International Journal of Applied Science; Vol. 7, No. 1; 2024
ISSN 2576-7240 E-ISSN 2576-7259
https://doi.org/10.30560/ijas.v7n1p8

An Experience of the Conservation of Historic Buildings' Facades in Old Saida City

Jad Hammoud[1]

[1] Faculty of Fine arts and Architecture, Lebanese University, Lebanon

Correspondence: Jad Hammoud, Faculty of Fine arts and Architecture, Lebanese University. Hadath Campus, Branch I, Beirut, Lebanon. E-mail: jadwhammoud@gmail.com

Received: June 19, 2024; Accepted: July 2, 2024; Published: July 3, 2024

Abstract:

This article delves into the nuanced experience and challenges involved in conserving historic building facades within an old Saida city neighborhood marked by neglect and limited restoration efforts due to class dynamics and discrimination by heritage curators. Nevertheless, its buildings have been subjected to lack of maintenance and repair which led to processes of degradation with time and loss of some cultural heritage [6]. Focusing on a deprived area, the paper examines the challenges and opportunities encountered in conserving architectural heritage amidst socioeconomic constraints. Damage related to the collapse of building elements necessitates an investigation into the underlying causes to prevent such occurrences. This involves identifying a set of parameters to assess the hazards of façades and public exposure. Through a blend of community involvement in close coordination between the author who drives innovative conservation techniques, UNDP and the Municipality of Saida, the project sheds light on the potential for safeguarding the historical character to the damaged historic *Musalkhiyyeh* street arcades and façades, *Kaniset el-amercani*, *Musallabiyyeh old market street*s amongst with a specific square called "*Furn el Saha*" in old Saida historic city. The project falls under the UNDP project "Improving Living Conditions in Gatherings Host Communities". The conservation project aimed to conserve those buildings, and promoted histories of places and people's memories connected to the selected heritage sites. The project rehabilitated internally and externally for the three selected areas. It addressed both the physical deterioration and build the knowledge about the importance of the sites. By documenting this journey, valuable lessons emerge for policymakers, urban planners, and conservationists seeking to address heritage preservation in marginalized communities. Historic structures design and construction tell us much about the cultures and the history of a community that created them and about the traditions and events from which our society grew.

Keywords: Maintenance, Assessment, Heritage, Conservation, Interpretation

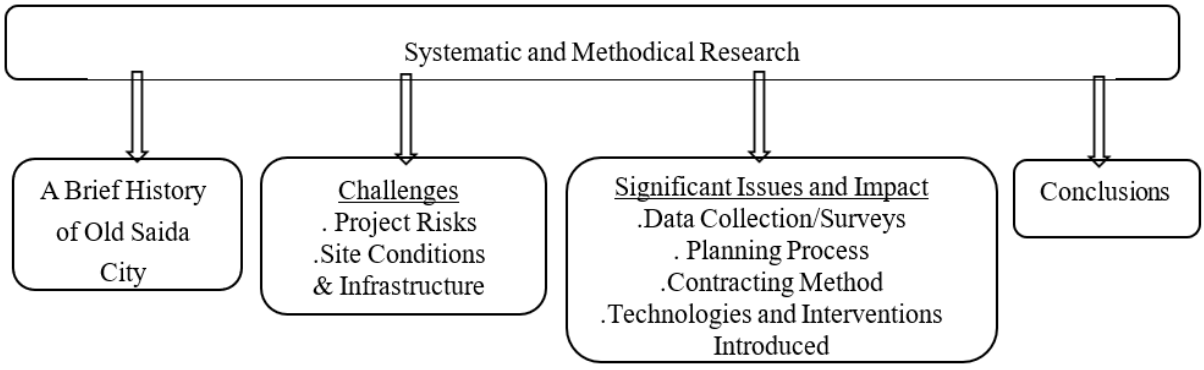
1. Introduction

In the labyrinthine streets of old Saida historic city, the historic buildings' façades serve as silent witnesses to the passage of time, bearing the scars of neglect and the weight of untold stories. During the last years, many hazardous events due to falling bodies and detachment of materials from historic buildings' façades have been reported by the municipality. Yet, amidst the crumbling edifices and fading grandeur, lies a profound opportunity for preservation phenomenon led under UNDP project "Improving Living Conditions in Gatherings Host Communities" to investigate the risks and to deepen the factors which cause it in collaboration with the author. This project has concentrated on physical rehabilitation of the facades which has foci of interest for all parties intrinsically conserving the tangible remnants of the past, honoring the craftsmanship of generations long gone, rather than urban regeneration and infrastructure. This article embarks on a journey into the old city, where the conservation of its architectural heritage had long been overshadowed by the specters of outgoing class disparities and entrenched discrimination. Within this context of historical neglect, significant concerns arise for locals, as addressing these issues is the first step towards improving the quality of life for those enduring deteriorated living conditions. Conversely, hazard and vulnerability are the main components of the risk for the safety of archaeological architectures according to the guidelines for the conservation of architectures of archaeological interest that depend on the element's conservation state [12]. Through meticulous restoration and repair, we seek not only to safeguard architectural treasures but also to reclaim spaces that have been marginalized and overlooked. Preventive conservation examines the risks to buildings with the goal of understanding the threats and the current state of conservation, thereby minimizing further degradation and extending the buildings' service life. [11]. The implementation of preventive measures requires a thorough knowledge of the risks historic buildings are facing.

In this sense, a detailed condition survey of all major components of the facades was collected and analyzed, including an analysis of the original materials and methods of construction revealing the roof cornices followed by facades' plasters, frames, timber windows and doors and balconies. In the *Musalkhiyyeh* and *Kaniset el-amercani* streets some of the façades are beginning to be slender and in some instances have been bolstered with concrete pillars and ceilings by the local community [1]. In *Furn el saha* square, façades are severely damaged and are structurally unsound, mainly due to illegal construction on top of existing buildings and due to the 1982 Israeli invasion of Lebanon, where the square is still occupied by residents who have nowhere else to go [1]. In addition to the rehabilitation projects for residential building facades that have already been implemented, local stakeholders have proposed a series of priority projects. Among these are 100 priority houses in the old city that require immediate intervention, including the removal of old, damaged floors categorized as structurally unsafe. In all of these cases, residents do not possess the financial means to repair these buildings. Technical approaches have been proposed in order to apply vulnerability to the preventive conservation of cultural heritage [10]. Preventive conservation studies the risks of facades aiming at understanding the threats and the current conservation condition to minimize further degradation and increase the service life of it [11].

2. Methodology

The deterioration of traditional construction materials, the lack of systematic maintenance, and various environmental factors are key contributors to the conservation challenges of architectural heritage, subsequently impacting public safety. Historic facade management requires maintenance as a process; therefore, multi-disciplined experience is needed by its active professional approach to building facade monitoring and rehabilitation on a thorough "needs analysis" of the structure's exterior [2]. Hazards and vulnerability analysis are the first step for risk assessment and for preventive interventions [2, 11]. In this context, and due to lack in providing direction for appropriate emergency interventions to conserve and protect a building's historic integrity, by local authorities, this article aims to show the minimum interventions used in old Saida city and to develop an approach in assessing the risk to humans related to falling bodies from historic buildings' façades by using suitable and smallest possible effort in intervention. This paper is structured as follows: Section 1 includes the brief history of old Saida city, the capital of Ottoman province. The main concept of the risks and the continuing threat coming from the highest densities in the old city and the under investments in the infrastructure described in section 2. Section 3 includes a working protocol where the author was responsible for preventive conservation by collecting data and obtaining reports and graphical visualizations outlining the correlations between material degradation and maintenance strategies. The approach has been implemented on a real building and results are exposed in Section 4; and discussed the strengths and limitations of the current work as well as future improvements.



3. Background History of Old Saida City

Saida is the third largest city located in south Lebanon, of which it is the capital, on the Mediterranean coast (Figure 1). It has been inhabited since very early in prehistory that is surprising in view of the fact that Saida was once an important Phoenician commercial city, which then saw the shift of various rulers and cultural patterns throughout different centuries. The existing historic city of Saida contains a mix of monuments, residential, commercial, secular, and religious buildings most of which date back to the 400 years of Ottoman rule [9]. It includes a number of historical buildings and places with accompanying material on local history and architectural forms. In the 18th century, Saida was the capital of the Ottoman province and became a noticeable Ottoman port city. Saida became the second town in southern *Bilad al-Sham* after Damascus. The Ottoman re-urbanization of Saida is closely connected to its role as a harbor city and the foundation of a commercial infrastructure. Arguably

all the markets date from Ottoman times and belong to the 18th centuries. It is especially the 18th century that witnessed a strong input in the urban development of the old city of Saida [14].

Generally speaking, traditional houses in Middle Eastern cities are built around a courtyard and courtyards tend to be on the ground floor. In Saida, courtyards can be found on the first level (Figure 2), many houses were constructed on top of large, vaulted substructures used as shops, storerooms, markets or workshops. Thus, residential functions could be spatially integrated into commercial areas, and privacy was secured by setting these conflicting functions apart vertically. To enter the house, a visitor had to climb the narrow stairs behind a simple door that gives no indication of the luxury of the residence. When reaching the main hall and former courtyard of the house, the visitor must have been impressed. The wealth of the owner was openly displayed on the walls and by the style of the house built according to the latest fashion. A closer look at the house shows that we are dealing here with a very ostentatious piece of architecture. The original 18th century layout of the old city was altered by the incremental addition of further rooms on top of the existing buildings during the later 19th and early 20th century, and transformed in the 1920s when another upper storey and a tiled roof covering the originally open courtyard were added [14]. In the course of this process, the functions of interior spaces reflected changes, and proper bathrooms added, reflecting the modernization of domestic culture and changing patterns of daily life in the city of Saida following and fostering the ongoing commercial activities of the city.

Figure 1. Location Saida city (Google Maps)

Figure 2. Courtyard located on the first floor level (Hammoud J., 2019)

Figure 3. Vaulted substructures at ground floor level used as shops (Hammoud J., 2019)

4. Challenges

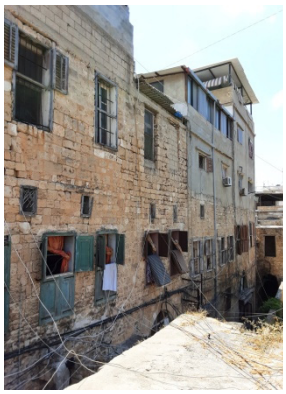
4.1. Project Risks

Conserving the architectural heritage of historic cities is a noble endeavor, but it comes with its own set of challenges and risks. In the conservation of historic building facades, several factors can pose significant threats to the integrity and success of restoration projects. These risks include the deterioration of materials, lack of historical documents, economic pressures, uncontrolled development, demographic changes, and finally the potential failure of restoration projects due to the selfishness of restorers who prioritize personal recognition over community engagement. The absence of coherent framework for urban development for the city as a whole, the poor conditions of the buildings and the lack in the development of restoration and unorganized maintenance of old buildings and structures in the old city of Saida during the past decades constituted a risk which had to be carefully evaluated prior to implementation. The deficiency of conservation and protection measurements in the site was the primary cause of the worsening conditions of the buildings in the neighborhood. Sequentially, this lead to the deterioration of the original building materials and supporting structures. Over time, weathering, pollution, and other external and environmental factors can cause damages and aesthetic degradations to these aging structures (Figures 4, 5, 6 &7). Without proper intervention, the authenticity and historical significance of these facades may be irreversibly compromised. Moreover, sourcing appropriate replacement materials that match the original composition and appearance can be challenging, further exacerbating the risk of deterioration. Therefore, proper analysis and assessments to the site were necessary for the selection of an appropriate method of treatment and restoration technique needed to revive and repair the neighborhood to achieve a better standard and quality of life for the places selected with added safety measures and protection strategies for both the people

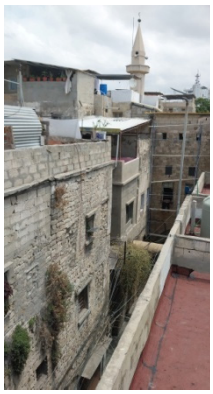
and buildings by applying proper arrangements and organization of the fundamental components in the site, and surely to improve the overall aesthetic presence of the buildings by paying close attention to details and ornaments that were used originally. The author interpreted related factors from a perspective based upon the damage to humans due to the elements of building façade degradation where in a given time period, falls and causes injury to somebody or damage due to falling bodies [1]. Although each labyrinthine street in the old city has its own particular set of conditions that result in specific responses, common trends are evident. A survey was driven from residents, local authority and municipality where respondents were asked if their city had guidelines or policies on a number of issues listed in the chart below in table 1. In a subsequent question, respondents were asked if their city had issues of great concern, one respondent highlighted that there is no guaranteed connection between the existence of guidelines and any appropriate design and there is a conflict between heritage design offices and planning offices. The city governments are not well-staffed and experienced with regard to the coordination with the restorers working in old Saida city specifically.

Table 1. Showing the great concerns of the residents

Issues of Greatest Concern	"Yes" %	"No" %
Repair or conservation of historic buildings	70%	30%
Changing demographics	90%	10%
Adaptation or alterations to historic buildings	55%	45%
New development in historic areas with regard to floor additions	75%	25%
Hazardous elements of historic building façades	75%	25%
Funding to implement professional and integrated restoration projects	90%	10%
Economic incentives for private owners	80%	20%
Economic incentives for tenants	90%	10%
Lack of coordination between the donor and the community	60%	40%
Sanitation, water supply and drainage system	80%	20%
Crime and safety	10%	90%



Kaniset el-amercani street



Musallabiyyeh street

Musalkhiyyeh

Furn el Saha Square

Figures 4, 5, 6 & 7. Poor conditions and damages of the facades, deterioration of the original building materials like lime plaster, timber windows, and aesthetic degradations (Hammoud J., 2022).

When asked to identify at which governmental policies affected the historic city in Saida, protective measures appeared concentrated within the Directorate General of Antiquities that lacks the historical documentation for the old city architectural typology, affordable restoration standards and lack of permanent management and planning for the future. In many cases, the original architectural plans, and historical records detailing the construction and evolution of these buildings may be altogether missing. This dearth of information complicates the restoration process, making it difficult for conservationists to accurately replicate the original design, materials, and techniques employed in the construction of the facades. Without comprehensive historical documentation,

restoration efforts may result in inaccuracies or deviations from the building's authentic historical character. In addition, the project suffers from a lack of an amended legislative framework that considers the particular needs of cultural heritage cities. Funding to implement management plans and economic incentives for private owners of historic buildings was notably lacking. Limited funding, competing budgetary priorities, and fluctuating market conditions can constrain resources and impede progress in conserving historic building facades [1]. Insufficient financial support may lead to compromised conservation efforts, delayed restoration timelines, or the abandonment of projects altogether, jeopardizing the long-term sustainability of these cultural assets. In addition, bureaucratic complexities and prohibitive financial costs discourage owners and tenants alike from investing in the restoration of historic structures. Current property and rent laws further compound these problems, rendering the restoration of old properties almost impossible. A better understanding of the physical impact of social change is the key to retain the heritage significance of an historic area. It is important to note that "changing demographics" was identified as a potential issue affecting historic cities. This factor is a major driver of change in the urban environment and directly impacts the conservation of historic urban areas.

Additionally, the success of restoration projects hinges on the expertise and integrity of the individuals involved. Unfortunately, there have been instances where the selfish motivations of some restorers have undermined the objectives of conservation initiatives. Some practitioners may prioritize personal recognition over community engagement and collaboration. This self-serving behavior can result in decisions that prioritize short-term gains or personal agendas at the expense of preserving the authentic historical legacy of the building facades. Such failures not only undermine the credibility of restoration efforts but also erode public trust and support for heritage conservation endeavors. It's crucial for some restorers to prioritize collaboration, communication, and the project's objectives rather than their own ego. Building a team-focused approach ensures that expertise is used effectively and the project's goals are met. It might be helpful to emphasize the importance of integrating social engagement into the restoration process to ensure the project benefits the local community as well as satisfying the donor's objectives. Engaging in constructive dialogue might help shift their focus towards the broader social implications of their work.

To effectively mitigate these risks, proactive measures must be implemented throughout the planning, execution, and monitoring phases of conservation projects. Thorough research, interdisciplinary collaboration, and engagement with local communities and stakeholders are essential for gathering historical data, assessing structural conditions, and garnering support for conservation initiatives. Additionally, risk management strategies, including contingency planning, resource allocation, and regular monitoring, are critical for identifying potential threats and addressing them in a timely manner [3].

4.2 Site Conditions & Infrastructure

The historic city of Saida is populated by Lebanese and Palestinian families. Most of its population may be more likely to live in poor-quality housing condition which remains a persistent issue affecting individuals and families. It acts as a place of refuge city characterized by substandard living conditions, a fact that is reflected in the social structure of its residents. Despite the diverse origins, the population profile of the historic core is relatively stable. The physical fabric of the selected area for conservation in Saida's historic core (Figure 8) is the *Musalkhiyyeh street*, *Kaniset el-amercani* old market street, *Musallabiyyeh old market street* and a specific square called "Furn el Saha" which is marked by several unique characteristics. The Old City's structure is dense, perpetuating cycles of poverty and social inequality. Buildings of varying heights are intermingled within the same block and aligned along the same streets. It was accessible primarily by means of labyrinthine alleyways between fragile traditional buildings that was 1-3 stories high and nowadays most structures are 3-4 floors high due to prohibitive constructions dotting the old city [7,8]. The primary function of the ground floor still somewhat reflects its traditional use, with 70% of the buildings serving as "stores" and 30% as residences. Parts of the alleyways in *Musalkhiyyeh* Street are covered with vaults (*subat*), which pass beneath residential structures that span the city's principle arteries (Figures 9 & 10). In between the main alleyway residential nodes exists a space that serve dual purposes as points of access and as communal gathering areas. At more than five persons per square meter, the historic area has some of the highest recorded residential densities in the old city. Surveys indicated a 15% increase in residential population between 1990 and 2000 [8]. With nearly half of households occupying rented property and two thirds of families dependent on a single income. The living conditions of residents however was dropping steadily due to the over exploitation of the buildings, the indiscriminate addition of concrete elements and structures without thorough investigation that severely impact the integrity and aesthetic appeal of historic facades and the modifications on old building features such as arcs, doors and openings or the removal of certain elements. Such interventions often disregard the architectural harmony and craftsmanship of the original buildings, disrupting the visual coherence of the urban landscape. Furthermore, the improper integration of modern materials

can accelerate the deterioration of historic facades over time, eroding their cultural significance and historical authenticity. Therefore the safety and quality of living in the neighborhood was greatly impacted. In addition, the piped water network and infrastructure suffered extensive war related damages, where contamination was common. With some of the highest densities in this area, conservation faced significant logistical and technical challenges.

Figure 8. Map of the selected areas (Hammoud J., 2022).

Decades of under investment in drainage, water supply and electric networks, coupled with war damages, directly affected the old Saida city. Due to negligence in essential and vital reparative works and lack of maintenance resulted in the bulk of the traditional housing being in a poor state. Neglecting the maintenance of essential infrastructure such as water drainage and electrical networks can have profound consequences for the preservation of historic facades. The accumulation of water due to poor drainage can lead to moisture infiltration and structural damage, compromising the integrity of centuries-old buildings. Similarly, faulty electrical systems pose fire hazards that threaten the irreplaceable architectural heritage of these cities. Addressing these infrastructure deficiencies is imperative to safeguarding the character and longevity of historic facades, ensuring they continue to stand as testaments to our cultural heritage for generations to come. Moreover, the poor distribution and organization of power cable contributed to a decreasing aesthetic picture of the buildings in Old Saida (Figure 11). Replacing the visual disruptive power cables crossing the site with a more organized layout held together by L-shaped metal joints while connecting the public light fixtures to ground level networks presented a major challenge.

Figure 9. Labyrinthine alleyways between fragile traditional buildings (Hammoud J., 2022)

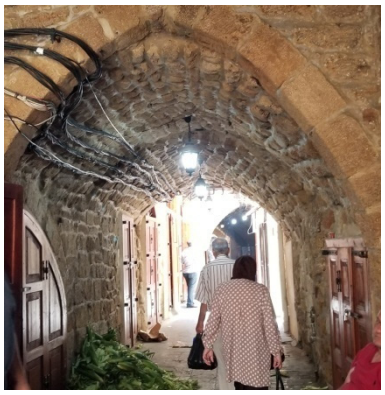


Figure 10. *Subat* is a shed between two walls with an accessible passage, suitable for the passengers and caravans.

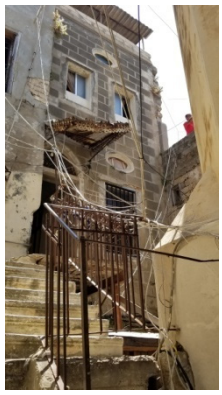


Figure 11. Disruptive power cables.

5. Significant Issues and Impact

5.1 Data Collection/Surveys

The lack of historical photographs for the buildings and the lack of important information about the original architectural features used in the ottoman era in old Saida city, allowed the author to visit the site several times with experts and surveyors to collect information through direct observation and mapping by means of survey sheets. Photos were taken of all initial building conditions that were used for reference and documenting; and measurements were recorded using a GPS-theodolite and laser distance measurer. In addition to documentation, site visits were crucial for analysis and for laying down the method and strategy of intervention to be executed with respect to the building conditions such as the structure, the exterior stone deterioration degree, the infrastructure and drainage pipes layouts in the site, and also the issues directly affecting the residents of the buildings and neighborhoods to be restored. All in terms of tools and techniques that would be most suitable for the type of intervention required. A complete study of buildings and topographical layouts of the historical facades has been carried out and completed with an on-site supervision that has allowed new data to be added. Buildings displaying architectural merit were documented and carried out along with the survey of existing services infrastructure. More than 50 drawings at various scales were produced to document and record the historical facades and details of the buildings in Old Saida (Figure 12, 13 & 14). Additionally, a condition field survey of all major components of the building fabric was conducted. This included an analysis of the original materials and construction methods through visual inspections from the street and high observation points, such as the roofs of nearby buildings, typically without entering the buildings or interviewing residents. The survey recorded relevant physical and functional features, evaluated the state of conservation, architectural quality, types of transformations, and overall state of repair. It's important to note that conducting these comprehensive field surveys allowed for the achievement of other key objectives. The architectural quality of the buildings was assessed based on the presence and richness of traditional architectural elements and their consistency with the historic urban fabric. Laboratory samples for existing mortar and plaster used were obtained and analyzed to distinguish new from old, and track the stages of interventions and transformations which took place in the building facades through time. Furthermore, the survey carried out shows that 12 buildings appear to have undergone interventions of different types. Amongst these interventions, the construction of "new floors" that is mainly concentrated in the new developments above the historic buildings. These interventions have altered the traditional appearance of the Old City to varying extents. Many buildings now feature recent vertical or horizontal additions, often built with modern, inconsistent materials. However, the most detrimental changes involve the installation of new metal or aluminum windows on the ground and upper floors, and especially the placement of water tanks and aerials on the roofs, which are transforming the Old City's skyline. It is essential for clarity and objectiveness to create the appropriate physical survey as what may be entirely applicable for one client, could well be useless for another. Once everything necessary has been examined and documented, cost estimates and BOQs are produced in order to create a proposal and tender documents for the execution work to begin. This process involves the 3D extrusion of the site and the immersion of new design elements proposed such as louvers, windows, panels, pipes and electricity. During this phase, useful facades renders can be generated for better visualization and sections and details are created for precision work. Services such as piped water and electricity, together with new mechanical and electronic equipment, have transformed local life. However before mains electricity arrived, coal-gas was piped in, or a petrol engine generated a private supply. Some of the more antiquated facilities and fixtures may still have their unique distinct importance and value.

Figure 12. Architectural drawings recording the existing situation of the facades in Musallabiyyeh old market street (Hammoud J., 2022).

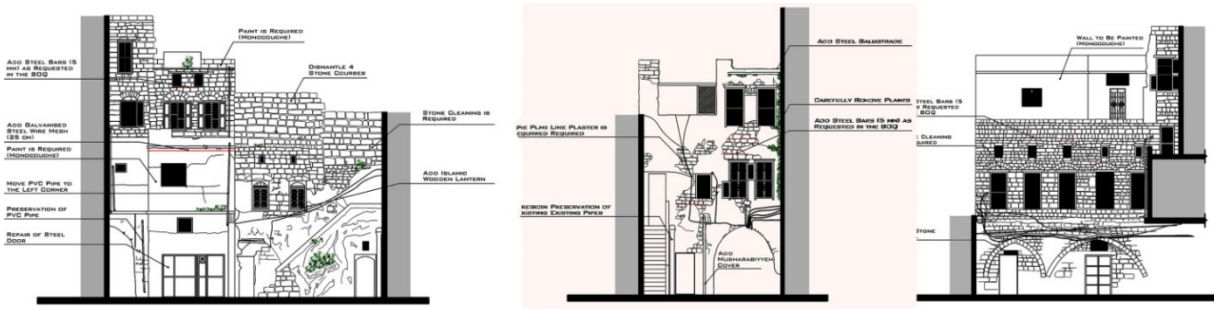


Figure 13. Architectural drawings recording the existing situation of the facades in Furn el saha Square (Hammoud J., 2022).

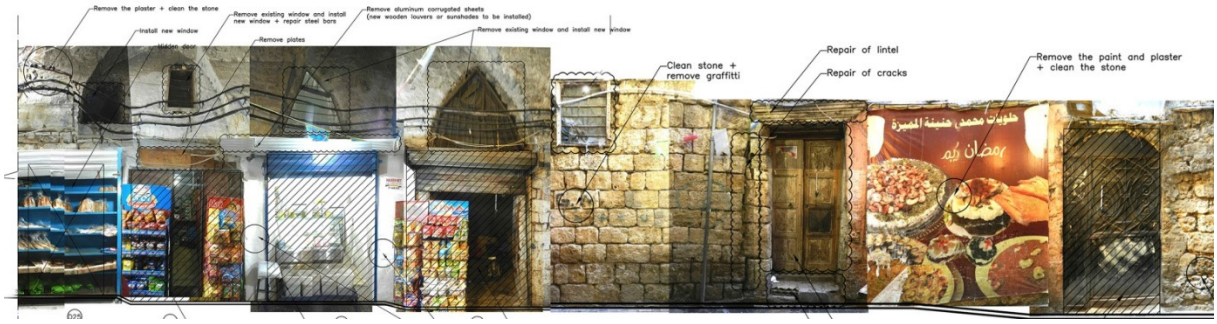


Figure 14. Architectural drawings recording the existing situation of the facades in Furn el saha Square (Hammoud J., 2020)

5.2 Planning Process

Physical rehabilitation is a feature of the approach used by the historic cities in its sites of interest. Although the planning strategy sought to maintain and strengthen the historic facades by improving tourist interpretation which was a major concern, the author believed that tourism-oriented projects and commodification of built heritage are able to destroy the authenticity of local cultural products and hide some historical characters that determine its value [2]. On the other hand, buildings in the old city of Saida are intricate systems made up of multiple assemblies constructed in various phases. This complexity increases the uncertainty in planning and executing building maintenance. Thus, designing a solution was defined for strategies related to "Conservation Plan" that was able to incorporate the contemporary needs of local community and to integrate any concerns raised by public. The planning design process for conserving historic facades involves an accurate approach that balances conservation with practical interventions and physical rehabilitation practices [5]. It begins with comprehensive research and documentation to understand the historical significance, architectural style, and materials of the facades. This information guides the development of conservation objectives and strategies tailored to each individual building. In Old Saida city, conservation and its related intervention which is the physical rehabilitation practices are the foci of interest for all parties involved in the development of the city. These issues are major concerns for locals, as addressing them is the first step toward improving the quality of life for those living in deteriorated conditions. Conversely, they are essential for preserving the original image of the old city, ensuring strict adherence to the historic area's existing fabric, including its uses, associations, and meanings. In this sense, the design aimed at respecting the original historic fabric, and taking into account the different building phases in order to evade subjective interventions and unnecessary modifications. When an agreement is reached by the donor and the decision to take a course of action is signaled, preparations of actual instructions, the drawings, specifications and schedules accurately describing the work to be done, in enough detail to allow us to obtain competitive prices, and to guide and control it is finally concluded. The key tools are experience and knowledge, and an open and flexible approach. The work must be very clearly foreseen, in the chronological sequence in which it will take place. The anticipated standards are often determined by that of the original historic work we are trying to match. However we must be very clear about exactly what it is that we expect as often absolute perfection may be beyond reach, especially at affordable costs.

In the planning process, the presence of hazardous elements such as balconies, windows shutters, string courses, plaster, protrusions, cornices, and awnings requires a comprehensive approach that prioritizes safety without compromising the architectural integrity and historical significance of the facades (Figure 15). The process begins with a thorough assessment of each element's condition, identifying potential risks and vulnerabilities. Conservation specialists' team evaluates the stability, material deterioration, and structural integrity of hazardous elements, informing decision-making regarding intervention and rehabilitation strategies.

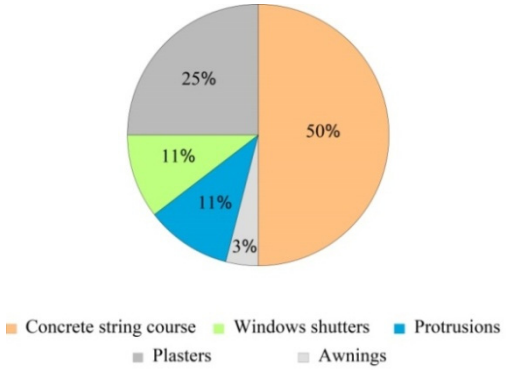


Figure 15. An assessment showing hazardous risk percentage (Hammoud J., 2023).

Mitigating risks associated with hazardous elements involves a combination of stabilization, repair, restoration, and, when necessary, selective replacement. More specifically, risk is most apparent in many structures in Furn el Saha square mainly due to illegal construction on top of existing buildings. Balconies and protrusions undergo structural assessments to ensure load-bearing capacity and stability, with reinforcement or restoration carried out using compatible materials and construction techniques (Figure 16). Windows shutters are inspected for decay or damage, with repairs undertaken to address structural weaknesses while preserving original features or replicating them as needed. In the Musalkhieh and Musallabiyyeh market streets, some of the façades are beginning to lean and in some instances have been bolstered with concrete additions by the local community. The addition of concrete balconies can be a contentious issue. While they may offer practical benefits such as increased living space and improved views, they can also pose significant challenges. Concrete string course at roof, plaster, cornices, and awnings are evaluated for signs of deterioration, such as cracks, decay and detachment. The author employs consolidation and replacement techniques to address damage while maintaining historical authenticity and visual continuity. Roof structures undergo thorough inspections to identify leaks, structural weaknesses, and weathering, with repairs or replacement conducted to safeguard against water infiltration and structural failure. Also the presences of elements, which may disfigure the traditional heritage values of the buildings, have been considered, such as addition of floors with inconsistent materials and closing of original openings (Figures 17&18).

Figure 16. Balcony hazardous element in Furn el Saha square

Figure 17. Deteriorated concrete string course and closed openings in the Musallabiyyeh market street

Figure 18. Addition of floor with inconsistent material in Musalkhieh street(Hammoud J., 2022)

Throughout the planning design process, interdisciplinary collaboration and stakeholder engagement are essential to align conservation objectives with safety requirements and aesthetic considerations. Close coordination between architects, engineers, contractors, and regulatory authorities ensures compliance with local codes, conservation

principles, and safety regulations. Transparent communication with property owners and community stakeholders fosters understanding and support for conservation efforts, promoting a shared commitment to preserving the cultural heritage and architectural legacy embodied in historic facades. By integrating conservation principles with best practices in engineering, the planning process facilitates the sustainable stewardship of historic facades, ensuring their continued enjoyment and appreciation for future generations. Through meticulous assessment, informed decision-making, and expert execution, hazardous elements on historic facades can be effectively managed, enhancing public safety while conserving the beauty and authenticity of these architectural treasures. Utilizing architectural software to create 3D models can help visualize potential solutions and assess their impact on the façade's aesthetics to ensure a comprehensive and effective design plan. The primary approach used in the design is to repair and restore all original materials like lime plaster, sand stone and timber doors and windows while the existing concrete additions were maintained to distinguish them from historic materials by employing external light color without compromising its historic integrity and involving a thoughtful combination and creative enhancement. The main challenge in lime plastering a historic facade lied in balancing aesthetics with functionality. While people and stakeholders appreciate the authentic look of exposed stone, it often lacks the necessary protection without the application of lime plaster. Conserving the stone's natural beauty while ensuring its longevity and structural integrity requires careful consideration. Integrating lime plaster in a way that complements the existing stone, perhaps by highlighting certain architectural features or creating a harmonious contrast, can address both aesthetic and functional concerns (Figures 19-22). Another approach was considered for the existing exposed sanitary pipes where modern materials were integrated to contrast with the historic facade in a complementary way, such as black cast iron pipes against natural sandstone and lime plaster, creating a modern juxtaposition that highlights the historic character of the building while still accommodating contemporary needs. Additionally, incorporating decorative elements on the pipes themselves can further enhance the contrast while adding visual interest to the facade. Overall, the key is to balance the practical requirements of modern plumbing with the aesthetic integrity of the historic structure. By carefully selecting modern materials that blend seamlessly with the historic facade, conservation efforts can uphold the original aesthetic while ensuring long-term structural integrity.

Figure 19. Design of the façade in Musallabiyyeh old market street involving a balanced blend of sensitivity and innovation. The design effectively differentiates the concrete parapet that is white in colour. The upper part of the façade is lime plastered while the market level is kept stone due to the local residents' request. The sanitary pipes are shown in black colour adding visual interest through contrast (Hammoud J., 2023).

Figure 20. Design of the façade in Kaniset el Amercani street showing its overall historic character. Timber doors and windows are restored, walls are lime plastered and the existing additions introduce distinct visual elements to the concrete portions coloured in white (Hammoud J., 2022).

Figure 21. Perspective showing the design of the modern canopy that covers part of Kaniset el Amercani market alley blending seamlessly with the historic facade (Hammoud J., 2022).

Figure 22. Design of the façades in Furn el Saha square. Timber doors, windows and *musharbiyyeh* are restored and walls address both aesthetic and functional concerns (Hammoud J., 2022)

5.2 Contracting Method

In most construction projects in Lebanon, the technical and professional verdicts are made when substantial consultations with project consultants and advisors ensue. Initially, potential and qualified contractors with the requisite skills necessary to meet the demands of each job shall be selected where the contractor shall be efficiently organized and take pride in upholding a steady and skilled regular workforce, that which the reputation of the whole team will depend on. Together with the donor, the consultant architect restorer is expected to pinpoint and consider the resources of the most appropriate building team to execute the work. In contracting methods for projects in sensitive heritage areas like old Saida city, the selection of contractors through tender procedures, followed by invitation based on donor inclination and negotiation, is a common practice without any coordination with the consultant. However, this process poses significant challenges, particularly in finding highly skilled craftspeople and laborers capable of executing technically demanding work. One of the primary obstacles faced by contractors is the scarcity of technical expertise within the labor pool. The intricate nature of restoration and conservation projects often requires specialized skills in traditional crafts and masonry, which are not readily available in the mainstream labor market in the old city. This scarcity complicates the contractor selection process and may result in compromises in the quality of workmanship.

Moreover, contractors are often required to prioritize the engagement of local residents for labor and masonry tasks. While this practice aims to promote community involvement and economic empowerment, it can lead to additional challenges. In some cases, contractors may encounter difficulties in finding skilled workers within the resident community, further exacerbating the labor shortage issue.

Furthermore, the presence of bullies or influential individuals within the resident community can pose significant challenges to the successful execution of construction works. These individuals may seek to exert control over the project, leading to disruptions, conflicts, and delays. Such interference can undermine the contractor's authority and compromise the overall integrity of the project. It is crucial to know exactly who will be administrating and running the job, who will be the site foreman, the site engineer and the manager. It will be on their accountability to secure the effective coordination of their labor force, planned as an integrated operation. In light of these challenges, contractors operating in sensitive heritage areas must navigate a complex landscape characterized by labor shortages, community dynamics, and interpersonal conflicts. Effective strategies for addressing these challenges may include proactive engagement with local communities, capacity-building initiatives for technical skills development, and establishing clear lines of communication and conflict resolution mechanisms. By addressing these challenges, contractors can enhance the quality and sustainability of their work in sensitive heritage areas while promoting positive community relationships.

After the decision is made and the contract has been placed, time is extensively spent in again visiting systematically the site with the site manager. Regular continued visits are thereafter critical. Building contracts are often complicated and work within a historic building can be especially so. However precision and detailed work, can profoundly define the exact standard and practices of work needed in an old building, the requirements of which have to be deduced on spot.

5.3 Technologies and Interventions Introduced

Conserving historic facades in Old Saida city requires a delicate balance between conserving the original character and allowing for necessary updates or repairs. It presents a unique challenge, requiring a careful blend of modern and traditional restoration techniques. This section explores the various interventions introduced to adapt original building technology while ensuring steady outcomes in the face of changing urban dynamics. The type and degree of intervention depend on factors such as the building's significance, condition, and local regulations. Common interventions include facade cleaning, repair of damaged elements, and compatible additions or alterations that respect the historic fabric. The goal is to maintain authenticity while ensuring the building remains functional and safe for current use. Old Saida City's architectural heritage is characterized by interconnected buildings, each with its own neighbourhood undergoing cyclical change. To conserve this heritage, interventions must respect the original building technology while accommodating modern needs and challenges. In addition, close attention must be given to guarantee that materials used in the conservation correspond to or are harmonious with the original. Throughout the conservation process, changes made for technical purposes are carefully documented and identified. This documentation serves to maintain transparency and guide future conservation efforts, ensuring that interventions remain faithful to the original design and construction. Despite the historical significance of traditional construction techniques, materials, and methods, donors often view them as inferior or prohibitively costly and time consuming for rehabilitation projects. Consequently, modern approaches are favoured, albeit with a commitment to conserving the authenticity of the historic facades. Through a series of solutions to most problems are developed such as methods of repair, materials, and ways of assembling, covering and finishing are made. The restorative work undertaken in Old Saida City encompasses a range of detailed interventions spread across the facades of historic buildings:

1). Cleaning Stone Facades: Exterior walls in old Saida City suffer from a multitude of problems. They are constructed with bonding technique of squared or coursed sandstones wall where mortar as binding material technique. Its length is around 40 cm, course height is 20 cm and depth is 25 cm. These dimensions form a single facing wall which is generally left bare and are pointed from outside washed with lime plaster and in some places with cement plaster [6]. There are number of common problems such as thermal effects, humidity, lack of tying between internal and external skins and movements due to matters such as ground settlement. The pointing of the wall is its first line of defense. During site observation, the pointing of the walls in most areas shows that it is weak where the mortar between the stones is eroded and the integrity of the wall is threatened. The mix to be used for re-pointing is important, mixing 1 serving of lime paste with 3 and a half portions of sand and dust of sandstone is applicable. A very hard pointing as seen on the site where cement pointing in many areas, often doing more harm than good. The re-pointing must begin with the removal of the existing pointing to an adequate depth [5,13]. The decayed and the cement pointing should be removed and left intact where it is sound, the resulting recess must be clean and the new lime mortar inserted correctly. This was considered a time consuming task for the contractors and the budget doesn’t allow for using lime material for all areas, so white cement was added to the lime to reduce the cost.

In some cases, cement material is used in the external coating in buildings. The difficulty of removing them varies enormously, depending on its condition, strength and how deeply it is applied to the surface. If the cement mortar is very deep it may be harder to remove, particularly if a strong mix was used. Traditional cleaning techniques are employed to remove accumulated dirt and grime by using chisels and hammers without causing damage to the original stone surfaces [6]. The chisels are tapped head gently to remove the existing and damaged cement layer plastered on the sandstone until it is exposed. In case where superficial dust and particulate matter are stuck on the stone, a simplest act of mechanical cleaning is used to physically remove the matter from the stone surface (Figure 23 & 24). There is no requirement that a machine is used and most mechanical cleaning is done by hand as the following steps [13]: 1. Trace the boundaries of the surface to work then cut the marked area with a chisel and a hammer to obtain a uniform cavity 15 mm deep surroundings. 2. Moisten the surface and apply with a trowel the mortar prepared to fill half the depth of the cavity. The mortar must be compact. 3. Water the surface. 4. Apply a second layer of mortar until it protrudes from the surface of the cavity. Reshape straight surfaces with a saw blade and those engraved with a fine chisel and a hammer. Cleaning should be performed from top to bottom, taking care to avoid using sharp tools when approaching the surface to prevent damage. No chemical interaction takes place. Before applying the lime plaster, the sandstone surface is washed by water and a soft brush is used to remove sedimentation (Figure 25).

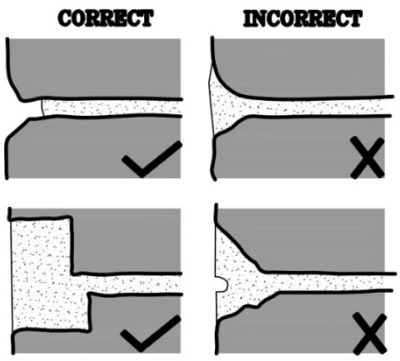


Figure 23. Explains the correct and false methods of pointing stone repair (re-drawn by Hammoud J., 2019)

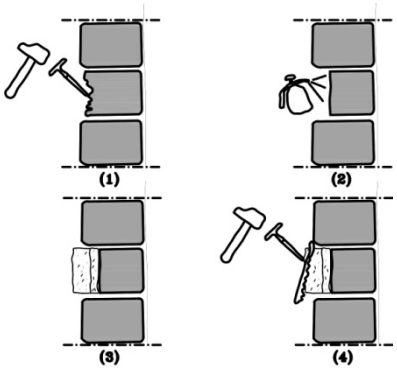


Figure 24. Showing the method and steps for cleaning stone repair

Figure 25. Cleaned stone façade in Furn elsaha square (Hammoud J., 2022)

2). Lime Plaster Application: Traditional lime plaster is meticulously applied to restore and protect the facades, ensuring compatibility with the original construction materials. Completing and repairing the mortar layers on stone walls is crucial. This layer acts as a protective skin on the surfaces of the stone walls, enhancing the cohesion of the wall stones and shielding the wall from various damaging factors like wind, sand, rain, salts, and biological damage [5]. The application process should involve multiple coats, possibly up to three. The first coat, known as the dubbing coat, provides a level surface that enhances the stability and cohesion of the subsequent mortar layers. This coat is the thickest, offering sufficient bonding to ensure the adhesion of the second coat. However, very deep hollows should be pinned to reduce the amount of mortar required. Allow the dubbing coat to set for 8-10 hours before scraping and keying it. These coats should be left rough to provide a good key, and it is preferable to use a rich mix with a binder-to-sand ratio of one part natural hydraulic lime NHL 3.5 to two parts 3-4mm grit sand. The normal thickness is between 3 and 5 mm. The second coat has to be applied four days after completion of first coat. Thickness will vary according to the overall thickness required but it is normally between 10 and 15 mm. It must not be over 20 mm thick. If this is required it should be done in successive coats each not exceeding 20 mm. The second coat should be put on with a wooden float and finished with circular strokes to leave a smooth, but not polished surface that helps a lot in leveling the surface The thicker the intermediate coats, the longer the waiting time before each subsequent application. This coat consists of one part of lime to two and a half well graded sand [6]. Just before the mortar is applied, the straw should be added with a length not to be more than 1.5 cm (Figure 26). The third coat is the finishing coat which is usually a thin layer of 1 mm thickness. Mortars should be prepared by using the Non-Hydraulic lime which results in fat lime putty hardens (Figure 27). It consists of one part of lime to one and a half parts of good quality of building sand. This coat is applied after the drying of the second coat to eliminate the surface microstructures [6]. The best tool for applying the render is a square, slightly curved blade with no sides, on which the mortar may be scooped up, spread on the blade then hurled at the wall with the flick of the wrist.

Figure 26. Lime mixture (Hammoud J., 2022).

Table 1. Application type of lime plasters (Hammoud J., 2022)

Application Type of lime	Lime: aggregate	mix ratio by volume	Comments
Budding out-Spatter dash	NHL 3.5	1:2 sand/aggregate	
Base/leveling coats	NHL 3.5	1:2.5 sand/aggregate	Add straw/fiber at 1.5kg/ton to provide tensile strength
External render			
Roughcast/finish coat	Non-Hydraulic	1:1.5 sand/aggregate	Apply to external render with trowel or Tyrolienne machine if possible.

Figure 27. Applying three coats of non-hydraulic lime on the stone facade enhances the aesthetic appeal by showcasing its natural color. Each layer is meticulously applied, starting with a rough scratch coat to provide a strong foundation, followed by a smoother coat, and finishing with a finely textured top coat. This process not only ensures durability but also highlights the lime's inherent beauty, creating an elegant look on the stone surface. (Hammoud J., 2022).

3). Improved Connection with Interior Wooden Ceiling. Interior wooden ceilings are constructed laying girders at short spans of the walls. Timber floors are constructed by placing the floor wooden girders that have a cross section about 15 x 9 cm. The floor girders are put in a row that consists of single layers that are inserted around 13 cm into the walls. The top of the floor girders was covered with the timber flooring boards (20x2cm) perpendicular to them… Tiling is applied at the top of this surface by adding a layer of aggregates. Due to damp and moisture coming from leaking roof or seepage from outer facades that let water straight through to the wall where the girders of the ceiling sit cause attach of biotic agents like fungi. However, the moisture gets there; it travels straight up the end grain and never gets a chance to dry out. The constant moisture is a perfect habitat for wet rot and dry rot. Strengthening the connection between the facade and interior wooden ceilings enhances structural integrity and conserves architectural authenticity. First, repair is typically needed for the end (timber-to-stone masonry connection) of timber beam-floors and unprotected areas that are at high risk. The rotten timber should be removed, and the end of the joist should be treated to prevent further decay. Typically, pairs of "L" section stainless or galvanized steel plates, pre-drilled, are used with standard coach screws [6]. These plates are screwed onto both bottom edges and secured at the ends of the degraded timber girders. They must be long enough to extend into the wall and past the rotten timber, ensuring a firm holds for the screws. The length also reduces the fulcrum effect, minimizing stress on the existing timber. The plates rest in or on the wall, allowing the rotted end to be cut off. For additional stiffness in rows of continuous end repairs, where there are no sound joist ends between, a bolted connection through the plates into the parent joist can be used. (Figure 28 & 29).

Figure 28. Showing galvanized L-Section plates inside the room (Hammoud J., 2022)

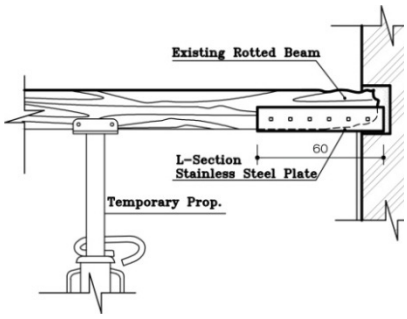


Figure 29. Detail showing the quick and neat solution for joist ends (Hammoud J., 2019)

4). Repair and Installation of Wooden Doors and Windows: Restoring historic windows and doors involves dispelling the myth that new installations, designed to match historic appearances, are always a superior solution. While modern replicas might visually mimic the original designs, they often utilize fast-growing, less durable woods prone to rot and insect damage. This contrasts with the aged hardwoods typically used in historic constructions, which have already proven their longevity. The reality is that authentic restoration, using traditional materials and methods, often results in more durable and historically accurate outcomes. Balancing historical integrity with practical durability necessitates a nuanced approach, prioritizing skilled restoration over simplistic replacement to preserve the true essence and longevity of historic buildings. Given budget constraints, the donor opts for these cheaper replacements, overlooking the long-term benefits of proper restoration. This often leads to a cycle of recurring repairs and replacements, ultimately costing more than investing in traditional restoration methods that preserve both the historical integrity and durability of the building. Replacing historic windows and doors with new ones while maintaining their coherence and functionality involved a meticulous process to ensure seamless integration with the building's historic character (Figure 30). This process included a thorough assessment and documentation of the existing windows and doors, capturing their dimensions and unique design features. Materials were carefully selected to match or closely resemble the originals, such as high-quality wood for the sash, casing, side jambs, and door panels, and single-pane glass to preserve the historic look, with the option of glass improved energy efficiency that mimics single-pane appearance. Custom fabrication was essential to accurately replicate the original profiles and patterns of the sash, muntins, and door panels. Finishing touches, such as historically appropriate paint and accurate hardware, complete the process, ensuring that the new windows and doors uphold both the aesthetic and functional standards of the originals (Figure 31-33).

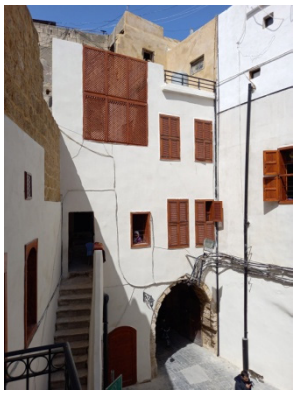


Figure 30. Installing new openings maintaining their coherence and functionality (Hammoud J., 2021)

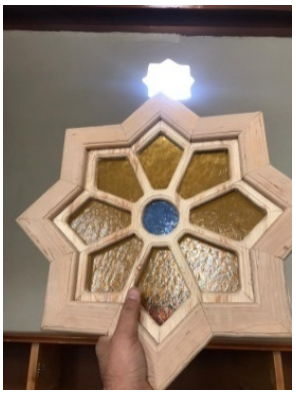


Figure 31. Installing new oculus matching the original design (Asmar P., 2020)

Figure 32. Door panels design for historic market door (Asmar P., 2020)

Figure 33. Fabrication of patterns of window casement, sash, muntins, and Iron bars(Hammoud J., 2021)

5). External Binding (Bulging of Walls): It may be disconcerting, but it has to be accepted as a fact that every building moves throughout its life. It is important that the original design and construction is such that movements

are modest, and indeed usually imperceptible, if a serviceable performance is to be achieved [5]. Historic structures in old Saida city are not exempt from this need or from the effect of movement. According to the author's visual inspection that was straightforward and by using a simple plumb and line level to check the distortion in stone masonry. In this case we noted bulging to the front and main facades, and the distortion showed to be around 65 mm forced outward. The bulging seen was often caused by a number of factors. A lack of lateral restraint which is a well-known principle that lateral restraint should be provided to arrest any potential movement in the stone walls, and this is usually achieved by building floor joist ends into the external stone wall being insufficiently thick. Another factor is the increasing of the floor loads and thermal or moisture expansion of the walls outer surface. This issue happens when massive amounts of water entering the stone walls. The need for strengthening was established. One principle reason for carrying out remedial treatment was to restore the structural adequacy that ensured safety. It was often necessary to incorporate active steelwork as sympathetic strengthening technique that was designed for this case. Opposite parallel walls were held to internal cross walls by pre-stressing bars, the anchoring being done against horizontal steel channels instead of small steel plates. The steel channels running from one cross wall to the other will hold the walls together and improve the integral box like action of the walls (Figure 34 & 35). It was suggested that steel bars to be totally buried under the tiles where the end of steel bars had to be supported in the external walls that may allow the passage of damp or where the steel plate was to be exposed to weather. In this sense, the plate had to be galvanized and powder coated to avoid corrosion problems. Holes drilled in the walls to anchor them had to be filled well with lime mortar.

Figure 34. Showing the galvanized plates from outside (Hammoud J., 2019)

Figure 35. Pre-stressing bars buried under tiles (Hammoud J., 2019)

6). Strengthening of arches: The safety of stone arches is largely a geometrical issue, involving the uncertain geometry and its impact on the horizontal load-bearing capacity of the circular stone arch. It is possible to assess the collapse mechanism and load factor originating from the first floor due to a large opening at the street level. Adding steel elements of flat iron bars provided to connect the bottom flanges of I-beams, connected by bolting or welding in the form of segmental arches attached to the existing arch of the building, Introducing new load bearing members to take the load and relieve the arch.

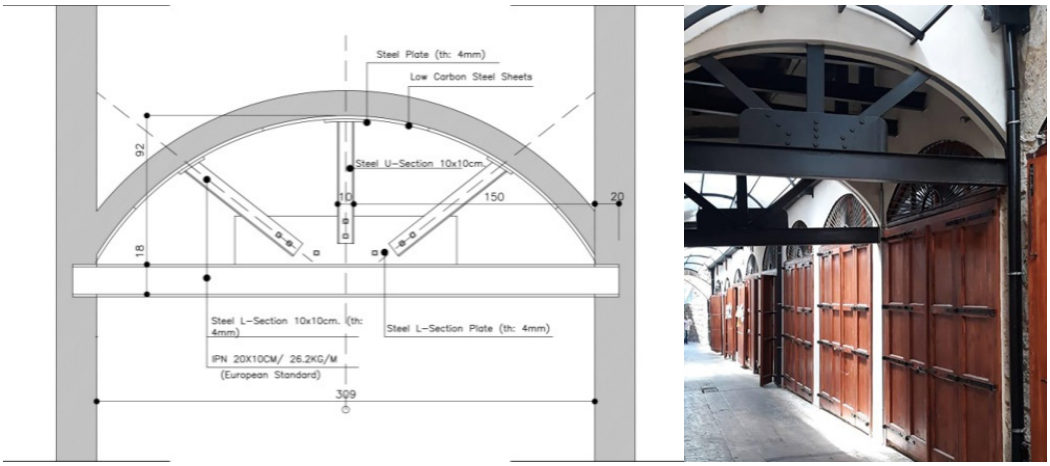


Figure 36. Flanges of I-beams connected by bolting in the form of segmental arches (Hammoud J., 2021)

7). Repair of reinforced concrete balconies and protrusions: Adding concrete balconies to historic buildings can raise concerns about the structural integrity of the original construction. Historic buildings might not be designed to support the additional weight and stress, potentially leading to damage or the need for extensive reinforcement. Severe exposure conditions cause concrete to deteriorate where carbonation of concrete is a cause of steel corrosion, which may result in aesthetic, functional, or structural problems. Localized patch repairs of areas of corrosion damage are popular due to their low cost and temporary aesthetic relief. Complete removal of chloride-contaminated concrete, where it is possible should successfully halt corrosion by restoring passivating conditions to the reinforcement. Mechanical removal of cover concrete is usually done with pneumatic hammers as seen (Figure 37). Patch repairs consist of several activities that start from the removal of delaminated concrete to fully expose the corroded reinforcement [5,6]. Then cleaning of corroded reinforcement and the application of a protective coating to the steel surface by applying anti-corrosion epoxy coating or zinc rich primer coat is required. Finally, the application of pre-mixed, polymer-modified cementitious non shrink mortar to replace the damaged concrete and giving high performance at plastic consistency [6]. *After* a thorough inspection *for* the additional loads the balconies need to support, the author proposed an intervention complying with historical conservation principles and do not adversely affect the building's historical value. Strengthening added concrete balconies in historic buildings using steel brackets is a practical method to enhance the structural integrity while maintaining the aesthetic and historical value of the building. The *steel brackets* with corrosion protection measures *are a strong, durable choice* to transfer loads from the balcony slab to the stone walls of the building. *Brackets are manufactured based on siding thickness.* As seen in the figure (Figure 38), steel brackets are attached to the concrete balconies by using two methods. The first method involves steel hollow sections fixed on walls by using anchor bolts, epoxy resin directly in the joints to ensure a strong connection without harming the existing stone. The second method involves IPNs fixed directly inside the wall where the voids between the IPN and the stones are filled with lime mortar to avoid additional stress points that could lead to future cracking or failure. By following these steps, you can effectively strengthen concrete balconies in historic buildings using steel brackets while maintaining the structural and historical integrity of the building.

Figure 37. Mechanical removal of concrete cover (Hammoud J., 2021)

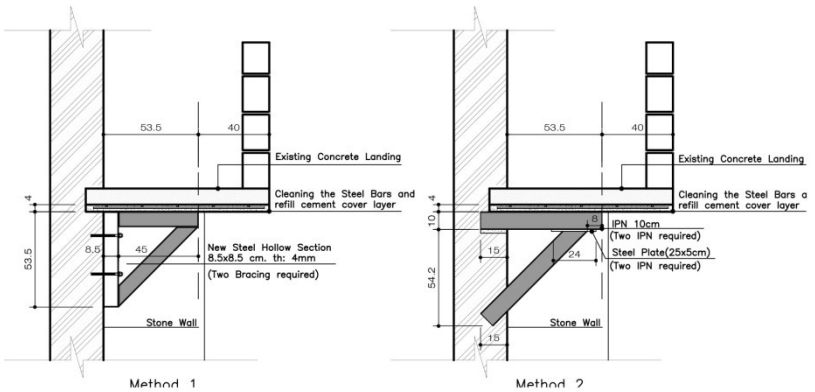


Figure 38. Detailed drawings showing two methods of using the steel brackets attached to the concrete balconies (Hammoud J., 2021)

6. Conclusions

In conclusion, the conservation of historic facades demands a meticulous approach that balances preservation, safety, and sustainability. By considering hazardous elements such as balconies, windows shutters, string courses, plaster, roofs, protrusions, cornices, and awnings, conservationists can implement tailored intervention and rehabilitation practices that safeguard architectural heritage while addressing structural vulnerabilities. Advanced technologies and innovative interventions enhance the effectiveness and precision of conservation efforts, enabling practitioners to mitigate risks and ensure the longevity of historic facades.

However, challenges persist, particularly when neglecting maintenance and prioritizing personal recognition over community engagement. The neglect of essential upkeep can lead to irreversible damage and pose significant risks to public safety, while the pursuit of personal acclaim over collaborative stewardship undermines the integrity and effectiveness of conservation initiatives. Therefore, fostering a culture of responsibility, inclusivity, and transparency is essential in the planning process, ensuring that preservation efforts align with the needs and values of stakeholders and the broader community.

Moreover, the promotion and appreciation of cultural heritage and historic sites are hindered by overlapping mandates and ineffective coordination among key stakeholders, such as the Directorate General of Antiquities, the Ministry of Culture, and local municipalities. Moving forward, it is imperative that practitioners, policymakers, and communities work together to uphold the principles of conservation and promote the sustainable stewardship of historic facades. By integrating technology, expertise, and community engagement into the planning process, we can ensure that these architectural treasures continue to inspire, educate, and enrich our cultural landscape for generations to come. Only through collective commitment and collaborative action can we preserve the past for the benefit of the present and the future.

References

[1] Al Hagla, K. (2020). Sustainable urban development in historical areas using the tourist trail approach: a case study of the cultural heritage and urban development (CHUD) project in Saida, Lebanon. BAU. https://doi.org/10.54729/2789-8547.1104

[2] Cecchi, R., & Gasparoli, P. (2011). La Manutenzione Programmata dei Beni Culturali Edificati. Florence, Italy: Alinea. ISBN- 9788860556684

[3] Cecchi, R. Roma Archaeologia. (2011). Interventi per la Tutela e la Fruizione del Patrimonio Archeologico. Milan, Italy: Electa. ISBN-8837087381.

[4] Davie, M. (2001). Beyrouth 1825-1975: Un siec1e et demi d'urbanisme. Beirut, Lebanon: The Order of Engineers and Architects.

[5] Forsyth, M. (2007). Structures and Construction in HISTORIC BUILDING Conservation. West Sussex, UK. John Wiley & Sons, Ltd. ISBN-9781405111713. https://doi.org/10.1002/9780470691816

[6] Hammoud, J. (2019). Conservação das estruturas arquitetónicas do período de transição em Beirute,1840-1940. UA - Doctoral thesis.

[7] Hydrosult, R., & Elard (2009) Cultural Heritage and Urban Development Project (CHUD): Environmental Baseline Monitoring and City Profiles. Council for Development and Reconstruction, Beirut, Lebanon.

[8] Information International Research Consultants (IIRC). (2001). Stakeholder Analysis and Social Assessment for the Proposed Cultural Heritage and Tourism Development Project: Final Report. Council for Development and Reconstruction, Beirut, Lebanon.

[9] Nour, A., (1982). Introduction a 1'histoire urbaine de 1a Syrie Ottomane (XVf-XVIIIe siecf). Beirut, Lebanon: Lebanese University Publications.

[10] Ortiz, R., & Macias-Bernal, J. M. (2018). Vulnerability and buildings service life applied to preventive conservation in cultural heritage: International Journal of Disaster Resilience in the Built Environment. ISSN- 1759-5908. https://doi.org/10.1108/IJDRBE-11-2016-0047

[11] Ortiz, R., & Ortiz, P. (2016**).** Vulnerability index: A new approach for preventive conservation of monuments: International Journal of Architectural Heritage. https://doi.org/10.1080/15583058.2016.1186758

[12] Ruggiero, G., & Marmo, R. (2021). A Methodological Approach for Assessing the Safety of Historic Buildings' Façades. Naples, Italy: MDPI. https://doi.org/10.3390/su13052812

[13] Walker, G. (2012). The nature of cleaning: physical and chemical aspects of removing dirt, stains and corrosion. International Symposium on Cultural Heritage Conservation.

[14] Weber, S. (2010). Space, Urban Institutions and Society in Ottoman *Bilad al-Sham* The Making of an Ottoman Harbour Town: Sidon/Saida from the Sixteenth to the Eighteenth Centuries. Brill. ISBN: 9789004191044. https://doi.org/10.1163/9789004191044_013

Copyrights