additions. "Restitution" aims to reconstruct a building's historical development and original state based on existing findings and documentation. "Restoration," on the other hand, involves repairing and adaptively reusing damaged or lost elements while preserving the building's authentic features [6].

Adaptive reuse refers to the process of assigning new functions to buildings that have lost their original purpose, are abandoned, or require conservation. It combines repair, restoration, additions, and modernization to achieve functions different from the original. According to Article 5 of the Venice Charter, "Monuments may be used for a socially useful purpose, provided that this does not alter their architectural plan. Within these limits,

modifications required for new use may be designed and implemented.” This establishes a framework for the adaptive reuse of historic structures [7].

Today, numerous approaches exist regarding the conservation of historic buildings. Preserving the identity of historical environments while re-evaluating and revitalizing them—transforming them into “living spaces”—is widely recognized as a universal principle for effective conservation [8].

### III. CONSERVATION METHODS

Conservation methods refer to technical and scientific approaches applied to ensure the continuity of cultural heritage. These methods vary according to the material properties of the building, types of deterioration, and environmental influences. For instance, terrestrial laser scanning technology enables detailed 3D modeling of structures, providing reference data for the restoration process [9]. Additionally, street revitalization projects aim to protect both registered and unregistered immovable cultural properties by addressing their surrounding environment [10].

**Completion:** According to Article 12 of the Venice Charter (1964), missing parts should be completed in a manner that is compatible with the overall structure while remaining distinguishable from the original to avoid misrepresenting historical authenticity. The goal of completion is to achieve harmony with the original monument while clearly indicating subsequent interventions [11].

**Cleaning:** Cleaning involves the removal of accumulated dirt, deposits, biological growth, or atmospheric pollutants from the building surface using techniques that do not harm the structure. It is crucial for both aesthetic and structural conservation [12].

**Integration:** In cases where multiple damaging factors coexist, large fragments may detach from stone elements. Detached stone pieces can be reattached using resins or stronger adhesives. If the fragment is a structural element, non-functional, or missing, similar stones or natural materials may be used to fill the gaps [13].

**Adaptive Reuse:** Adaptive reuse provides historic buildings with new functions suitable for contemporary needs. This method aims to preserve the structure while enhancing its social and economic value [14].

**Restorative Repair:** This involves repairing damaged or deteriorated building components using original materials and techniques. The goal is to maintain the historical and aesthetic value of the structure [3].

**Stabilization:** Stabilization refers to structural interventions designed to preserve the current condition of a building and prevent future deterioration. This method is particularly critical for stone and wooden structures [15].

### IV. METHODOLOGY

In this study, a combination of literature review and application-oriented analysis methods was employed to develop recommendations for the conservation of traditional masonry buildings. The primary aim of the research is to create a model that preserves the authentic values of masonry structures and proposes sustainable interventions in light of existing conservation theories and local practices.

The methodology followed in this study can be summarized as follows:

#### 1. Selection of Sample Buildings:

- Traditional masonry buildings in Istanbul’s Çatalca district, distinguished by their architectural features and historical significance, were identified.
- The selected buildings were classified according to material type, intended use, and current conservation status.

#### 2. Data Collection:

- The current conditions of the buildings were documented through photographs, drawings, and field observations.
- Types of material deterioration, structural problems, and human-induced effects were recorded in detail.
- Existing restoration practices, archival documents, and reports from relevant conservation boards were examined.

#### 3. Analysis Method:

- The collected data were evaluated using qualitative analysis, and issues were categorized in terms of structural, material, and aesthetic integrity.
- Conservation principles suggested in the literature were compared with the selected buildings, and feasible solutions were developed.
- Special emphasis was placed on sustainable material use, renewal techniques, and preservation of historical function.

#### 4. Development of Recommendations:

- Findings were synthesized in light of existing literature and national/international conservation standards to create applicable and systematic conservation recommendations.

- This methodology integrates both theoretical and practical perspectives, ensuring a holistic and sustainable approach to the conservation of traditional masonry buildings.

## **V. FINDINGS**

The traditional masonry structures examined in this study exhibit various issues in terms of materials, structural integrity, and functionality. The findings are categorized under three main headings: material deterioration, structural problems, and human-induced impacts.

### **V.I. Material Deterioration**

The most common types of deterioration in traditional masonry buildings include the disintegration of bricks and stones, cracking of mortar, and moisture-induced deformations. Deterioration observed particularly on wall surfaces and load-bearing elements directly affects the mechanical durability of the structure. According to Ahunbay (2019), such deterioration primarily results from the use of inappropriate materials and a lack of maintenance.



**Figure 2. Material Deterioration**

#### **1. Stone Structures**

- Physical Deterioration: Freeze-thaw cycles, salt crystallization, cracking, and surface flaking.
- Chemical Deterioration: Acid rain, corrosion, darkening, and biological growth on surfaces.
- Mechanical Damage: Cracks and breakage in stone blocks, settlement, and slipping in load-bearing surfaces.

#### **2. Brick Structures**

- Material Loss: Surface powdering and fragmentation.
- Moisture and Humidity: Deterioration in joints, efflorescence, and blistering of bricks.
- Structural Issues: Cracks and differential settlement in masonry walls.

#### **3. Timber Structures**

- Biological Damage: Infestation by insects (termites, woodborers), fungi, and mold.
- Physical Damage: Cracking, bending, warping, and swelling or shrinking due to moisture.
- Fire Risk: One of the most critical threats in wooden buildings.

#### **4. Masonry Walls**

- Load-bearing Damage: Differential settlement, cracks, and collapses due to earthquakes.
- Binder Deterioration: Decomposition, powdering of mortar, and joint widening.
- Moisture Effects: Capillary rise causing efflorescence and plaster detachment.



## **V.II. Structural Problems**

The analyzed structures exhibited foundation settlement problems, roof deformations, and partial collapses in load-bearing systems. These issues pose significant risks, especially in regions with high seismic activity. Early detection and appropriate intervention are critical for ensuring both safety and preservation of historical value.



**Figure 3. Roof Deformations and Partial Collapses in Load-Bearing Systems**

## **V.III. Human-induced Damage**

Inappropriate interventions, improper repair techniques, and functional loss have adversely affected the authentic values of masonry buildings. For instance, additions made with reinforced concrete or modern materials compromise both aesthetic harmony and the natural behavior of the structure.



**Figure 4. Inappropriate Repair Techniques and Loss of Function**

#### **V.IV. Preservation Priorities**

The findings indicate the following priorities in the conservation of traditional masonry structures:

- Preservation of material authenticity and selection of appropriate materials.
- Ensuring structural integrity and using reinforcement methods compatible with traditional techniques.
- Controlling human interventions and applying suitable restoration techniques.
- Maintaining functional continuity, ensuring the structure remains active within its social and cultural context.

These priorities, in line with the literature, demonstrate that both technical and cultural dimensions must be considered in the conservation of traditional masonry buildings.

#### **V.V. Conservation Recommendations**

The recommendations for preserving traditional masonry structures were developed by considering both international principles emphasized in the literature and local application examples. These recommendations focus on material integrity, structural durability, aesthetic value, and sustainability.

##### **Material and Structural Repair**

- The original materials of the buildings, such as stone, brick, and mortar, should be preserved, and similar local materials should be used whenever possible.
- In the repair of deteriorated elements, traditional techniques should be prioritized. Contemporary materials may be integrated only if they do not compromise the mechanical or aesthetic integrity of the building.
- Foundation settlements and roof deformations in load-bearing systems should be addressed using traditional reinforcement methods; modern interventions should not alter the original behavior of the structure.

##### **Function and Usage Continuity**

- The cultural and social functions of masonry buildings should be maintained, and they should not be left vacant due to functional loss [16].
- In adaptive reuse, the original spatial organization and aesthetic features should be preserved.

##### **Sustainability and Environmental Compatibility**

- Long-term preservation should consider energy efficiency and the use of environmentally friendly materials [16].
- Harmony with the natural environment and landscape should be part of conservation strategies, taking into account the historical and natural context of the site.

##### **Education and Awareness**

- Training technical staff and raising public awareness during restoration processes will improve the quality of interventions on traditional masonry buildings [17].
- Local authorities and conservation boards should develop educational programs to ensure the continuity of implementation standards.

These recommendations, aligned with principles highlighted in the literature, contribute to the preservation of both the physical and cultural values of traditional masonry structures.

### **VI. CONCLUSION AND DISCUSSION**

In this study, the issues and solutions regarding the preservation of traditional masonry structures were evaluated through a literature review and application-focused analyses. The findings indicate that masonry buildings face three main problems: material deterioration, structural issues, and human-induced damage. These problems threaten not only the physical integrity of the structures but also their cultural and social values.

The proposed conservation recommendations were developed considering international principles and local practices, focusing on material integrity, structural durability, functional continuity, and sustainability. The findings align with the literature, highlighting the importance of addressing both technical and cultural dimensions in a holistic approach to masonry building preservation.

The academic contribution of this study lies in providing a systematic conservation approach for traditional masonry structures and developing sustainable intervention recommendations. From a practical perspective, it offers concrete suggestions that can enhance the effectiveness of restoration and maintenance processes. Particularly, preserving material authenticity, ensuring functional continuity, and considering environmental compatibility are critical factors that support the long-term survival of masonry buildings.

In conclusion, the conservation of traditional masonry structures should not be limited to technical interventions alone but must also consider cultural, social, and environmental aspects. This approach is crucial for transmitting historical structures to future generations and ensuring the sustainability of cultural heritage.

**Recommendations at the building scale to sustain traditional residential culture:**

- Qualitatively significant buildings identified through analyses should be officially registered.
- Traditional structures that pose structural risks but need preservation should be documented, demolished if necessary, and reconstructed in accordance with their original design.
- Historical additions providing information about specific periods should be preserved during restoration.
- For historical buildings in the traditional fabric of Çatalca – Yalıköy Village, repairs should be carried out based on the building's needs, including simple interventions such as façade cleaning and repainting, or extensive works such as structural reinforcement, removal of incompatible additions, restoration of original window and door proportions, and roof reconstruction.
- Newly constructed or restored buildings should have façades compatible with the original Çatalca–Yalıköy architectural character.
- Methods should be developed to promote the adaptation and use of traditional materials in contemporary construction and to encourage their preference in new residential buildings.

Following these principles, the aim is to preserve the original construction techniques, materials, layout schemes, and façade arrangements of traditional residential culture. In this way, the sustainability of traditional housing culture will be ensured through the active use of existing historical buildings and the protection of socio-economic characteristics within the village context.

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