

ARCHITECTURAL HERITAGE OF AS-SALT, JORDAN: COMPREHENSIVE ANALYSIS, TOURISM DEVELOPMENT POTENTIAL AND STRUCTURAL ASSESSMENT FRAMEWORK

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Abstract: This study examines As-Salt, Jordan's architectural legacy, which is crucial to cultural heritage tourism since it was added to the UNESCO World Heritage List in 2021. This study explores the unique architectural features of As-Salt through thorough documentation and analysis of the city's historical building stock. These features include the city's famous yellow limestone construction, the fusion of Ottoman and European classical influences, and the patterns of spatial organization that developed during the Golden Age (1860–1920). In order to assess the built heritage of As-Salt's current relevance and preservation potential, this study combines architectural documentation, morphological analysis, and tourism development perspectives. The results show that the city's architecture, which combines Ottoman spatial traditions, European neoclassical elements, and native stone-building techniques that developed from nineteenth-century commercial vernacular through early twentieth-century modernization, is a singular example of architectural synthesis and cultural coexistence. The study problems key conservativeness by questioning the trade-off development between tourism and heritage. Discussions may be on the emergent management of heritage that would see the integration of sustainable tourism with respect to the cultural significance of a sacred site, which also provides for quality visitor experience. These conclusions are of much value for those professionals managing urban historic districts in the ME and point to the fact that architectural heritage is highly crucial in respect to sustainable urban development. In this research, a framework is proposed for structural assessment and restoration, which consists of non-destructive diagnostics integrated with a compatible intervention strategy. Literature evidence suggests that utilizing ultra-fine lime-based grouts (D_{90} under 100 μm) in conjunction with Textile-Reinforced Mortar (TRM) systems can offer a high-performance solution for enhancing ductility and seismic resistance. This framework aims to ensure safe adaptive reuse of heritage assets for the tourism sector while maintaining structural integrity in a seismically active region.

Keywords: As-Salt, Architectural Heritage, UNESCO World Heritage, Cultural Heritage Tourism, Heritage Conservation, Ottoman Architecture, Jordan, NDE, TRM, Lime grouts

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INTRODUCTION

Jordan's As-Salt City is a prime example of late 19th- and early 20th-century traditional Levantine architecture. The city saw substantial architectural development during its heyday (1881–1918), propelled by regional trade and the blending of Ottoman, European, and indigenous building traditions. A unique architectural vocabulary with distinctive façade compositions, material choices, and spatial arrangements resulted from this synthesis (Assi, 2020; Zalloom & Tarrad, 2020). In 2021, As-Salt's historic core was inducted into the World Heritage List by UNESCO, which acknowledged the city's Outstanding Universal Value as a demonstration of architectural excellence, urban hospitality, and cultural tolerance (UNESCO, 2021). Built primarily of native yellow limestone using traditional masonry techniques, the city's significant heritage building stock is both a cultural asset and a conservation challenge that calls for thorough documentation and strategic management (Cotella et al., 2025; Aburamadan et al., 2022).

As-Salt's UNESCO designation has put it in a favorable position for the growth of heritage tourism, but it has also made preservation more difficult. Sustainable heritage management necessitates striking a balance between community

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involvement, economic viability, accessibility for tourists, and conservation imperatives (Garrod & Fyall, 2000). Maintaining the site's Outstanding Universal Value while creating tourism infrastructure and programming that doesn't jeopardize architectural integrity or disturb residential communities is the main source of conflict (Jamhawi & Hajjah, 2017). To support heritage management strategies that promote sustainable tourism development while maintaining the city's cultural authenticity and spatial character, this study looks at important architectural typologies found in As-Salt's historic center. The unique masonry typology of As-Salt's architectural legacy consists of load-bearing walls made of yellow limestone that can reach a thickness of one meter and support intricate cross-vaulted systems.

Because the city is close to the Dead Sea Transform, which is an active seismic zone, structural conservation requires a thorough understanding of the mechanisms underlying lime mortar carbonation and long-term durability performance (Balzani et al., 2024; Chen et al., 2024). In order to maintain the UNESCO-listed fabric and guarantee seismic safety, this study suggests combining sophisticated non-destructive testing fusion protocols (combining sonic velocity profiling with electromagnetic mapping) (Roumeliotis et al., 2024; Barrile et al., 2024).

Understanding this architectural legacy requires situating it within its historical context. The highest possible level of economic development came during the final days of Ottoman rule, therefore during this period, As-Salt became the economic axis of East Jordan. The city's geographical location was the main impetus behind its economic development as a passage along trade routes connecting Palestine and Syria with their Transjordanian backwoods. The kind of wealth managed by the mercantile elite trickled down in a manner creating changes in the landscape, redeploying storeys of privately-built mansions by wealthy families which purported to mark some discriminator of wealth and status in terms of Levantine architectural style (Rogan, 1999; Assi, 2020). During the golden season, some merchant families from the cities of the Levant brought architectural know-how, building techniques, and a very particular set of decorative traditions to As-Salt (UNESCO, 2021). This changing of cultural mores produced a peculiar architectural trend combining Ottoman interval structures, elements of European styles, and local building techniques (Assi, 2020).

It was this migration of skilled craftsmen to As-Salt that made this development possible, aided sharply by the master builder of Nablus, 'Abd al-Rahman al-'Aqrūq, who shared his accomplishments, among others, in advanced Levantine architectural techniques transforming many a local bizarre design into yellow lime parts, fancy building fronts, and more than functional room designs (Jordan News, 2021; UNESCO World Heritage Site Guide, 2014).

These historical dynamics are best interpreted through established analytical frameworks. Ottoman architectural theory (Necipoğlu, 2005) and Islamic urban morphology studies (Bianca, 2000) establish analytical frameworks for understanding As-Salt's spatial organization. These theoretical foundations provide essential context for interpreting the synthesis of architectural traditions evident in As-Salt's built heritage. Regional architectural research examines economic-architectural relationships in Levantine cities (Assi, 2020), Ottoman administrative contexts (Rogan, 2020), and digital heritage documentation methodologies (Cotella et al., 2025). Building on these frameworks, heritage tourism scholarship (Timothy & Boyd, 2003; McKercher & du Cros, 2002) provides conceptual tools for evaluating sustainable tourism development potential. These frameworks emphasize the relationship between architectural authenticity and visitor experience quality, balanced with conservation imperatives and community engagement (Garrod & Fyall, 2000).

Alongside these cultural and touristic considerations, the structural dimension of heritage conservation demands equal attention. Contemporary approaches to heritage masonry conservation emphasize minimum intervention principles (ICOMOS) while addressing seismic vulnerability through compatible materials. Research demonstrates that ultra-fine lime-based grouts ($D_{90} < 100 \mu\text{m}$) combined with Textile-Reinforced Mortar (TRM) systems offer effective solutions for enhancing ductility and seismic resistance while maintaining material compatibility with historic fabric (Petrovčič & Kilar, 2022; Dinç-Şengönül et al., 2023). Non-destructive testing fusion protocols enable comprehensive structural assessment without compromising heritage values (Roumeliotis et al., 2024; Barrile et al., 2024).

PROBLEM STATEMENT, RESEARCH QUESTIONS, AND OBJECTIVES

Problem Statement

There is a significant lack of thorough architectural documentation of As-Salt's stock of historic buildings, even with the city's 2021 UNESCO World Heritage designation. Although recent literature has recognized the site's cultural and architectural significance (Assi, 2020; Zalloom & Tarrad, 2020; Cotella et al., 2025), there is still a dearth of systematic architectural analysis. The way Ottoman, European, and vernacular architectural traditions coexist in As-Salt's urban fabric has not been thoroughly examined in previous research. The Abu Jaber House is one of the few exceptions to the general lack of comprehensive architectural documentation and technical evaluation of heritage buildings. This lack of documentation makes it difficult to integrate architectural heritage into frameworks for sustainable tourism development and limits evidence-based conservation planning (Alnsour et al., 2023; Zalloom & Tarrad, 2020). In the heritage context of As-Salt, a thorough scholarly analysis is necessary to determine the relationship between architectural authenticity, spatial quality, and visitor experience.

For As-Salt and the surrounding area to benefit economically and socially from the city's cultural assets, a thorough research framework that connects formal architectural analysis, heritage documentation, and sustainable tourism principles is necessary. Beyond documentation, As-Salt's heritage faces two structural challenges: the inherent seismic vulnerability of multi-leaf limestone masonry walls, which often have internal voids and insufficient shear transfer capacity, and increased live loads from tourism adaptation (Dinç-Şengönül et al., 2023; Van Gemert et al., 2015). In similar contexts, historical interventions with incompatible materials, especially Portland cement, have accelerated the deterioration of limestone through As-Salt crystallization (Loke et al., 2025). In order to overcome these obstacles, knowledge-based structural evaluation that complies with ICOMOS minimum intervention guidelines must replace aesthetic restoration (Petrovčič & Kilar, 2022).

Research Questions

Main Research Question: How do the city's architectural heritage buildings aid in their promotion of tourism potential and sustainable heritage development, in As-Salt City and its surroundings? **Sub-Questions:**

First, what are the architectural elements and construction methods characteristic of traditional buildings in As-Salt City reflecting Ottoman, European, and local architectural characteristics? Second, how does the Abu Jaber House exemplify the evolution of architecture and craftsmanship during As-Salt City's golden age, and what are the architectural lessons to be learned from the analysis of the Abu Jaber House? Third, what recurring architectural patterns and typologies define the cityscape of historic downtown As-Salt, and how do these contribute to the urban fabric and visual integrity of the surroundings in the historic fabric? Fourth, in terms of tourism allure, how do the architectural qualities of As-Salt's heritage buildings, such as authenticity, aesthetics, and spatial experience, suitably cater to an urban situation? Fifth, what strategies could be suggested in order to work towards sustainability in tourism through use and maintenance of As-Salt City from the perspective of architectural heritage and its preservation through architectural authenticity and integrity? Sixth, what structural assessment framework and intervention strategies can be recommended, based on current research, to support the safe adaptive reuse of As-Salt's Ottoman-era heritage buildings for tourism?

Research Objectives

General Objective: The main aim of this research is to analyze the architectural characters in As-Salt city being combined in heritage buildings and their significance on sustainable heritage tourism development.

Specific Objectives: This study aims to document and analyze architectural variations of style and construction methods of traditional architecture of As-Salt city, which shows the blend of Ottoman, European, and indigenous architectural traditions; to undertake a comprehensive architectural analysis of the House of Abu Jaber as a grand case study of the city's past architectural magnificent achievement; to analyse architectural elements and urban design implications of Hammam Street and illustrate the examples of its spatial organization and business heritage; to examine how architectural authenticity, aesthetic value, and spatial qualities of historic buildings influence the experience of tourists as well as define the tourism appeal of As-Salt; to design sustainable tourism strategies balancing heritage conservation with community linkages; to contribute to the increased academic knowledge on heritage conservation by offering exhaustive documentation of a UNESCO World Heritage Site; and to establish a comprehensive structural assessment framework specifically for historic buildings in As-Salt based on literature evidence.

RESEARCH METHODOLOGY

Research Design and Approach

This research employs a qualitative methodological framework to examine As-Salt's architectural heritage through integrated architectural documentation, historical analysis, and heritage assessment protocols. The overall structure of the research methodology is illustrated in Figure 1. The study is structured around six representative case studies selected through purposive sampling to exemplify the dominant architectural typologies of As-Salt's Ottoman-European synthesis period (1881–1918). The methodology synthesizes three complementary analytical approaches, as outlined in Figure 1:

A. **Documentation and Architectural Analysis:** Systematic documentation of heritage buildings within As-Salt's historic center employs multiple data collection methods, including direct field observation, detailed measured architectural surveys, comprehensive photographic documentation, and material characterization. These records capture architectural features, structural systems, construction materials, spatial organization, and decorative elements. Abu Jaber House serves as the principal case study, with comparative analysis extending to five additional significant heritage structures to identify recurring architectural patterns and typological characteristics.

B. **Historical-Contextual Analysis:** The late Ottoman period (1881–1918) witnessed significant architectural transformation in As-Salt, driven by urban expansion and evolving socio-economic conditions. This research utilizes archival sources, historical documentation, and published scholarship to contextualize architectural developments within broader patterns of regional trade, cultural exchange, and urban modernization.

C. **Evaluating Heritage Tourism:** This component evaluates the relationship between architectural authenticity, spatial quality, and visitor experience within sustainable tourism development frameworks. The analysis examines how As-Salt's architectural heritage can be effectively integrated into tourism programming while maintaining conservation standards and community engagement. Field investigations and analysis were conducted over 18 months (2024–2025).

Study Area and Scope

A. **Geographic Scope:** The research focuses on the historic center of As-Salt (32°02'N, 35°44'E), the administrative capital of Al-Balqa Governorate, situated approximately 28 km northwest of Amman, Jordan. Positioned along the

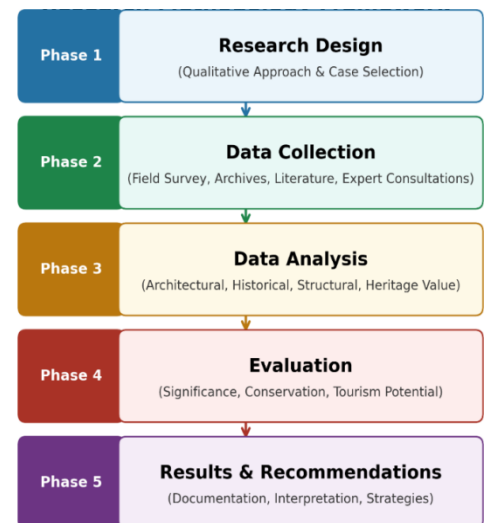


Figure 1. Conceptual framework of the research methodology, from research design to results and recommendations (Source: Authors)

eastern edge of the Jordan Rift Valley escarpment, the city occupies a rugged mountainous terrain at elevations ranging from approximately 700 to 1,100 m above sea level (Figure 2).

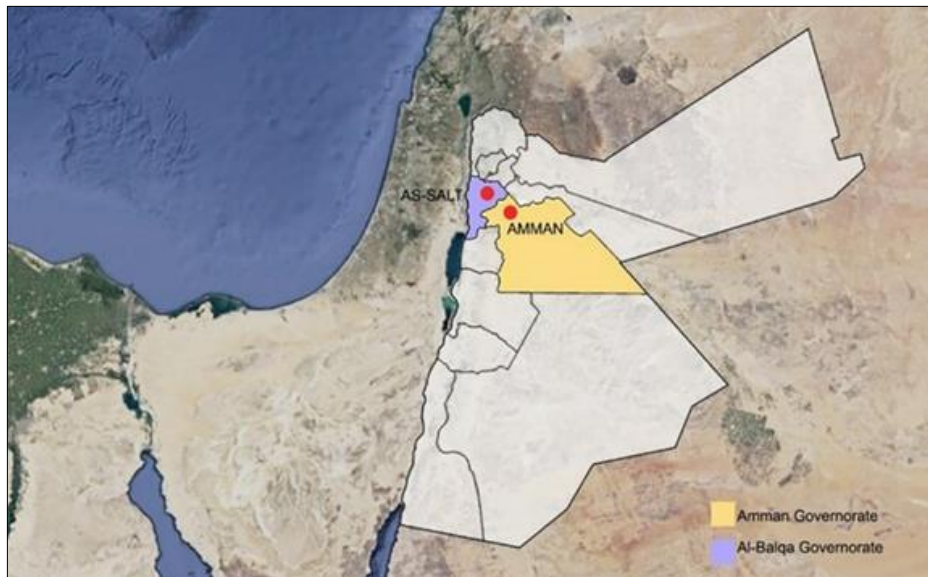


Figure 2. Location of the study area: As-Salt (32°02'N, 35°44'E) within Jordan, approximately 28 km northwest of Amman (Source: Aburamadan et al, 2022)

In 2021, As-Salt's historic core was inscribed on the UNESCO World Heritage List under the title "As-Salt – The Place of Tolerance and Urban Hospitality." The designated heritage area, covering approximately 70 hectares, is characterized by a distinctive urban morphology shaped by three prominent hills: Al-Qal'a, Al-Jad'a, and Al-Salalem. The organic street network and dense residential fabric of the old town have developed in direct response to this challenging topography, yielding a compact, vertically layered urban form (Figure 3).

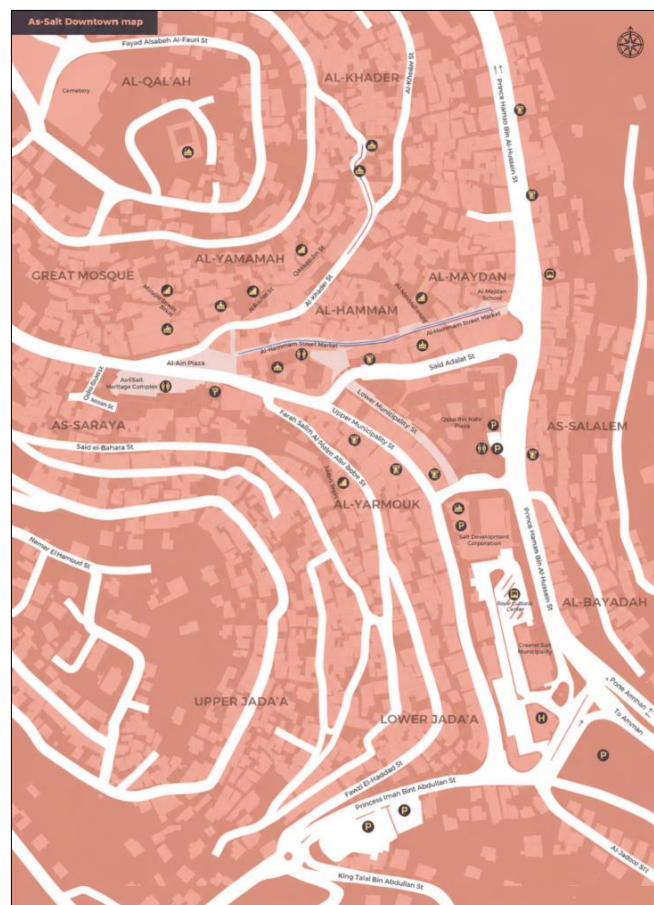


Figure 3. Location of the study area: the three principal hills — Al-Qal'a, Al-Jad'a, Al-Salalem — and Hammam Street (Source: Salt Development Corporation, n.d.)



Figure 4. Panoramic view of Al-Qal'a Hill from Al-Jad'a Hill, showing the yellow limestone urban fabric and the Great Mosque dome (Source: Salt Development Corporation, n.d.)

Particular attention in this study is directed toward Hammam Street, the principal commercial artery that traverses the valley floor between the three hills, serving as the primary connector among the surrounding historic neighborhoods. The street and its immediate architectural context constitute the primary spatial unit of analysis.

The historic core of As-Salt is built across three closely-spaced hills — Al-Qal'a (Figure 4), Al-Jad'a (Figure 5), and Al-Salalem — creating a distinctive steep urban landscape where residential neighborhoods on the slopes are connected to the public spaces below through a network of stairs, alleyways, and nodes.

B. Temporal Scope: The study examines architectural developments during As-Salt's Golden Age (1881-1918), documenting their conservation status as of 2026. This temporal frame captures the city's most significant period of architectural production and subsequent conservation interventions.

C. Case Study Selection: While As-Salt's historic core contains an extensive inventory of heritage buildings, this study employs purposive sampling to select six representative case studies that exemplify the dominant architectural typologies of the Ottoman-European synthesis period. Selection Criteria:

- Architectural integrity: Buildings retaining original spatial organization and material fabric
- Typological diversity: Representation of distinct building categories (palatial residences, merchant houses, commercial structures)
- Structural condition: Varied states of preservation enabling comparative conservation analysis
- Documentation accessibility: Permission for detailed survey and non-destructive investigation
- Historical significance: Buildings documented in archival sources and heritage inventories

Selected Case Studies:

1. Primary case study: Abu Jaber House (comprehensive architectural and structural analysis)
2. Secondary case studies: Touqan House, Muhyar House, Al-Dawood House, Qaqish House, Falah Al-Hamad House.
3. Urban context: Hammam Street commercial corridor and surrounding heritage fabric.

This sampling strategy enables in-depth architectural analysis while maintaining research feasibility and ensuring representation of As-Salt's diverse architectural heritage.

D. Structural Assessment Framework: The methodology establishes a structural evaluation protocol for representative buildings characterized by thick load-bearing limestone masonry walls and cross-vaulted systems. This framework integrates:

- Non-destructive testing (NDT) fusion protocols: Combining sonic velocity profiling with electromagnetic mapping to assess masonry integrity without fabric damage.
- Material characterization: Laboratory analysis of historical lime mortars, limestone properties, and decay mechanisms.
- Seismic vulnerability assessment: Evaluation of lateral load capacity and shear transfer mechanisms in multi-leaf masonry construction.
- Compatible intervention strategies: Development of repair material specifications (ultra-fine lime-based grouts, Textile-Reinforced Mortar systems) informed by published studies on heritage masonry conservation.

This approach adheres to ICOMOS minimum intervention principles while addressing the dual challenges of seismic vulnerability and increased live loads from tourism adaptation.

Data Collection Methods

This research integrates multiple data collection methods to ensure comprehensive documentation and analysis of As-Salt's architectural heritage.

1. **Field Surveys and Architectural Documentation:** Systematic field investigations were conducted throughout As-Salt's historic center during 2024-2025, encompassing exterior surveys of heritage buildings, interior documentation of publicly accessible structures (museums, cultural centers, commercial establishments), and detailed observation of construction techniques, materials, and conservation conditions. Architectural measurements recorded essential dimensional data including building footprints, wall thicknesses, opening dimensions, vault spans, and urban spacing patterns. Comprehensive photographic documentation captured building exteriors, architectural details, construction materials, interior spaces, and urban fabric characteristics, providing visual records for comparative architectural analysis across the six case studies.

2. **Archival and Documentary Research:** Historical documentation was gathered from multiple institutional sources. Primary materials included UNESCO's 2021 World Heritage nomination file and ICOMOS advisory evaluation for As-Salt, JICA's 2010 cultural resources survey, and Jordan's Ministry of Tourism and Antiquities heritage management documentation. The research also consulted technical conservation reports, architectural surveys, restoration assessments, and interpretive materials from As-Salt Historical Museum (Abu Jaber House). These archival sources provided historical context for architectural development patterns and informed comparative analysis of building typologies.

3. **Literature Review:** The literature review synthesized scholarship across four thematic domains. Ottoman architectural theory (Necipoğlu, 2005) and Islamic urban morphology studies (Bianca, 2000) established analytical frameworks for understanding As-Salt's spatial organization. Regional architectural research examined economic-architectural relationships in Levantine cities (Assi, 2020), Ottoman administrative contexts (Rogan, 2020), and digital heritage documentation methodologies (Cotella et al., 2025). Heritage tourism scholarship (Timothy & Boyd, 2003; McKercher & du Cros, 2002) provided conceptual tools for evaluating sustainable tourism development potential. This synthesis revealed gaps in empirical architectural analysis and visitor experience research specific to As-Salt, justifying this study's integrated approach linking architectural heritage documentation with tourism development frameworks.

4. **Expert Consultations:** Informal consultations with local heritage specialists, conservation practitioners, museum staff, municipal heritage officers, and community historians provided contextual knowledge regarding As-Salt's architectural evolution, current conservation challenges, and community perspectives on heritage management priorities.

Analytical Framework

1. **Architectural Analysis Methods:** The architectural analysis employs a multi-layered methodological approach integrating typological, stylistic, material, and spatial investigation strategies. Typological analysis classifies buildings according to functional categories (residential, commercial, mixed-use) and identifies recurring spatial organization patterns, including courtyard houses and triple-arcade plans characteristic of As-Salt's Ottoman-European synthesis period. Structural systems are categorized by construction technique (cross-vaulted, flat-roofed, hybrid timber-masonry configurations). Stylistic analysis documents architectural influences—Ottoman, European neoclassical, and indigenous Levantine traditions—through examination of decorative programs, artistic elements, and façade composition strategies. Material and technical analysis investigates construction materials (local yellow limestone varieties, imported elements), structural techniques (load-bearing masonry walls, arches, vaults, early steel beam applications), and material supply chain patterns. Spatial analysis examines interior organization, circulation sequences, courtyard environmental strategies, and building-street relationships within the historic urban fabric.

2. **Heritage Value Assessment:** Heritage significance is evaluated through criteria adapted from UNESCO World Heritage and ICOMOS frameworks, assessing architectural significance (design uniqueness, craftsmanship quality, technical innovation), historical significance (association with As-Salt's Golden Age development), cultural significance (community identity, social values), authenticity (material integrity, design continuity), and integrity (structural completeness, contextual preservation). This multi-criteria assessment establishes the conservation priorities and informs intervention strategies for each case study building.

3. **Tourism Development Potential:** Tourism evaluation examines the relationship between architectural authenticity and visitor experience quality, considering spatial characteristics that enhance sensory engagement, interpretive programming opportunities, accessibility for diverse visitor demographics, adaptive reuse potential for sustainable economic functions, and integration capacity within As-Salt's broader heritage tourism infrastructure. This assessment framework links architectural qualities directly to tourism development strategies while maintaining conservation standards.

Ethical Considerations

This research adhered to established ethical protocols throughout all phases of heritage documentation and analysis. Field investigations maintained strict respect for private property rights and resident privacy, limiting architectural documentation to publicly accessible spaces, building exteriors, and cultural institutions open to visitors. All historical photographs and archival materials sourced from institutional repositories are appropriately attributed to their originating collections. The research approach demonstrates sensitivity to local cultural values and community perspectives on heritage preservation, acknowledging the invaluable contributions of indigenous architectural knowledge and local expertise in interpreting As-Salt's built heritage. These ethical considerations ensured that the documentation process respected both the physical heritage assets and the living communities that maintain cultural continuity within the historic center.

RESULTS

Architectural Synthesis: Ottoman, European, and Indigenous Influences

As-Salt's architectural heritage exemplifies a sophisticated synthesis of Ottoman, European, and indigenous building traditions that emerged during the Late Ottoman period. This architectural hybridity reflects the city's cosmopolitan

character and strategic position within regional trade networks, where foreign influences were selectively integrated while maintaining strong roots in local construction practices.

A. Ottoman Architectural Traditions: As-Salt's residential architecture demonstrates substantial Ottoman influence through characteristic structural and spatial configurations. Key Ottoman elements include vaulted construction systems (domes, barrel vaults, cross vaults), which define primary load-bearing techniques. These structural systems reflect the geometric harmony inherent in Ottoman architecture, where builders employed transitional elements such as squinches and pendentives to achieve spatial continuity between the cubic base and the vaulted ceiling (Al-Mughrabi et al., 2026; Necipoğlu, 2005). Centrally-located or strategically-positioned enclosed courtyards structure domestic spatial organization. These courtyard systems provided environmental comfort, privacy hierarchies, and social differentiation while expressing Islamic cultural values regarding family privacy, hospitality, and gender relations—features consistent with widespread Ottoman domestic architecture throughout the Levant (Bianca, 2000; Necipoğlu, 2005).

B. European Neoclassical Influences: Alongside Ottoman traditions, late 19th-century architectural production incorporated European neoclassical elements reflecting the city's economic and cultural openness. European influences manifest through sloping tiled roofs, imported steel beams, projecting balconies, and tall vertical windows inspired by contemporary European residential design. Material imports—Italian marble, German ceramics, Belgian stained glass—signify the cosmopolitan aspirations of As-Salt's merchant elite and their engagement with modernizing architectural aesthetics (Assi, 2020; Zalloom & Tarrad, 2020).

C. Indigenous Construction Practices: Despite global architectural currents, indigenous building practices remained fundamental to As-Salt's built environment. The predominant use of locally-quarried yellow limestone established the city's visual identity while ensuring material compatibility with regional climate and traditional construction methods (UNESCO, 2021). Architectural responses to As-Salt's mountainous topography—terraced construction, climate-responsive fenestration patterns, natural ventilation strategies—demonstrate site-specific design adaptations that integrate buildings with the natural environment and local climatic conditions (Daoudi et al., 2019; Salameh & Touqan, 2022). This synthesis of imported influences with indigenous practices reinforces local cultural identity within a cosmopolitan architectural vocabulary.

Comprehensive Analysis: Abu Jaber House

1. Historical Background and Basic Information

Located in As-Salt, the Historical Museum is housed in the Abu Jaber House, one of the finest examples of late Ottoman residential architecture in the city's historic center. The building was commissioned by the Abu Jaber family and constructed between 1896 and 1906. Situated at the base of Al-Jad'a Hill, the house reflects the characteristic yellow limestone construction and arched facades that define the surrounding historic neighborhood, as shown in Figure 5.

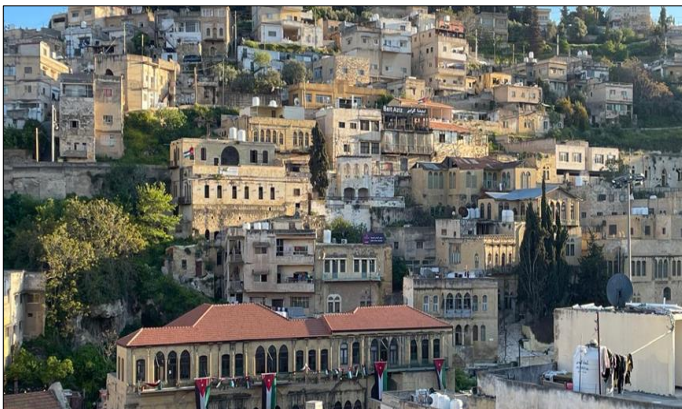


Figure 5. As-Salt historic urban fabric and architectural character of the study area, showing Al-Jad'a Hill with its dense layered arrangement of yellow limestone heritage buildings



Figure 6. Abu Jaber House / As-Salt Historic Museum, Hammam Street, combining white and local yellow limestone (Source: Authors)

The ground floor of the building which opened in 1896 used local yellow limestone for its construction and served as both storage areas and guest reception space (Trillo et al., 2020). The designer of the building 'Abd al-Rahman al-'Aqrūq al-Nabulsi used advanced Eastern Mediterranean building methods which included cross-vaulted ceilings and intricately designed arched windows (Aburamadan et al., 2022). The second floor which finished construction in 1905 used decorative elements that combined local materials with international products to create spaces which included residential areas for the family (Cotella et al., 2025; UNESCO, 2021). The house demonstrates architectural styles which became common among As-Salt merchant families during the late Ottoman era as it combines traditional building methods with European decorative art (Assi, 2020). This master of Nabulsi craftsmen, Abd al-Rahman al-Aqrūq, actually supervised the building, further transferring Nabulsi architectural traditions to As-Salt through superior craftsmanship and superior building technologies (Assi, 2020; Trillo et al., 2020). He was one of the notable builders who moved from Nablus in the last decades of the Ottoman period and brought with him specialized knowledge about stone building, decor, and spatial organization (Aburamadan et al., 2022). A comprehensive restoration was done on the building which had been inaugurated as the As-Salt history museum, ensuring the preservation of its architectural integrity and adapting the interior spaces to house museum

functions (Figure 6) (UNESCO, 2021; Cotella et al., 2025). It has now become a focal point in As-Salt heritage conservation operations, interpreting the city's social, architectural, and cultural history for visitors (Alnsour et al., 2023).

2. Structural Analysis and Architectural Elements

Ground Floor: The bottom floor is supported by a traditional structural system consisting of thick-bearing walls of stone and semi-circular arches used by late-ottoman domestic architecture in As-Salt. As far as the roofing of main interior spaces is concerned, a cross-vault system has been used to cover its wide area without the aid of internal walls. Not only does this system contribute to increased structural stability, but it also offers some flexibility in the use of space within the defined structural parameters, thereby integrating technical construction knowledge with locally rooted social and spatial practices (Municipal Heritage Platform Balqa Governorate, 2025; Bianca, 2000; Necipoğlu, 2005). The building demonstrates the characteristic use of local yellow limestone, the primary construction material sourced from nearby quarries during As-Salt's Golden Age (UNESCO, 2021). The distinctive yellow limestone which became a historical construction material for As-Salt architectural development originated from local quarries that included the Al-Salalem area (UNESCO, 2021). The high-quality construction of Abu Jaber House demonstrates the building standards from its time period because builders used local yellow limestone to create the structure which expert craftsmen from Nablus built under the guidance of master builder Abdel Rahman al-Aqrouq (Assi, 2020 UNESCO, 2021). Rounded cobblestones were used for floors. The coloring made them in black and light white. In the guest hall, decorative colored tiles with geometric and floral patterns measuring 30×30 cm were used, in colors including black, yellow, pink, and the natural stone color, indicating a high level of craftsmanship.

Second Floor: The second floor denotes a distinct shift higher up in the construction technology of As-Salt in the late Ottoman period. Imported European steel beams were used to support the ceilings of the upper floor, thus allowing the walls to be kept at a thickness of almost 30 cm, as opposed to the significantly thicker walls of the ground floor. That technological advancement has allowed for big, roomy, and not dogmatically organized interior spaces with an increased natural light and breathing ability, testifying to the success of Western structural innovation within a traditional Levantine architectural context (Assi, 2020; Necipoğlu, 2005). Italian Carrara marble was used to tile the second floor of Abu Jaber House. The marble was specially imported from Italy to Haifa port by sea, then transported by train from Haifa to Daraa, followed by the Hejaz Railway from Daraa to Amman, and finally carried on camels' backs from Amman to As-Salt.



Figure 7. Interior of the Madafa (guest reception hall), Abu Jaber House, showing Italian marble flooring and yellow limestone walls (Source: Authors)



Figure 8. Interior hall, Abu Jaber House / As-Salt Historic Museum, now a cultural event space, with arched windows and marble floor tiling (Source: Authors)

This complex logistics chain demonstrates the exceptional wealth and determination of the Abu Jaber family to create one of the finest houses in As-Salt (Jordan News, 2021). German tiling on pitched roofs ridge balconies evokes durability and the essence of European architecture. Belgian glass functions for the window openings, whether clear or tinted color glass, ensuring the daylighting and place embellishments (Zalloom & Tarrad, 2020). On the second floor, three separate apartments were designed, each incorporating a small interior courtyard that served as a secluded open-air retreat and a decorated guest reception hall (madafa) (Figure 7). Adapted from the Ottoman residential tradition to the specific urban context of As-Salt, the spatial arrangements reflect the social rituals of wealthy merchant households, including the formal reception of visitors, private family living, and leisure (Bianca, 2000; Assi, 2020). The structural components of the second floor demonstrate a high degree of material finish and construction precision. Pitched ceilings clad with red clay tiles were supported on sloped timber rafters, while cantilevered stairs (*volée*) projected from the façade to maximize interior space. These elements exemplify the late Ottoman architectural practice of integrating European construction techniques to enhance functional adaptability, while the applied ornamentation complements the architectural character of the historic fabric (Necipoğlu, 2005; Assi, 2020; Municipal Heritage Platform, Balqa Governorate, 2025).

3. Decorative and Artistic Elements

The house of Abu Jaber presents beautiful scenes from tiles of Eastern and Western design culture are woven together to form an interesting fusion of decorative elements (Figure 8). Geometric patterns embody Islamic design practices in never-ending and tightening repetitive actions that impart continuity and rhythm in the visual; floral decoration shows the influence of European design, with naturalistic patterns deriving from the sources of organic forms, truly exemplifying the

patterns of the botanical world, inspired also being with water-based ornamentation, and counterbalancing the whole sky with compositions of geometric forms. The wall paintings in Abu Jaber House are a unique artistic phenomenon in As-Salt City, not found in any other building. These include European rural house paintings discovered during restoration work, kitchen paintings mimicking oak bark (a decorative technique common in Europe), and ceiling paintings depicting the four seasons executed using oil paints. The German artist 'Menlik' from Haifa is believed to have executed these works.

Recurring Architectural Patterns in As-Salt

1. **Yellow Limestone as Unifying Element:** Local yellow limestone constitutes the unifying architectural element that connects As-Salt's heritage buildings and gives them their distinctive architectural identity (Figure 9). This distinctive yellow limestone was traditionally extracted from local quarries, particularly from the Al-Salalem area, though these historical quarries are now closed (ICOMOS, 2021). Current conservation work sources similar stone from quarries in Dair Allah and the Mafrq region (UNESCO World Heritage Centre, 2021). The limestone exhibits warm yellow coloring ranging from light yellow to golden, relatively smooth texture easy to carve and shape, durability resistant to weather conditions, and creates visual unity when used in adjacent buildings.

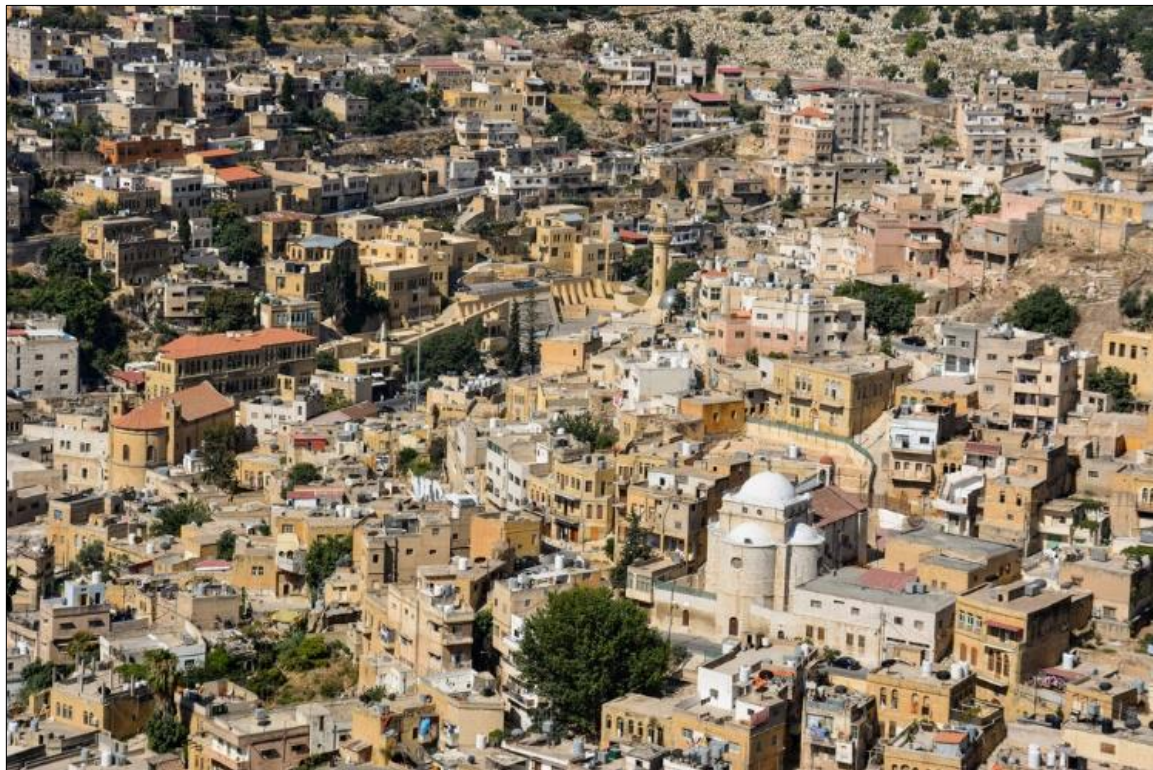


Figure 9. Panoramic view of As-Salt's historic center, showing the yellow limestone urban fabric cascading along Al-Qal'a and Al-Jad'a hills (Source: Authors)

2. **Arches and Arcades:** Arches and arcades are among the most eye-catching architectural features in As-Salt buildings, serving both structural and aesthetic purposes. Structurally, they support ceilings and distribute loads on side walls, reduce pressure from load-bearing walls, and allow coverage of wide spaces without internal columns. Aesthetically, they create harmonious visual rhythm in facades and express craftsmanship skill and artistic mastery. Types include pointed arches, semi-circular arches, cross vaults, and segmental arches.

3. **Windows and Openings:** As-Salt buildings are characterized by abundant arched windows, predominantly in the upper stories, reflecting European architectural influences adapted to local climatic needs (Assi, 2020; Trillo et al., 2020). These carefully proportioned openings ensure ample natural lighting and ventilation, demonstrating the synthesis of imported design aesthetics with climate-responsive building practices (Aburamadan et al., 2022; UNESCO, 2021). A representative example is found on the upper floor of the Abu Jaber House, where triple-arched windows combine pointed arches with polychrome stained glass in green, red, and yellow, set within ornamental wrought-iron grilles that exemplify the European influences integrated into the traditional Levantine residential design of As-Salt's Golden Age (1881–1918) (Figure 6, 8, 10).

4. **Roofing Systems:** Roofing systems (Figure 2, 5, 6, 9) in As-Salt buildings varied according to time period and economic level. Traditional roofs included stone vaults and small domes in some rooms. Advanced roofs featured sloped wooden roofs covered with red tiles and modern flat roofs using steel beams.

5. **Urban Fabric and Topographic Integration:** As-Salt extends over three main hills — Al-Qal'a, Al-Jad'a, and Al-Salalem — giving the city a unique architectural character (UNESCO, 2021). Yellow limestone buildings are arranged on the slopes of these hills, forming a cohesive architectural mass consistent with the natural contours of the terrain (Figure 9). Urban fabric characteristics include vertical gradation with buildings terraced on the hillsides, compact density with narrow

spaces between buildings, and winding streets following the natural topography. The city's distinctive monumental stairways connect the hillside neighborhoods and serve as primary pedestrian routes (Figure 11 a), while the coexistence of mosques and churches within the historic skyline reflects the cultural tolerance that defines As-Salt's urban identity (Figure 11 b).

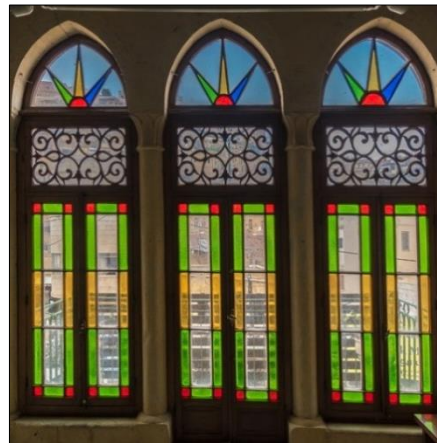
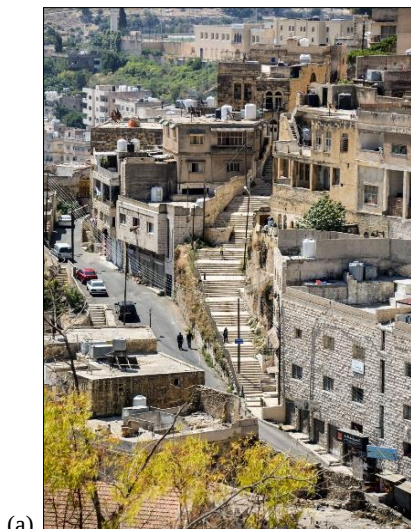


Figure 10. Triple-arched stained-glass windows, upper floor, Abu Jaber House (Source: Authors)



(a)



(b)

Figure 11. Urban landscape: (a) stone stairways (*salalem*) linking hillside neighborhoods (Source: Daher, n.d.); (b) mosque minaret and church bell tower coexisting, reflecting the tolerance behind the city's inscription on the UNESCO World Heritage List in 2021; Abu Saleem, 2016)

Comparative Case Studies

1. Touqan House: Located on Prince Hamza Street near Hammam Street in As-Salt, Touqan House is a prominent heritage building constructed between 1900 and 1905 by master builder 'Abd al-Rahman al-'Aqrūq for the Touqan family, who migrated from Nablus (Trillo et al., 2020; UNESCO, 2021). The house currently serves as the As-Salt Archaeological Museum, showcasing artifacts from the Roman, Byzantine, and Islamic periods. The building's entrance exhibits cross-vaulted and barrel-vaulted ceilings which serve as structural roofing systems for the building while the upper floor uses iron girders which match the construction materials that builders used for the Hijaz Railway infrastructure (UNESCO, 2021). Architecturally, the frontage portrays unique decorative elements. The façade integrates Art Nouveau and Neoclassical elements, including decorated columns, floral-petal pilasters, and a symmetrically composed stone staircase with ornate balustrades (Cotella et al., 2025). These architectural features exemplify the blending of European aesthetic traditions with the local Levantine building vocabulary that characterized late Ottoman-era merchant residences in As-Salt (Assi, 2020; Aburamadan et al., 2022) (Figure 12).

2. Muhyar House: The Muhyar complex on Hammam Street exemplifies the integrated commercial-residential typology that defines As-Salt's historic commercial district. The complex consists of two buildings: the Muhyar Building, with its main entrance and two-storey design, and the Muhyar House, which lies to the east of the main building; both structures were constructed using local yellow limestone (UNESCO, 2021). The main exterior of the Muhyar House features two distinct window styles combined with three arched windows extending across the principal entrance area. The design employs Ottoman architectural elements to create street frontages that support commercial activities (Cotella et al., 2025). The main entrance provides access to a curved stairway linking the ground-level commercial spaces to the upper residential quarters. Documentary sources confirm that street-level vaulted rooms functioned as commercial premises, while the upper floors served as family living quarters (Trillo et al., 2020; Alnsour et al., 2023). This architectural arrangement was widely adopted

in Ottoman-Levantine trading towns, as it enabled merchant families to operate their businesses from home while maintaining the privacy of their domestic life (Assi, 2020) (Figure 13 a, b). The yellow limestone construction and seamless integration into Hammam Street's commercial fabric contributed to As-Salt's inscription on the UNESCO World Heritage List in 2021, which recognized the city's integrated urban development and diverse architectural styles (UNESCO, 2021).



Figure 12. Touqan House, now the As-Salt Archaeological Museum: façade showing ground-floor arcade, decorative columns, and yellow limestone masonry (1900–1905) (Source: Authors)



Figure 13. (a) Muhyar House, Entrance (b) Hammam Street by day, showing ground-floor commercial spaces (*souq*) with mixed-use commercial-residential buildings typical of Ottoman-Levantine trading towns (Source: Authors)

3. Al-Dawood House (Dawood Triangle): Al-Dawood House, commonly known as the Dawood Triangle, stands at the junction of Al-Khader Street and Hammam Street, opposite Al-Ain Plaza. The building demonstrates a distinctive architectural response to non-standard urban land configurations. Constructed by the Daoud family in the late 19th century, this two-storey mixed-use building features a triangular plan that was purposefully designed to conform to the acute corner site at one of the key intersections of As-Salt's historic commercial district (Jamhawi & Hajahjah, 2017; Trillo et al., 2020) (Figure 14 a, b).

4. Qaqish House: The Qaqish House, constructed between 1895 and 1900, is located in the Al-Qal'a district on Al-Khader Street (Figure 15). The building exhibits a traditional courtyard plan that ensures visual privacy while facilitating natural ventilation throughout the interior spaces (Trillo et al., 2020; UNESCO, 2021).



Figure 14. Al-Dawood House (Dawood Triangle) at Al-Khader/Hammam junction: (a) triangular-plan mixed-use building in yellow limestone; (b) view from Al-Ain Plaza within its urban setting (Source: Authors)

The design of both interior and exterior spaces establishes a harmonious relationship with the surrounding mountainous landscape and the local temperate climate (Aburamadan et al., 2022). Architecturally, the Qaqish House represents the evolution from simple peasant dwellings to the more refined stone residences built by prosperous merchants during the late Ottoman period, incorporating characteristic elements such as cross-vaulted ceilings, yellow limestone walls, and arched window openings (Trillo et al., 2020). The building is recognized as one of As-Salt's earliest significant heritage residences and currently serves as the headquarters of As-Salt's City Development Project (Aburamadan et al., 2022).

5. Falah Al-Hamad House: Falah Al-Hamad House is located on Prince Hassan bin Talal Street, approximately 400 metres uphill from the Historic Old As-Salt Museum (Figure 16). Constructed between 1890 and 1918 for Falah al-Hamad, a municipal council member and tribal court specialist, the building represents the quintessential architectural character of As-Salt's merchant residences (UNESCO, 2021). The façade features an elaborately decorated entrance portal with twisted columns exhibiting Art Nouveau and Neoclassical stylistic elements, reflecting the multicultural influences that shaped As-Salt's architecture during the late Ottoman period (Cotella et al., 2025). The building served multiple functions across four generations: the first floor operated as "Al-Khreisat Madafa," a traditional guest reception hall in accordance with Levantine hospitality customs, while the ground floor housed a flour mill that remained operational until the 1970s (Trillo et al., 2020; UNESCO, 2021). During the 1948 Arab-Israeli War, the house served as a refuge for Palestinian refugees, demonstrating its significant social and humanitarian role within the local community (UNESCO, 2021). The building is currently planned for restoration and adaptive reuse as a public library, incorporating spaces that will preserve its historical function of hospitality and community service (Alnsour et al., 2023).



Figure 15. Qaqish House, Al-Khader Street (1895–1900): pointed arches, yellow limestone masonry, and wrought-iron balconies (Source: Authors)



Figure 16. Falah Al-Hamad House (1890–1918): ornate Art Nouveau entrance portal and yellow limestone masonry, now deteriorated and awaiting restoration (Source: Authors)

Urban Commercial Corridor: Al-Hammam Street

1. Historical Development: Al-Hammam Street (Figure 17) was established during the 1880s by merchants coming from Nablus, and named after an old Turkish bath whose remains are still visible. The street creates a unique commercial pathway which stretches 300 meters from Al-Ain Plaza to its pedestrian-only area (Khirfan, 2013). The urban plan demonstrates how a street connects with the historical city area while commercial buildings create a street front that harmonizes with the area's natural landscape (Khirfan, 2017).



Figure 17. Urban plan of Al-Hammam Street, connecting Al-Ain Square to Al-Maidan Street (Source: Authors)

2. Architectural Characteristics: Al-Hammam Street demonstrates the mixed-use development pattern that defines As-Salt's commercial building design. The Abu Alouf Building (constructed 1881–1884) by master builder Abdel Rahman al-Aqrouq for Daoud Abdul Rahman Touqan from Nablus exemplifies this pattern, with five commercial shops and a main gateway at street level opening onto Al-Hammam Street, and two residential apartments of varying sizes on the upper floor accessed through a stairway from the main entrance. The architectural design establishes a continuous commercial frontage that merges with residential spaces, showcasing urban planning practices from the late Ottoman era. The building's construction used local yellow

quarried limestone, while the ground floor contains wide openings directly facing the street and the upper floor features arched windows typical of the period (Khirfan, 2013; Universes in Universe, n.d.), as shown in Figure 18.



Figure 18. The Abu Alouf Building, Al-Hammam Street: mixed-use building in local yellow limestone construction (Source: Authors)

3. Religious and Commercial Integration: The Small Mosque (Figure 18 a, b) was constructed in 1906-1907 by Sulaiman Abu Al-Hussein, a local builder from As-Salt, using traditional yellow limestone quarried from the surrounding area (UNESCO, 2021). The mosque demonstrates Islamic architectural design principles which have been modified to fit the architectural practices of the As-Salt area. The building design creates a wide prayer space that connects to a wooden narrow mezzanine which contains a minbar and a mihrab that displays elaborate Islamic geometric and floral patterns of late Ottoman religious design (Trillo et al., 2020; UNESCO, 2021). The decorative features showcase the expert skills of local craftsmen who operated according to traditional Islamic design standards. The mosque's most distinctive architectural feature is its minaret, which designers built to replicate the minaret of the Hanbali Mosque in Nablus, Palestine (Cotella et al., 2025). The architects created this design to show the deep cultural and trade ties between As-Salt and Nablus which existed during the late Ottoman period when Nabulsi merchants and craftsmen, including builders like 'Abd al-Rahman al-'Aqrūq, contributed significantly to As-Salt's architectural development (Assi, 2020). The minaret thus serves as a physical manifestation of the architectural lineage and cultural exchange between these two important Levantine trading centers.



Figure 19. (a) The minaret (b) As-Salt Small Mosque on Al-Hammam Street: arched entrance integrated with commercial market stalls, demonstrating religious-commercial coexistence (Source: Authors)



Figure 20. A nighttime view of Al-Hammam Street, showing limestone-paved sidewalks, wooden shopfronts, and the commercial corridor's overhead canopies (Source: Authors)

4. **Street Infrastructure and Pedestrian Networks:** Since the Ottoman period, As-Salt's historic center has retained its original street plan with stone-paved roads and sidewalks typical of late-Ottoman urban design principles. Hammam Street shows the older form of street design with proper stone-paved sidewalks and progressive walking and vehicular pathways (UNESCO, 2021). Street surfaces use limestone blocks from local quarries arranged in geometric patterns. The street network system enables the city to overcome topographic challenges spanning three hills through advanced design using stone staircases and stepped pathways (Zalloom & Tarrad, 2020). The Harmony Trail, serving as a heritage walking path, starts at Abu Jaber House and takes visitors through historical streets showing As-Salt's traditional urban fabric (UNESCO, 2021). Figure 20 illustrates the northern section of Al-Hammam Street, highlighting the preserved stone-paved pathways and traditional wooden shopfronts that characterize this historic commercial corridor.

DISCUSSION

Architectural Heritage as Tourism Asset

1. **Tourism Value of Architectural Elements:** As-Salt architectural heritage represents a unique tourism resource due to its authenticity and uniqueness, creating a visual and cultural experience not repeated elsewhere. The density and concentration of heritage buildings within a compact area (approximately 2,000 meters diameter) enriches the visiting experience. The uniform yellow stone creates visual integration across the urban fabric, while functional diversity of heritage buildings as museums, cafes, commercial shops, and residences provides immediate material experience of living heritage rather than static display.

2. **Visitor Spatial Experience:** Visitors to downtown As-Salt city experience a multidimensional spatial journey. The visual experience features As-Salt's hillside setting creating continuous streetscapes of yellow limestone facades achieving unity through repeated arched openings, decorative stonework, and human-scale proportions. The movement experience includes staircases and narrow lanes connecting hillside neighborhoods, with courtyards and small plazas punctuating the urban fabric. The sensory experience engages multiple senses: yellow limestone unifies building facades and paving creating tactile warmth; street sounds from markets and cafés animate the district; aromas of traditional coffee and sweets from historic shops evoke cultural memories tied to place.

3. **Future Tourism Development Potential:** As-Salt's architectural heritage possesses significant tourism potential through heritage hotels via adaptive reuse of heritage buildings into boutique hotels, heritage restaurants and cafes occupying heritage buildings allowing visitors to experience traditional architecture while dining, specialized museums dedicated to traditional crafts and local architecture, workshops teaching traditional crafts such as stone carving and traditional carpentry providing interactive visitor experience, and specialized architectural tours led by architecture and history specialists targeting tourists interested in architectural heritage.

Structural Assessment and Conservation Framework

1. **Non-Destructive Evaluation Methods:** Accurate diagnostic protocols are essential for structural intervention. Non-destructive testing (NDE) is recommended for mapping internal deficiencies without compromising the building's integrity. Sonic and ultrasonic testing techniques (measuring wave velocities between 1000 and 4000 m/s) should be used to identify density variations and delamination within cross-sections. Furthermore, ground-penetrating radar (GPR) should be used to plan internal geometry and determine moisture distribution, achieving a void detection resolution of 1–5 cm (Hussain & Akhtar, 2017). Further, integrate these datasets through NDE fusion enhance diagnostic accuracy. Specifically, combining sonic velocity profiles with GPR radargrams provides a comprehensive assessment of injection efficiency and void continuity (Roumeliotis et al., 2024). In addition, infrared thermography (IRT) should be used to detect thermal anomalies indicative of subsurface discontinuities or moisture pockets (Tejedor et al., 2022). The flat-jack test remains the reference for determining the modulus of elasticity and stress states in situ (Hussain & Akhtar, 2017). In the context of As-Salt, these techniques are recommended for confirming wall configuration and identifying moisture-induced limestone erosion and thus guiding intervention point locations (Hussain & Akhtar, 2017; Tejedor et al., 2022).

2. **Intervention Strategies for As-Salt's Ottoman Masonry:** The structural rehabilitation of heritage buildings in As-Salt requires a comprehensive integration of materials science, diagnostics, and structural analysis. The evaluation phase should initiate with visual inspection and moisture mapping, acknowledging carbonation inhibition outside the 50–70% RH range (Chen et al., 2024). This is followed by NDT fusion to locate internal voids within cross-sections (Hussain & Akhtar, 2017; Roumeliotis et al., 2024). Repair materials should be carefully selected to ensure compatibility with existing limestone properties (mechanical and chemical properties). Priority should be given to lime mortars modified with pozzolans achieving compressive strengths of 2.5–7.8 MPa (Tombulca & Çavuş, 2023). The structural rehabilitation should encompass three integrated components. First, mass consolidation through mineral grouts with $D_{90} < 100 \mu\text{m}$ should be used to restore monolithic behavior (Padovnik et al., 2024), targeting 61% shear strength recovery (Dinç-Şengönül et al., 2023). Second, seismic strengthening by TRM (Textile-Reinforced Mortar) systems with lime-based matrices should be used to address out-of-plane vulnerability and provide breathable reinforcement without vapor impermeability (Petrovčić & Kilar, 2022; Azimi et al., 2025). Third, post-rehabilitation monitoring should compare pre- and post-injection UPV measurements (Roumeliotis et al., 2024), supplemented by permanent wireless sensor networks to track dynamic responses for early detection of settlement or seismic damage (Pallarés et al., 2021; Barrile et al., 2024). This integrated approach respects the minimum intervention principles for heritage rehabilitation while guaranteeing structural safety in a seismically active zone.

3. **Assessment Framework: Vulnerability Modeling and Monitoring:** For seismic vulnerability assessment of heritage buildings, pushover analysis should be employed to derive capacity curves and identify collapse mechanisms. Equivalent frame modeling is recommended to approximate nonlinear behavior (Petrovčić & Kilar, 2022). Assessment should focus on

susceptibility to soft-story mechanisms and out-of-plane failures, particularly at floor–wall connections (Yildizlar et al., 2019; Htet et al., 2025). As-Salt is situated near the Dead Sea, one of the most active seismic zones. Therefore, hazard analyses shall account for inertial forces from massive limestone walls. Accordingly, interventions should be designed to maximize ductility and stability (Balzani et al., 2024; Petrovčič & Kilar, 2022). Furthermore, structural digital twins within Heritage Building Information Modeling (HBIM) increasingly support risk management and maintenance protocols (González et al., 2025). Permanent Structural Health Monitoring (SHM) networks should be integrated into significant heritage structures for long-term performance verification. The monitoring framework should incorporate: (1) Operational Modal Analysis (OMA) to track shifts in modal frequencies and damping ratios as early indicators of stiffness degradation, (2) accelerometers and tiltmeters to detect minute deformation trends enabling service life prediction (Pallarés et al., 2021), and (3) laser scanning with drone photogrammetry to provide high-precision point clouds for tracking millimetric shifts (Barrile et al., 2024).

Heritage-Tourism Integration and Sustainability

The primary challenge lies in balancing tourism development with heritage conservation while maintaining As-Salt's Outstanding Universal Value. Increased visitor numbers generate economic benefits but create risks including structural stress from increased live loads, wear on historic fabric from intensive use, and potential disruption to residential communities. Sustainable tourism development requires strategic planning that integrates conservation imperatives with accessibility, economic viability, and community engagement. Key strategies include implementing visitor capacity management to prevent overuse, establishing conservation protocols for adaptive reuse ensuring structural safety while maintaining authenticity, developing community-based tourism initiatives ensuring local economic benefits, creating interpretive programming that educates visitors about heritage values and conservation needs, and establishing monitoring systems tracking both tourism impacts and conservation outcomes. Success requires collaboration among local and central government, academic institutions, private sector developers, local communities, and international heritage organizations.

CONCLUSION AND RECOMMENDATIONS

As-Salt City's architectural heritage portrays an exclusive architectural trend from the late Ottoman era to the early 20th century. The city successfully integrated Ottoman architectural symbols, European influences, and local traditions to manufacture a distinctive architectural style embodying local authenticity. Detailed analysis of Abu Jaber House and other heritage buildings demonstrates that As-Salt's traditional architecture stands out through: yellow limestone as the main element for construction giving tangible identity; evolution from traditional construction methods to contemporary materials and technology; rich decorative style integrating Eastern and Western motifs; and effective integration with mountainous terrain creating harmonious urban form. The research concludes that the preservation of As-Salt as a global tourism destination requires a shift toward "knowledge-based restoration". The proposed framework demonstrates through literature evidence that minimum interventions can meet the safety requirements of building codes. In addition, the proposed framework begins with NDT fusion and concludes with compatible repair materials. Published evidence confirms that lime mortars modified with pozzolans represent the most effective choice for balancing compressive strength (up to 7.8 MPa) with the required flexibility (Tombulca & Çavuş, 2023). Furthermore, permanent SHM networks should be integrated into the most significant structures to detect millimetric deformations early, thereby ensuring the sustainability of cultural tourism and the protection of life in historic city (Pallarés et al., 2021; Roumeliotis et al., 2024; Barrile et al., 2024). Building on these conclusions, several practical recommendations follow. For heritage conservation: implement systematic documentation of remaining undocumented heritage buildings; establish conservation protocols based on ICOMOS minimum intervention principles; prioritize compatible repair materials (ultra-fine lime grouts, TRM systems) over Portland cement-based solutions; and integrate permanent SHM systems in key heritage structures. For tourism development: develop heritage hotels through adaptive reuse maintaining architectural integrity; establish specialized architectural tours with trained guides; create interpretive centers explaining architectural heritage and conservation; implement visitor capacity management preventing overuse; and develop community-based tourism ensuring local economic benefits. For structural safety: conduct seismic vulnerability assessments using pushover analysis; implement NDT fusion protocols before intervention; establish monitoring frameworks tracking long-term performance; and develop emergency response protocols for heritage structures.

Future research should further address: quantitative assessment of tourism economic impacts and visitor satisfaction; long-term monitoring of conservation interventions measuring effectiveness; comparative studies of As-Salt with other Levantine heritage cities; development of digital heritage platforms using HBIM for management; investigation of climate change impacts on limestone deterioration; and community perception studies regarding heritage tourism development.

In closing, As-Salt's architectural heritage represents an exceptionally fine cultural and tourism asset. Should this heritage continue to be preserved and developed, it can become synonymous with cultural authenticity and economic wealth. The Abu Jaber House and similar heritage buildings are not mere yellow stones joined piece after piece, but dramatic representations of the golden age in architecture and culture; they become a link connecting past and present and a sustainable asset for the city's future. Success requires relentless energy by principal stakeholders—local and central government, academia, industry, community, and international organizations—working together to ensure As-Salt's heritage maintains its deeper meanings and implications for generations to come.

Limitations

This research acknowledges several methodological constraints. Access to privately-owned heritage buildings limited interior documentation to publicly accessible structures, while deteriorated conditions prevented safe entry to some buildings.

Original architectural drawings and detailed construction specifications are absent for most heritage structures, and historical records regarding construction dates and ownership chains remain incomplete. The scope of field surveys was constrained by single-researcher capacity, and long-term conservation monitoring extends beyond the research timeframe. Limited availability of tourism economic data and visitor statistics restricted quantitative tourism impact assessment.

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List of Abbreviations: ICOMOS = International Council on Monuments and Sites; UNESCO = United Nations Educational, Scientific and Cultural Organization; NDT = Non-Destructive Testing; NDE = Non-Destructive Evaluation; TRM = Textile-Reinforced Mortar; SHM = Structural Health Monitoring; HBIM = Heritage Building Information Modeling; GPR = Ground-Penetrating Radar; IRT = Infrared Thermography; OMA = Operational Modal Analysis; UPV = Ultrasonic Pulse Velocity; RH = Relative Humidity.

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