The reusing of Historical Buildings: Embracing transparency as an approach to heritage preservation

Dr. Esraa Gamal Ahmed Felifal

Assistant Professor - Onaizah Colleges – Department of Architecture and Interior Design

Alexandria University – Fine Art Faculty – Decor department – Interior Architecture

esraafelifal@oc.edu.sa

Abstract:

Architectural heritage serving as a tangible reflection of the cultural, political, economic, and social interactions. Each stage of culture and civilization has left its unique mark on the built environment, making heritage and historical buildings invaluable documentation of these significant civilizations.

Many of the heritage buildings are at risk of demolition, refers to a specific problem like the lack of appreciation for architectural heritage stems from a variety of factors. Modernization often takes precedence, with a focus on new construction rather than the preservation of existing structures. Additionally, limited resources and funding constraints hinder the necessary maintenance and restoration.

The research aims to use technological advancements effectively preserve and reuse heritage and historical buildings, and the research seeks to harness the technology potential for the conservation and adaptive reuse of valuable historical buildings. Through this research, the importance is to identify and evaluate various technological approaches such as transparent smart materials.

The research adopted an analytical and descriptive approach to study the advancements in technology and their impact on the development of materials. It focused on transparent and permeable materials and their role in preserving historical buildings, treating their internal spaces, and achieving a harmonious relationship with the surrounding environment. The research includes an applied study of the utilization of transparency in the preservation and repurposing of historical buildings.

In conclusion, by transparency, this research seeks to contribute to the ongoing efforts of preserving and repurposing important ancient heritage and historical buildings. By striking a balance between innovation and preservation.

Keywords:

Heritage, Historical building, preservation, Advanced Transparent materials, Adaptive reuse.

ملخص البحث:

التراث المعماري بمثابة انعكاس ملموس للتفاعلات الثقافية والسياسية والاقتصادية والاجتماعية. لقد تركت كل مرحلة من مراحل الثقافة والحضارة بصماتها الفريدة على البيئة المبنية، مما يجعل التراث والمباني التاريخية توثيقًا لا يقدر بثمن لهذه الحضارات المهمة.

العديد من المباني التراثية معرضة لخطر الهدم، مما يشير إلى مشكلة محددة مثل عدم تقدير التراث المعماري الذي ينبع من مجموعة متنوعة من العوامل. التحديث غالبا ما يكون له الأسبقية، مع التركيز على البناء الجديد بدلا من الحفاظ على الهياكل القائمة. بالإضافة إلى ذلك، فإن محدودية الموارد وقيود التمويل تعيق أعمال الصيانة والترميم اللازمة.

ويهدف البحث إلى استخدام التقدم التكنولوجي بشكل فعال للحفاظ على المباني التراثية والتاريخية وإعادة استخدامها، ويسعى البحث إلى تسخير إمكانات التكنولوجيا للحفاظ على المباني التاريخية القيمة وإعادة استخدامها على التكيف. ومن خلال هذا البحث تكمن الأهمية في تحديد وتقييم الأساليب التكنولوجية المختلفة مباستخدام الشفافية من خلال الخامات المتطورة.

يركز البحث على تحقيق الشفافية والنفاذية البصرية من خلال استخدام المواد المتقدمة لتعزيز المباني التراثية التاريخية القديمة وبث حياة جديدة فيها، مما يمكنها من التعايش بشكل متناغم مع التقدم التكنولوجي واستيعاب الوظائف والأنشطة الحديثة التي تتماشى مع العصر الحالي. بالإضافة إلى ذلك، نهدف إلى إنشاء لغة تصميم مناسبة تسد الفجوة بين المتطلبات المعاصرة والحفاظ على المباني التراثية.

اعتمد البحث المنهج الوصفي التحليلي لدراسة التقدم التكنولوجي وأثره في تطور المواد. وركزت على المواد الشفافة والنفاذة ودورها في الحفاظ على المباني التاريخية ومعالجة فراغاتها الداخلية وتحقيق علاقة متناغمة مع البيئة المحيطة. ويتضمن البحث دراسة تطبيقية للاستفادة من الشفافية في الحفاظ على المباني التاريخية وإعادة توظيفها.

ونسعى من خلال البحث إلى المساهمة في الجهود المستمرة للحفاظ على التراث القديم والمباني التاريخية الهامة وإعادة استخدامها. من خلال تحقيق التوازن بين الابتكار والحفظ.مع إيجاد حلول مبتكرة تحتفي بقيمة التراث وتقيم حواراً بين التقليد والحداثة. من خلال تبني الشفافية والاستفادة من المواد المتقدمة، هدفنا هو إنشاء تصميمات تكون بمثابة شهادة على الإرث التاريخي الغني مع احتضان التطورات والتطلعات في الوقت الحاضر.

Introduction:

Preserving heritage and historical buildings is essential to maintain cultural legacy, the preservation and treatment along with the promotion of awareness and attention towards them, reflect a significant interest in heritage and historical matters. There exists a diversity of opinions regarding the most suitable methods for preserving and treating these buildings, taking into consideration their unique nature, value, and identity. These buildings serve as tangible links to our history, representing the architectural achievements of bygone eras. They hold immense cultural, historical, and aesthetic value.

Determining the appropriate preservation and treatment methods for these buildings requires careful consideration. Each heritage structure possesses its own distinct characteristics, historical context, and cultural significance. Therefore, it is vital to approach their preservation with a nuanced understanding of their nature, value, and identity.

Decisions regarding the preservation and treatment of heritage and historical buildings necessitate a balance between conservation and adaptive reuse, to protect the integrity and authenticity of these structures while also ensuring their relevance and functionality in the contemporary world. This includes considering factors such as structural stability, material decay, and the impact of climate and environmental conditions.

However, due to the advancements achieved in this era, there exists a gap in how we approach and deal with architectural heritage and its interior architecture. Technological development can be both a blessing and a curse in this regard. It can negatively impact and harm the building if not used appropriately, or it can have a positive impact by achieving a harmonious integration of the heritage building with contemporary requirements and designs. This approach represents one of the best and most important ways to approach the treatment processes.

Preserving heritage buildings and their internal architecture is closely tied to the concept of transparency. Transparency refers to the openness and clarity in the design and treatment of these buildings. It involves creating a dialogue between the historical context and the requirements of the present era, ensuring that the design respects the integrity of the heritage structure while accommodating modern needs and aesthetics.

By embracing transparency in the preservation and treatment of heritage buildings, we can strike a balance between honouring the past and embracing the future. This approach allows for the creation of spaces that not only preserve the historical and cultural value of the building but also provide functional and adaptable environments that meet contemporary demands. Transparency plays a crucial role in the restoration and adaptive reuse of historical spaces and buildings. It ensures that the functional requirements, formal qualities, aesthetic appeal, and ethical considerations are all carefully considered and integrated into the design process.

The development of transparent and permeable materials has significantly influenced the evolution of building design. The use of these materials, which combine openness and translucency, has become a defining feature of contemporary architecture. Transparency as a concept holds immense importance, although its definition can vary due to the wide range of interpretations.

According to Usher (2003), the diverse definitions of transparency make it challenging to provide a concise and comprehensive explanation of its characteristics. However, it is widely acknowledged that transparency is a fundamental quality that has roots in both art and architecture, as noted by Sigfried Giedon (1962). In the words of Forte (2004), transparency has become a defining architectural term of the twenty-first century. As a result, transparency has

become an integral part of the structure and design language that has evolved in architecture and interior architecture worldwide.

The incorporation of transparency in building design allows for the creation of spaces that are visually open, light-filled, and interconnected. It fosters a sense of transparency not only in terms of physical materials but also in the way spaces are organized and experienced. The use of transparent and permeable materials enables the merging of form and meaning, enhancing the overall aesthetic and functional qualities of the built environment.

The research focuses on achieving transparency and visual permeability through the utilization of advanced materials to enhance old historical heritage buildings and breathe new life into them, enabling them to harmoniously coexist with technological advancements and accommodate modern functions and activities that align with the current era. Additionally, we aim to establish an appropriate design language that bridges the gap between contemporary requirements and the preservation of heritage buildings.

By striking a balance between appropriate design principles and the demands of the era, we seek to achieve a design that seamlessly connects the past and the present. This approach not only preserves the intrinsic value of heritage but also reflects its enduring significance. We aim to create a design that respects the historical context and cultural identity of heritage buildings while integrating contemporary elements and meeting the needs of the present.

Through the research, we endeavour to find innovative solutions that celebrate the value of heritage and establish a dialogue between tradition and modernity. By embracing transparency and leveraging advanced materials, our goal is to create designs that serve as a testament to the rich historical legacy while embracing the advancements and aspirations of the present time.

Research objective:

The research aims to enhance the importance of heritage and historical buildings by treating and reusing them through advanced transparent materials that enhance transparency, permeability and sustainable interaction with the surrounding environment. This approach includes preserving heritage and historical buildings by creating a positive change to revive them to keep pace with development, using transparency as a design concept that helps historical heritage buildings and their internal spaces to accommodate the new functions and activities that are added to them, in addition to managing privacy, improving visibility and lighting, and establishing a stronger connection with nature. And the environment.

Research Methodology:

The theoretical part: The theoretical segment of the study centres on leveraging transparency and visual permeability to showcase the historical and heritage significance of old buildings. This is achieved through the utilization of advanced materials to revitalize historical heritage structures and create a design language that harmonizes contemporary needs with heritage preservation, thereby striking a balance between appropriate design principles and modern

requirements. The aim is to achieve a seamless design that effectively connects the past with the present. This occurs in the research in the theoretical part through the analysis of international examples of heritage buildings.

Practical implementation part: By applying the theoretical concepts that explored in the research, which involve the use of transparency and visual permeability, a suggestion is submitted for the Qaitbay Citadel in Alexandria, Egypt, is repurposed as a maritime military museum that depicts the history of the Egyptian Navy during a specific historical period.

1. Architectural heritage:

Architectural heritage refers to a collection of buildings, structures, and antiquities that hold historical, artistic, architectural, or scientific value.

1.1 Heritage buildings:

Heritage buildings are architectural structures serve as physical representations of specific events or periods, and they hold immense architectural[1], aesthetic, historical, and cultural value[2]. Each heritage building is unique and requires a tailored approach to its preservation and treatment, depending on the specific values it represents and communicates. Before embarking on transparency in the conservation and preservation of these buildings, it is essential to understand their different types and the associated preservation and treatment practices.

1.1.2 Classification of architectural heritage:

The approaches to dealing with heritage buildings vary depending on their specific types and characteristics[3]. It is crucial to have a clear understanding of the nature and type of a heritage building in order to determine the appropriate treatment and preservation methods it requires. The diagram below illustrates this concept:

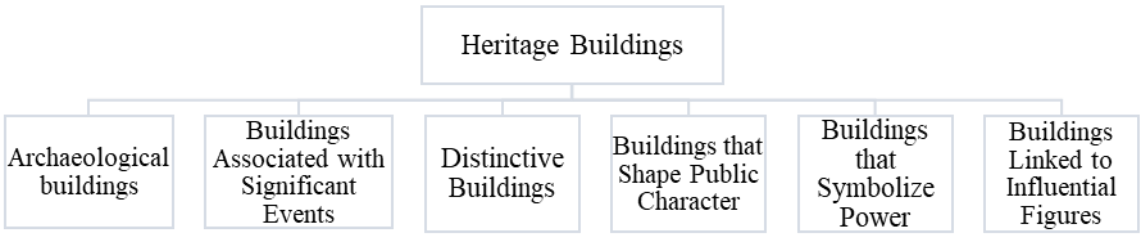


Diagram 1. Showing the types of heritage buildings

- Archaeological buildings: are unique structures that offer glimpses into ancient eras and centuries past. These buildings carry immense historical, artistic, and aesthetic value. With an age surpassing one hundred years.
- Buildings Associated with Significant Events: hold a profound connection to specific periods of time and historical significance. These structures gain heightened value as they become intertwined with pivotal moments that have shaped our history.
- Distinctive Buildings: Unique and Memorable Structures: Distinctive buildings are those that stand out due to their unique characteristics, architectural design, or cultural

significance. These structures leave a lasting impression and are often recognized as landmarks or symbols of a particular place.

- Buildings that Shape famous Character: Influential Structures: Buildings have the power to shape the character and identity of a place. Certain structures become synonymous with a city or region, leaving a lasting impact on its public character. These buildings possess unique qualities that contribute to their significance and influence on the surrounding environment.
- Buildings that Symbolize Power: Architectural Icons: Certain buildings have come to symbolize power, representing the authority, influence, and status of individuals, institutions, or nations. These structures leave a lasting impression and serve as visual representations of power and prestige.
- Buildings linked to influential figures often hold historical, cultural, or architectural significance.

2. **Transparency and its relationship to heritage and historical buildings:**

The role of transparency is crucial in the preservation of heritage and historical buildings as it serves several vital purposes:

- Transparency interacts with the environment in a sustainable, eco-friendly, and climate-responsive manner, enabling the space to adapt to its surroundings and climate while safeguarding the heritage and historical significance.
- It aids in blending heritage buildings with modern architectural trends.
- Identifying the suitable language to address the needs of heritage buildings in the context of modern requirements.
- Creating contemporary designs that positively transform heritage and historical buildings to rejuvenate them and align with the era's development and needs. This process also facilitates repurposing heritage buildings for new functions and activities.
- Attaining both the aesthetic and functional dimensions, while also cultivating a suitable culture for engaging with heritage buildings.
- Reflecting the historical significance and identity of the heritage building.
- Transparency is accomplished through the use of advanced transparent materials and visual permeability, creating an open space that embodies flexibility, efficiency, and effectiveness. This approach controls privacy, visibility, and clarity, resulting in interconnected spaces that bridge the internal and external design. It also regulates light and temperature levels, while fostering a close connection with nature and the surrounding environment.

Now, we explore the connection between transparency and its significance in the preservation and restoration of heritage buildings, following our understanding of the pivotal role that transparency plays in enhancing and conserving the building, while also showcasing its historical value in a modern context.

3. Transparency and its relationship to heritage and historical buildings:

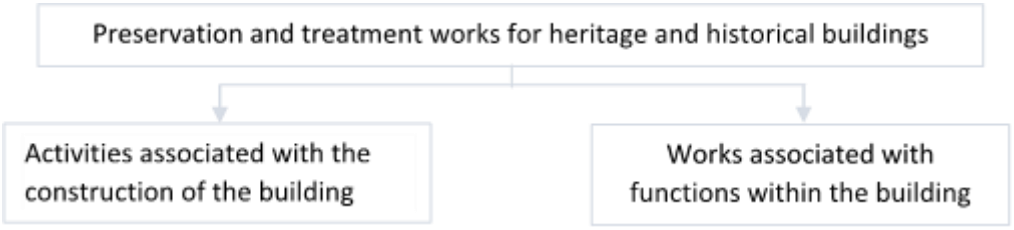


Diagram 2. Showing the preservation and treatment work related to buildings

The preservation and treatment work is segmented into two parts: preservation and treatment work associated with the building, and preservation and treatment work tailored to the specific requirements of the interior job, as depicted in diagram 2. Each segment is further categorized into various types based on the building's needs and characteristics, and these works are interconnected. Works are conducted concurrently with the preservation work related to the building[4].

Table 1. Shows the preservation and treatment work related to buildings:

preservation and treatment related to the building	Preservation
	Conservation
	Consolidation
	Restoration
	Reconstruction

Table 2. Shows the preservation of buildings based on their type and function:

preservation and treatment according to the functions inside the building	Rehabilitation
	Development
	Reuse - Adaptive Reuse
	Renovation
	Additions and Extensions

There are numerous preservation and treatment methods associated with heritage and historical buildings, as illustrated in table (1) and (2). However, the selection of the preservation and treatment approach depends on several factors, including the nature, type, age, architectural and aesthetic significance, historical value of the heritage building, as well as the intended or existing functions within it. An inappropriate choice of treatment and preservation method can lead to the deterioration of the building and have a negative impact. Therefore, it is crucial to select the most suitable treatment and preservation method that aligns with the building's characteristics. Additionally, multiple treatment methods may be employed in a single building, depending on its future use and requirements.

In this research, we explore the utilization of transparency as an approach and means for implementing various crucial methods of treatment for heritage and historical buildings. These methods include restoration through reconfiguration and construction works, rehabilitation, renovation, as well as extensions and addition works. The selection of the appropriate transparent material for processing is of utmost importance, as each material possesses distinct properties and uses. Consequently, not all materials are suitable for achieving the necessary methods of treatment and preservation required for heritage buildings in an appropriate manner. We exemplify this concept through the analyzation of international models that have effectively utilized transparency and transparent materials in the treatment and preservation of heritage and historical buildings.

3.1 First: Transparency and Reconfiguration, and Construction works:

Reconstructing[5] heritage and historical buildings involves reassembling their components and restoring their original condition using modern materials integrated into the building's structure[6]. This phase is pivotal for accurately preserving and reviving the building, ensuring its continuity and potential for future use. It particularly addresses buildings that have been damaged or collapsed due to disasters[7], necessitating a meticulous approach based on comprehensive studies and documentation of the building's form and details. The reconstruction process must align with the building's heritage, distinguishing itself from the original structure. It can encompass total or partial[8] reconstruction[9]. Some models have utilized transparency as a method for reconfiguring and constructing heritage and historical buildings, aiming to create a design that preserves the building's character and values.

3.1.1 Model (1): Using smart glass for the reconfiguration and partial construction of the Menken heritage building:

United States of America, holds the status of a heritage. It bears historical significance as a symbol of the Declaration of Independence, and its surroundings are integral to a wildlife reserve. The building experienced a partial collapse, resulting in approximately 80% of the original structure and its materials remaining, shown in Figure. 1.

Figure 1. Shows the remnants of the Mencken Building, and the use transparency in reconfiguring and constructing the building.

Choosing the reconfiguration and partial construction of the Menken heritage building in order to revive it due to its importance by using transparency through smart glass to provide reinforcement to the existing external part and structure, in addition to the use of glass in the interior architecture of the building, shown in the Figure. 2.

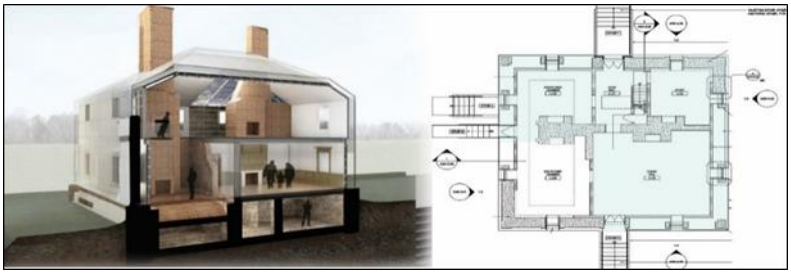


Figure 1. Shows the remnants of the Mencken Building, and the use transparency in reconfiguring and constructing the building.

Figure 3. Shows the smart passive glass on the exterior facade of the building

Transparency facilitates cohesion and integration between the design, contemporary requirements, and the heritage of the historical building. Passive smart glass was employed to externally complete the demolished sections of the building, harnessing natural external stimuli such as heat, light, and ultraviolet rays for conversion. This approach fosters a harmonious relationship between the building's interior and exterior, reflecting the value of the heritage structure and ensuring the visibility of its remaining elements, while also promoting energy efficiency and reduced consumption, shown in the Figure. 3.

Glass was incorporated into the interior design of the building, featuring prominently in the second-floor, ceilings, stairs, and corridors. Additionally, active smart glass was utilized in the glass partitions to segment the spaces on the floor, aiming to decrease energy usage by employing electrical current as a catalyst for transitioning between opaque and transparent states, shown in the Figure. 4.

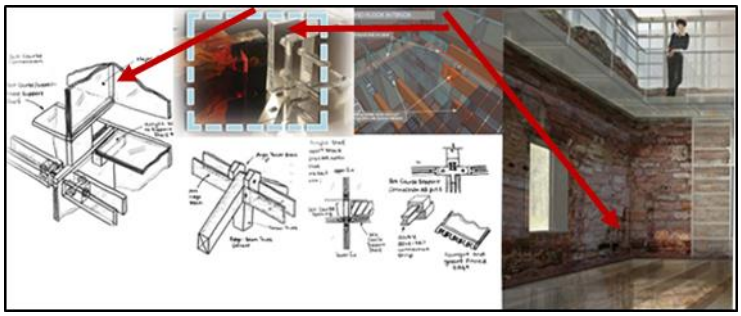


Figure 4. Shows the use of glass in floors, ceilings, stairs, and corridors

3.2 Second: Transparency and rehabilitation:

Rehabilitation involves the process of renovating heritage and historical buildings to either continue their original function or serve a new purpose in a more efficient manner, while still preserving their historical and heritage significance[10]. This process is an important aspect of conservation and treatment, with the aim of addressing any damage or deterioration without compromising the essential historical elements of the structure, it aims to bring the building back to its original state through repairs or modifications[11]. Rehabilitation allows for radical changes that meet the needs and requirements of modern times without impacting the building's external facades. However, these changes must be in line with the intended function of the building and consider factors such as architectural style, age, artistic and cultural value, among others (Banjan1996).

3.2.1 Model (1): Utilizing transparency to restore the Monastery of San Juan in Burgos, Spain, by incorporating glass and wooden mesh. The renovated space will serve as a museum for cultural activities and a public venue for diverse celebrations:

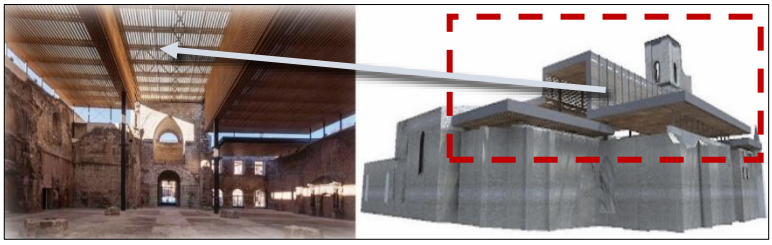


Figure 5. Shows the method of conserving the Monastery of San Juan through rehabilitation by transparency using wood mesh, and glass

The San Juan edifice is a gothic-style monastery dating back to the 11th century, located in the northern Spanish city of Burgos, is a, and is part of the complex of buildings surrounding the Benedictine monastery. The structure suffered damage from two consecutive fires, as well as conflicts in the 18th century, prompting efforts to preserve the remaining architectural heritage and rehabilitate it for continued use. This is due to its significant historical and heritage value, serving as a key testament to a specific period in Spain's history[12]. The preservation process by using transparency for rehabilitation, to create a sheltered space to host diverse events and celebrations while also housing a museum for cultural activities , all protected from harsh climatic conditions, and shown in the Figure. 5. The focus was on rehabilitating the building with an innovative design that contrasts with the old architectural fabric, safeguarding the remaining architectural remnants from severe weather conditions. Additionally, new spaces were created to accommodate diverse events, celebrations, and serve as a museum for cultural activities[13]. The design features a contemporary covering in the shape of a large folded surface, reflecting the three-part classification of the ancient church. Two horizontal surfaces were added to cover the ornate semi-circular section of the building and the north-western area.

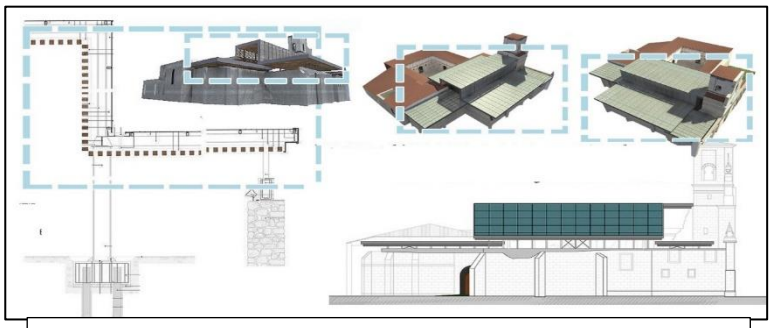


Figure 6. Shows cases the modern design of the building's roof, elucidating how the added surfaces seem to hover above the monastery's remnants and ruins and combination of wooden mesh and glass

The combination of wooden mesh and glass serves as a bridge between the monastery's ancient heritage and modern architecture, shown in the Figure.6. By day, the suspended ceiling regulates natural light and filters it through the wooden grille[14]. At night, indirect artificial lighting within the wooden grille accentuates the site's ancient architecture[15]. From the exterior, the illuminated transparent glass surface acts as a beacon, showcasing the cultural activity within the heritage space.

3.3 Third: Transparency in Reuse and Adaptive Reuse:

Adaptive Reuse[16], and Reuse are crucial strategies[17] for preserving heritage and history[18], representing modern preservation methods that keep buildings relevant and valued by the community[19]. This approach fosters a positive image, economic growth, and cultural

enrichment, while enhancing the interior space of heritage buildings. Repurposing extends beyond abandoned structures[20] to include structurally sound[21] buildings adapted to meet contemporary needs and functions[22], preventing them from becoming closed-off monuments or relics. Reuse and adaptive reuse encompass two distinct categories of preservation and transformation).

The difference between reuse and adaptive reuse is that reuse means reusing the building in the same original function without making a modification or change in the structure of the building[23], and only rehabilitation work is done, such as religious buildings such as mosques and churches. In these cases, reuse is done. With the same function, it is the best and most suitable for the building's architectural and cultural value. As for Adaptive Reuse, it occurs through reuse with a new function adapted to the heritage building without dissonance. It means transforming the original function of the heritage building into a new function that suits the current requirements while ensuring the preservation of the building's value.

3.3.1 Model (1): Using transparency in the adaptive reuse of Herbstein Palace in Austria, transforming it into a history museum in Graz by using materials such as acrylic, mirrors, and polypropylene mesh:

Herbstein Palace, a venerable historical structure in Austria, has roots dating back to the sixteenth century[24], with subsequent repairs and modifications carried out in the eighteenth century. There is a deliberate effort to leverage the palace's potential while honoring its historical significance. In pursuit of this goal, adaptive reuse has been chosen as the approach to repurpose the building for a new function that harmonizes with its heritage, meeting contemporary needs while safeguarding its intrinsic value. This includes interior architectural changes to optimize space and enhance amenities.

Figure 7. Shows the historic Mirror Hall and how transparency was used in a design that simulates a metaphorical reflection of the interior architecture of the palace.

Transparency was the guiding principle in repurposing Herbstein Palace into a museum, infusing a fresh perspective into the presentation of historical exhibits, shown in the Figure. 7. The museum showcases a vast collection of artifacts spanning from the middle Ages to the twentieth century, alongside multimedia archives, all within the confines of a historically significant space. Meticulous care was taken in preserving the heritage building, with interior architectural treatments reflecting both the building's value and historical significance, as well as the technological advancements of the era[25].

Transparency played a key role in the treatment of the interior architecture, incorporating acrylic materials, mirrors, and polypropylene mesh, shown in the Figure. 8. These transparent materials were strategically integrated into the interior architecture of the building[26].

Figure 8. Shows the transparent materials acrylic materials, mirrors, and polypropylene mesh.

The first permanent exhibition, known as the Historical Mirror Hall, embodies a design concept that symbolically reflects space, heritage, and time while also achieving spatial intervention in both functional and aesthetic dimensions. This design concept was realized through the use of acrylic and mirrors, shown in the Figure. 9. Transparent, lustrous acrylic was employed in crafting the display units for the sixteenth-century heritage and historical artifacts, with these units then being positioned on mirror bases. The mirrors were strategically utilized to create the illusion of the display units floating, thereby erasing distinct boundaries and engendering an interplay of overlapping spaces, contrasting the typical principles of interior architecture. The hall serves as a testament to the merging of the past and present.

Figure 9. Shows the transparent materials acrylic materials, and mirrors of the first permanent exhibition

The concept behind the second permanent exhibition aims to offer a profound exploration of the warehouse's dispersed nature through cinematic photography, evoking a sense of embarking on a journey into the past for visitors. As a result, the exhibition was fashioned in the likeness of a warehouse, employing polypropylene nets affixed with stainless steel to facilitate a seamless traversal along the retinal wall loop, striking a harmonious balance between historical content and contemporary exhibition design. Within this framework, multimedia archives showcasing furniture and clothing dating back to the sixteenth century are prominently featured, shown in the Figure. 10.

Figure 10. Shows the transparent polypropylene material

3.4 Fourth: Transparency, and Renovation of heritage and historical buildings:

Renovation of heritage and historical buildings is to accommodate the specific demands and necessities of the building's new function[27]. This renovation is necessitated by the unsuitability of the building's interior spaces for its intended use. Renovation will be confined to areas that do not compromise the building's character, historical significance, architectural integrity, and artistic value. The renovation encompass vertical communication elements, modern interior architectural features, or any other elements essential for the building to fulfil its function while safeguarding its unique form and character. Transparency plays a pivotal role in the renovation and redevelopment of heritage buildings for their adaptive reuse. This involves integrating new elements that align with modern development, utilizing materials that promote transparency to achieve this objective.

3.4.1 Model (1): Using transparency and visual permeability in the renovation of the roofs of Lacoste Castle in France, and establishing a versatile space (Wind Shape) utilizing translucent white polypropylene fabric:

The University of Arts and Design was tasked with creating a modern pavilion for communal gatherings and public meetings in the historic city of Lacoste, France, with the added capability of hosting concerts and exhibitions during the summer months. Given the city's rich architectural heritage and natural surroundings, the design concept aimed to interconnect the city's historical significance, its people, and the surrounding environment, reflecting the inherent power and beauty of nature, shown in the Figure. 11.

Figure 11. Shows the wind pavilion and the rooftop renovation of the historic Lacoste Castle in France

Transparency was used for the design of the pavilion structure at the historic medieval Lacoste Castle, resulting in the creation of the Wind Shape Pavilion[28]. This pavilion was crafted from translucent white polypropylene fabric, selected for its optical clarity, flexibility, wind and weather resistance, tensile strength, heat resistance, and other properties that contribute to achieving transparency. Consequently, the temporary Wind Shape pavilion stands out for its lightweight nature, simplicity, ease of assembly and disassembly, as well as its ability to seamlessly blend with the surroundings and climate while accentuating and preserving the heritage value of the location, shown in the Figure. 12.

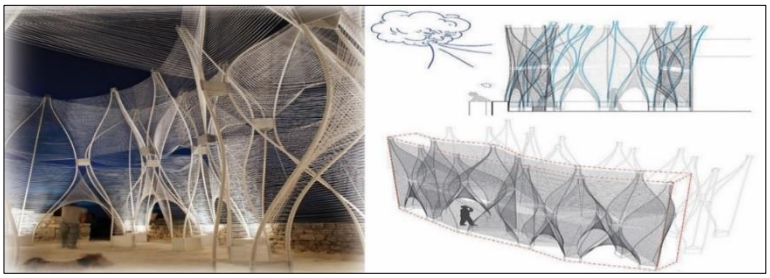


Figure 12. Shows the design of the pavilion's structure emphasizes transparency through visual permeability, along with its high flexibility to withstand winds and the harsh climate of the surrounding city.

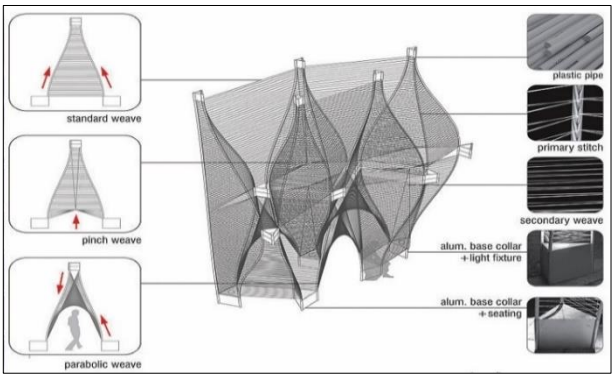


Figure 13. Shows the design of the pavilion's structure

The aim was to develop a temporary structure that can be easily assembled and disassembled without impacting the heritage and while harmonizing with the surrounding nature. The wing's design concept draws inspiration from nature, hence its name "Wind Shape," reflecting its ability to interact with the wind through its inclined and curved form, as well as its adaptable control from one side to the other. The pavilion's structure incorporates flexible, supple, and durable elements to achieve the desired slope and curvature ratio for wind responsiveness, while maintaining a lightweight construction to preserve the heritage and historical building's integrity, shown in the Figure. 12-13. The structure interacts with the wind in various ways, including rhythmic oscillations and rapid undulations during strong winds, with sails and netting fixed in void-like forms on the castle's side. The pavilion's structure[29] comprises two eight-meter-high wings that dynamically adjust their orientation in response to the wind. It is anchored into the limestone of the castle and constructed with aluminum beams, which are then enveloped in transparent white polypropylene fabric. This fabric, known for its flexibility and softness, allows the structure to sway and interact with the wind, achieving transparency that harmonizes with the natural beauty and power of the surrounding environment. This design approach also serves to honor the value and identity of the building, as well as the heritage and historical significance of the city dating back to the middle Ages.

3.5 Additions and Expansion of Heritage and Historical buildings through Transparency:
Transparency contributes to beneficial transformations with heritage buildings, both internally and externally, including extensions and additions. It embodies the design philosophy of these additions in a manner that aligns with the nature and significance of the heritage building, whether through congruence, compatibility, or deliberate contrast. The incorporation of internal and external extensions and additions to heritage and historical buildings represents a significant aspect of architectural history, dating back to ancient times. Their prevalence expanded in the twentieth century, serving as a crucial method for addressing numerous challenges encountered by heritage buildings in contemporary urban settings[30].

These additions and extensions are prompted by growing functional needs and evolving requirements, or by the introduction of new functions to the building. They can manifest in tangible or intangible forms, and may be either temporary or permanent in nature. The typical approaches for creating additional spaces involve either internal modifications or external alterations[31]. Internal changes necessitate careful examination and understanding, following established principles and guidelines to appropriately address the heritage and historical significance of the building. Internal modifications encompass three main categories: reorganization and utilization, internal extensions, and comprehensive internal alterations. External changes to heritage buildings can take the form of visible or concealed extensions.

3.5.1 Model (1): The use of transparency in the interior architecture of the Metropolitan Museum of Art's addition, using white transparent perforated PVC fabric in the Fashion in the Age of Technology exhibition located within the extension:

The Metropolitan Museum, founded in 1870, is the largest art museum in the United States, housing over two million works of art from diverse cultures and civilizations. In the twentieth century, the museum expanded to encompass modern and contemporary art, and it features various wings for art exhibitions, such as the Robert Lehman Wing addition[32], which hosts the Fashion in the Age of Technology exhibition, shown in the Figure. 14.

Figure 14. Shows the Metropolitan Museum and the interior addition.

The Robert Lehman Wing constructed in 1975, is an octagonal addition[33] situated along the museum's central axis, utilizing the former entrance of the museum as exhibition space, shown in the Figure. 15. The exhibition's design concept centers on the intersection of fashion and technology, aiming to mirror the museum's architecture while providing a neutral backdrop to highlight the exhibits and their intricate details. To achieve this, transparency was selected as the key design element, resulting in a "Cathedral of Ghosts" constructed from transparent fabric (poly chloride vinyl) that emulates classical architectural forms in harmony with the museum's architecture, shown in the Figure. 16. Spanning two floors, the exhibition seamlessly integrates 3D-printed models, laser and machine-produced items, and traditional handicrafts, blending media with the architectural surroundings. The exhibition seamlessly integrates 3D-printed models, laser and machine-produced items, and traditional handicrafts, blending media with the architectural surroundings.

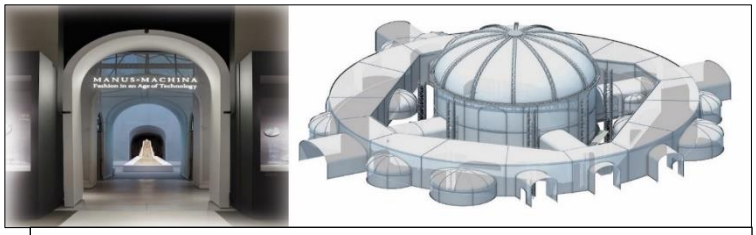


Figure 15. Shows the Robert Lehman Pavilion, which is an addition and extension to the museum in a double octagonal shape.

Figure 16. Shows the transparent fabric (poly chloride vinyl)

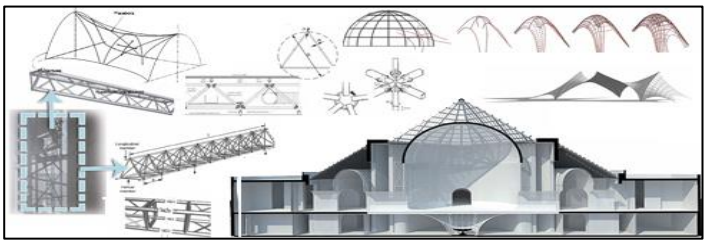


Figure 17. Shows the metal scaffolding enveloped in transparent, perforated PVC fabric

The exhibition's interior design consists of metal scaffolding enveloped in transparent, perforated PVC fabric, creating a sense of spatial depth and establishing visual connections with the exhibits throughout the pavilion, shown in the (Figure. 17). This design choice also allows the shadows of the scaffolding frame to be revealed inside the space. Moreover, transparent perforated white PVC fabric[34] is utilized in the corridors, walls, ceilings, and central courtyards, offering flexibility in dome design and varying levels of transparency. When frontally lit, the fabric appears opaque, serving as a backdrop to showcase exhibit details, while back lighting results in high transparency, fulfilling the specific requirements of the space.

4. The preservation of historical buildings in Egypt according to the functions inside the building using transparent advanced materials:

Preserving historical buildings in Egypt according to the functions inside the building using transparent materials involves a complex interplay of historical significance, architectural considerations, and preservation techniques. The ancient Egyptian architectural landscape was characterized by the predominant use of mud brick and stone. Stone was typically reserved for tombs and temples, while mud brick was used for various structures, including royal palaces, fortresses, and subsidiary buildings in temple complexes.

In the context of preserving historical buildings, the reuse of historic buildings with a new function is considered an effective way to preserve self-financing and add new value to cultural aspects, contributing to the generation of new values and a more comprehensive vision.

4.1 Advantages of transparent advanced materials in according to the climate:

4.1.1 Polymethyl methacrylate (PMMA) known as acrylic/Plexiglas:

Acrylic, prized for its transparency, durability, and weather resistance, is a compelling option for diverse applications in hot climates. It serves as a cost-effective substitute for polycarbonate, excelling in tensile strength and UV resistance. Its break-resistant nature and lightweight properties make it a preferred alternative to glass and polycarbonate, impacting various architectural areas due to its resistance to harsh climatic conditions and energy-saving attributes.

Developed using advanced technology, acrylic boasts distinct features[35] such as high transparency, UV resistance, and superior impact strength compared to glass. It transmits over 92% of light, making it a versatile material with various types and color options, including transparent white, semi-transparent colored, and decorated varieties. These characteristics position acrylic as a versatile and impactful material in architectural design, offering flexibility and functionality in hot climate environments.

4.1.2 Smart Glass:

In hot climates, the use of smart glass offers several benefits for building design and energy efficiency. Smart glass, also known as switchable glass or dynamic glass, can change its optical properties in response to electrical or thermal signals.

Smart glass helps create climate[36] adaptive building shells, providing benefits such as natural light adjustment, visual comfort, UV and infrared blocking, reduced energy use, thermal comfort, resistance to extreme weather conditions, and privacy. Smart windows can self-adapt to heat or cool for energy conservation in buildings. They can prevent sunlight and heat from entering a building during hot days, improving energy efficiency. This feature can lead to more refined and efficient temperature and light control in the building, ultimately lowering the cost of heating, cooling, and lighting the interior.

4.1.3 The mesh and its use in achieving transparency and permeability from several materials (metal and wire mesh - plastic mesh - wooden - textile mesh - fiberglass):

The ancient Egyptians and Vikings first used metal and wire meshes for jewelry, later evolving to protective shields and industrial applications. Meshes were then employed in World War II and eventually found widespread use in arts and architecture due to their contemporary design, visual effects, strength, and flexibility. These meshes offer natural ventilation, sunlight filtration, security, transparency, durability, and resistance to corrosion, contributing to the revitalization and preservation of old, heritage, and historical buildings while harmonizing with modern architectural designs.

- **Plastic Mesh:** Easily shaped and sized, it can be crafted from polyethylene, nylon, polyvinyl chloride, or polytetrafluoroethylene.
- **Metal Mesh:** Comprising stainless steel or other controllable metals, it can undergo drilling or electro polishing to adjust capacity and size.
- **Wired Mesh:** Consists of woven coiled wire, offering flexibility through interwoven metal wires.
- **Fiberglass Mesh:** Woven from fiberglass strands and often coated with polyvinyl chloride for added strength and flexibility.
- **Fabric Mesh:** Contains widely spaced holes for permeability, going beyond transparency.
- **Wooden Mesh:** Crafted from treated timber panels, leveraging voids created during their fastening for flexibility.

4.2 Model (1): Using transparency in preserving what remains of a heritage building in the Nazlet El-Semman area and reusing it as an observatory under the name (CHEOPS OBSERVATORY[37]):

The design concept is centered on preserving the historical significance of a selected old building located next to the Great Pyramid of Khufu, while also expanding its utility in a manner that respects its value and location. The intention is to reconfigure, reconstruct, rehabilitate, and repurpose the building as an observatory, aligning with both its historical context and the

demands of the present day. The original building, built using locally available raw bricks and featuring traditional windows, reflects vernacular architecture. Although only a portion of the building remains, it will be repurposed in a way that integrates its materials with new ones, creating a connection between the vernacular, heritage, and contemporary eras within the structure. The design emphasizes transparency, incorporating glass elements to honor and interact with the heritage area, shown in the (Figure. 18).

Figure 18 shows the handling and repurposing of the remaining portion of the ancient building, which originates from the seventh century, into an observatory.

The observatory was strategically positioned in alignment with the Great Pyramid of Khufu, featuring an east-west orientation that offers an optimal vantage point for observing the paths of the sun and moon across the widest possible expanse, shown in the (Figure.19). This exceptional positioning facilitates the examination of the pyramid's relationship to the North Star, the onset of the equinox, and other celestial phenomena, contributing to the creation of architecturally and landscaped compositional relationships with logical continuity and harmonious views. This layout also enables compelling views of the pyramid from the garden, the pool, the time room, and even the reflections on the furniture.

Figure 19 shows the contemporary design of the observatory inspired by the Great Pyramid of Khufu

4.3 Model (2): Using transparency (metal mesh) in the display units of the Baron Palace Museum after its restoration and rehabilitation:

The Baron Empain Palace, a remarkable architectural achievement, was finalized in 1911 AD and is situated in the Heliopolis area. The palace's design draws inspiration from the Indian heritage, specifically the Angkor Watvi Temple in Cambodia and the Hindu temples of Orissa, shpwn in the (Figure.20). Comprising two floors and a basement, the first floor encompasses seven rooms, while the second floor houses four rooms[38].

Figure 20. Shows the architectural design of the Baron's Palace

The design concept revolves around preserving the distinctive architectural masterpiece of the palace while repurposing it into a museum, with the aim of narrating the history of the Heliopolis region. This historical journey starts with the ancient city of On, dating back to Pharaonic times, and continues through to the establishment of the neighborhood now known as Baron, while also spotlighting key Egyptian figures who significantly contributed to the establishment of the Heliopolis region.

Figure 21. Shows the design of display units for museum collections

Within the museum, a diverse collection of photographs, archival documents, illustrations, maps, and records pertaining to the history of the Heliopolis neighborhood (Heliopolis and Matareya) across different epochs is curated, showcasing its significant heritage landmarks and the lifestyle during that distinctive period. The approach of transparency was deliberately selected for presenting the museum's array of artifacts, achieved through the use of metal grilles. The manipulation of the spacing between the metal panels aims to maintain visual permeability, ensuring that the interior architectural features of the palace remain visible, while also creating a sense of separation and isolation for each display area. This approach fosters a connected narrative of the region's historical development throughout the exhibition, all the while preserving the building's internal integrity without causing any damage, shown in the (Figure.22)

Figure 22. Shows the relationship between the display units and the interior architecture of the palace

4.4 Model (3): Using transparency as an approach to displaying jewelry and collectibles belonging to the Alawite family in the Museum of the Royal Jewelery of the Alawite family:

The Alexandria[39] Royal Jewelry Museum stands as one of Egypt's largest museums, spanning approximately 4,185 square meters. It houses a significant collection of jewelry and artifacts from the Alawite family. Constructed between 1919 and 1923, the museum has undergone extensive preservation, restoration, and enhancement efforts over an extended period. Following its reopening in 2010, the museum introduced new amenities, including a library, a study hall, a restoration laboratory, and a comprehensive security system featuring fire protection and central air conditioning, among other facilities[40].

Figure 23. Shows the eastern and western wings and the main corridor that connects them palace

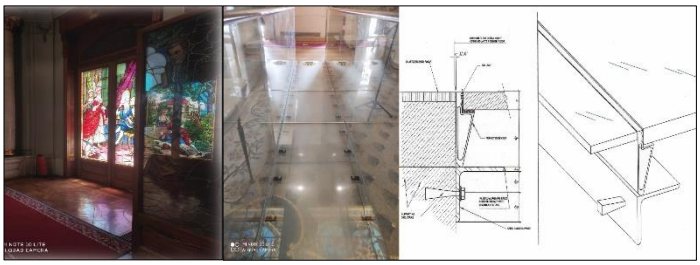


Figure 24. Shows the use of glass inside the museum

Transparency significantly influenced the interior design of the museum, particularly evident in the display units and the glass corridor within the main bathroom of the palace, ensuring the preservation of the palace's value and identity without compromising its interior architecture. Additionally, the use of colored stained glass has a profound impact, as it allows the sun's rays to be refracted through the colored glass onto the walls of the palace, creating a striking visual effect. This same effect is achieved through the ceilings adorned with colored stained glass paintings.

Figure 25. Shows he display units made of glass, explaining the lighting added to the unit and the installation method

In the main bathroom of the palace, a glass corridor was implemented to protect the Roman-style mosaic panel, known as the carpet panel, which forms the bathroom floor. Beyond the glass corridor, visitors encounter glass display units showcasing a collection of artifacts and oil paintings of the upper beds. Jewelry is exhibited within these glass display units, while oil paintings are presented in glass units affixed to the museum walls. Notably, one of the most renowned items on display is a chessboard, artfully exhibited within a glass unit with a mirrored base to reflect the intricate design of the board.

5. Applied study: The use of advanced transparent materials in the adaptive reuse of Qaitbay Citadel into a maritime military museum:

Figure 26. Shows the location of Qaitbay Citadel and its main tower

The applied aspect examines the utilization of state-of-the-art transparent materials in the adaptive reuse of the significant heritage building, Qaitbay Citadel in Alexandria[41], shown in the (Figure. 26). By integrating transparent materials into the design, we aim to establish a national maritime museum within the castle's ground floor, offering a simulated representation of Alexandria's maritime history and the battles it witnessed during the Mamluk era[42].

The adaptive reuse of the heritage building and leveraging its historical significance demands a careful approach that respects and safeguards its integrity. Hence, opting for transparency as a guiding concept for the adaptive reuse of the Qaitbay Citadel[43] into a national maritime museum is the most fitting choice due to the various benefits it offers. Transparency serves to underscore the building's importance, accentuate its value, and preserve its status, while also facilitating a

harmonious fusion of the building's historical significance with contemporary trends and technological advancements.

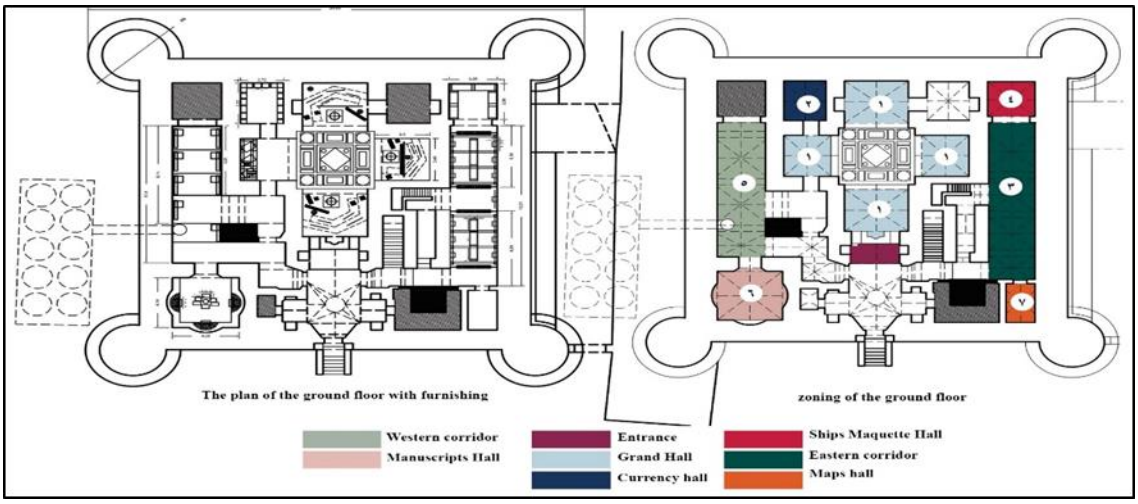
The concept of the National Maritime Museum aims to vividly depict and narrate the history of the castle and its naval engagements. Situated on the ground floor of the castle's main tower, the museum will house Egypt's significant maritime collections from the Mamluk era, encompassing maritime art, historical depictions, maps, manuscripts, official documents, ship models, scientific and navigational instruments, attire, and more. Transparency will be leveraged to bring the vision of the National Maritime Museum to life within the historic confines of the Qaitbay Citadel.

The Qaitbay Citadel occupies an expansive area of approximately 17,550 square meters, equivalent to around four acres. The outer walls encompass this entire space, while the focal point of the castle is the main tower situated on the north-western side[44]. Constructed from sturdy limestone, the main tower takes on a square shape. Adding to its architectural allure, four round towers emerge from the roof of the main tower, each with a diameter of 6 meters, elevating the structure to a height of 17 meters. Inside, the tower comprises three floors, with the entrance positioned on the southern side. The entrance reaches the height of the first floor and spans a width of 3 meters.

4.1 Study of the ground floor of the main tower of the castle using transparency for adaptive reuse and treatment of the internal space:

The ground floor encompasses various sections, with the prominent feature being the mosque, occupying over half of the floor space. Constructed in accordance with the Mamluk school system, the mosque comprises an open courtyard enclosed by four iwans. The courtyard's floor is adorned with coloured marble arranged in geometric patterns. Adjacent to the interior's right side is the eastern section, consisting of a lengthy corridor hall running parallel to the outer wall and housing several small rooms along the tower's southern side[45]. On the opposite side of the interior lies the western section, comprising a similar lengthy corridor parallel to the western wall and featuring a single room along the tower's southern side, shown in the Figure. 27.

Figure 27. Shows the ground floor of the main tower



4.2 Design concept of the ground floor:

The design concept is rooted in the fusion of Islamic architectural style[46] and maritime characteristics, accentuating the significance, historical context, and identity of the structure. Additionally, it incorporates contemporary elements through the use of transparent materials such as glass, acrylic, polycarbonate, wire and metal mesh, as well as wooden and rope mesh, to achieve transparency through optical transmittance.

4.2.1 First: the entrance - the reception area:

A wire mesh was employed in crafting the display unit, drawing inspiration from the Islamic star in the entrance of the castle, shown in the Figure. 28-29. Positioned between two layers of acrylic, it features the castle's name and a compass-inspired logo at its center. The selection of wire mesh was driven by its ability to achieve clarity, vision through optical transmittance, high flexibility, tensile strength, and overall lightness and simplicity. Meanwhile, acrylic was chosen for its transparency and high durability, as it is resistant to corrosion and well-suited to fluctuations in climate and humidity. The design is both removable and installable, leaving the heritage unaffected and seamlessly integrating with the natural surroundings. Furthermore, it serves to underscore and safeguard the building's identity and heritage value.

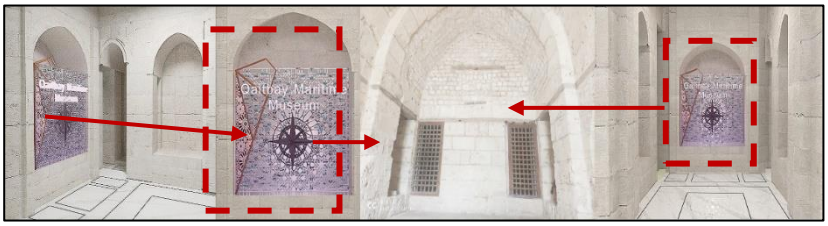


Figure 28. Shows design of the entrance

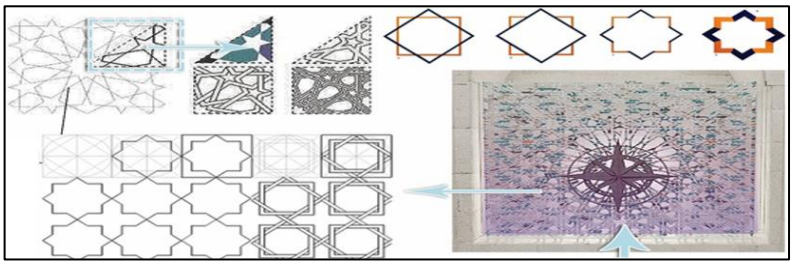


Figure 29. Shows the concept design of the entrance

4.2.2 Second: Western corridor:

The western section, situated to the left of the interior, comprises a hall designed as a lengthy corridor parallel to the western wall, inspired by Islamic arches[47]. The arches, measuring 4 meters in height and 18 millimeters in thickness, are arranged in a gradual form and crafted from transparent colored acrylic. Glass railings and metal runners support the arches, creating a color gradient that evokes a sense of grandeur and an illusion of depth. The choice of blue acrylic is influenced by the maritime character of the building, which historically served as an impregnable fortress defending against invasion from the sea, Also there is Acrylic display units, mounted on 3-meter-high metal mesh between the arches. The design not only accentuates the castle's identity and heritage value but also boasts flexibility, lightness,

Figure 30. Shows the concept design of the western corridor

simplicity, and high transparency. Furthermore, it is removable and reassembly, ensuring its adaptability for future needs, shown in the Figure. 30.

4.2.3 Third: Manuscripts Hall:

The western section of the hall features a room on its southern side, specifically designed to house manuscripts. The design incorporates transparent perforated white polyvinyl chloride fabric to create domes inspired by Islamic architecture, imparting a sense of depth. This fabric is affixed to metal units, with lighting positioned behind it to form compositions of Arabic letters that highlight exhibit details and historic Mamluk-era writings as decorative elements. The fabric offers varying levels of transparency, appearing opaque when lit from the front and highly transparent when backlit. A polycarbonate column adorned with Arabic script is situated in the center, encircled by acrylic display units mounted on mirror bases to reflect the castle's interior space. The units come in various dimensions and can be easily removed and installed without impacting the heritage site, seamlessly blending with the surrounding environment to achieve harmony, shown in the Figure. 31.

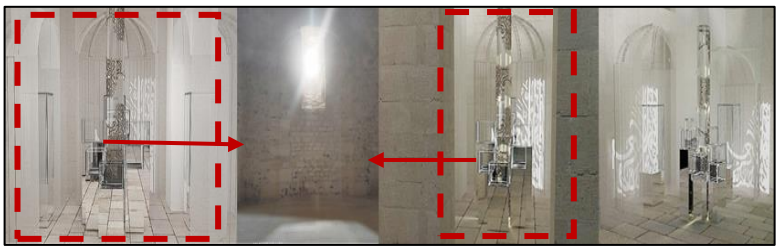


Figure 31. Shows the concept design of the western corridor

4.2.4 Fourth: The mosque:

The mosque area comprises more than half of the building's total area and follows the Mamluk school system. It features an open square courtyard surrounded by four iwans on all sides, with a floor adorned with colored marble in geometric patterns. The mosque's design aims to transform it into the Great Hall, symbolizing Egypt's naval and military history during the Mamluk era through an abstract concept that merges Islamic heritage, naval military elements, and the practical military uniform of that time. This design evokes a sense of journeying into the past and creates a reflective space, serving as a metaphor for space, heritage, and time. The use of three wire mesh panels to resemble a ship's sail, in addition to metal mesh for designing lighting units and lamps featuring abstract partitions inspired by Islamic motifs, adds to the ambiance. The three iwans showcase sculptures of Mamluk soldiers mounted on transparent concrete, while a wire mesh mosque with LED lighting above the marble floor serves as the centerpiece, with lighting units attached to the iwans' walls, shown in the Figure. 32.

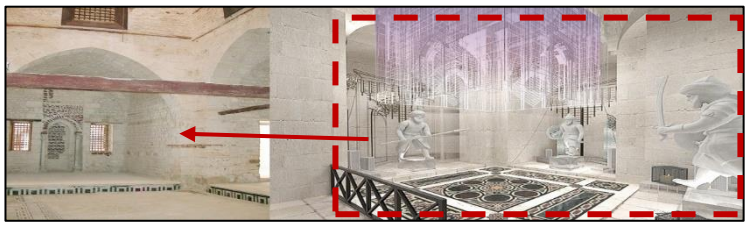


Figure 32. Shows the design of the mosque before and after. It also shows the interior design using transparency to simulate the Islamic history of Egypt in the Mamluk era

Wire mesh was used into the suspended mosque design at the center of the four iwans, positioned above the marble floor, with LED lights embedded in the iwans' walls. The use of wire mesh in the design is distinguished by its optical transparency, exceptional flexibility, tensile strength, and, most significantly, its lightweight, simplicity, and ease of disassembly and installation. These attributes help emphasize and preserve the building's Islamic identity and the heritage value of the site, shown in the Figure. 33.

Figure 33. Shows the design of the mosque before and after. It also shows the interior design using transparency to simulate the Islamic history of Egypt in the Mamluk era

4.2.5 Fifth: Coins hall:

The Coin Hall showcases the coins utilized during the Mamluk era. It is displays on acrylic display units (30 cm * 50 cm) arranged in a metal mesh at varying dimensions and heights, with the first level at 1.20 m and the second at 1.50 m. The design is known for its optical transparency, exceptional flexibility, tensile strength, lightweight nature, simplicity, and ease of disassembly and installation. Additionally, this design serves to underscore and safeguard the building's identity and the heritage significance of the site, shown in the Figure. 34.

Figure 34. Shows the interior design of the coin hall from the Islamic star

4.2.6 Sixth: Eastern corridor:

The eastern section is situated on the right side of the interior and comprises a long corridor-shaped hall running parallel to the external wall, along with several rooms on the southern side. The design of both the corridor and the adjacent room incorporates transparent materials like acrylic, glass, transparent concrete, wire mesh, and ship rope mesh. The arches in the design draw inspiration from Islamic architecture, paying homage to the castle's history and heritage. These arches have a height of 3m and a depth of 25cm, adding a distinct visual element to the overall design, shown in the Figure. 35.

Figure 35. Shows the interior design of the coin hall from the Islamic star

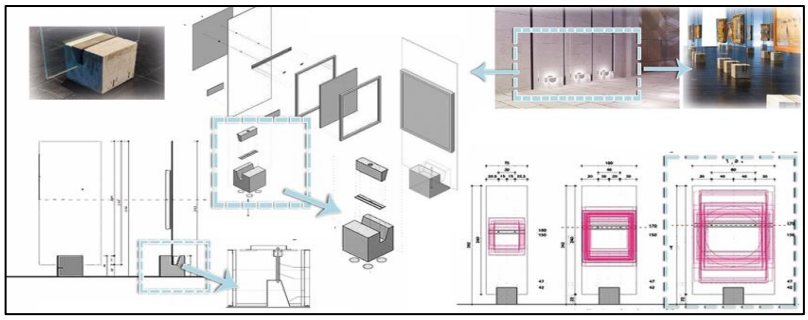


Figure 36. Shows the design of the eastern corridor

Within the arches, there are Islamic-style drawings reminiscent of the famous stained glass found in Islamic civilization, affixed to a transparent concrete base, shown in the Figure. 28. In the middle of the eastern corridor, acrylic display units (3.50 m * 0.40 cm) are mounted on a metal base with a height of 1.30 m. Positioned at the top is a wire mesh boat design suspended and secured to 3 cm thick beech wood columns, resembling ship wood and featuring LED lights, signifying the ship model hall at the corridor's end. Alongside the wooden mesh, paintings depicting the history of the castle are displayed on acrylic panels set in transparent concrete on both sides of the corridor.

6. Results:

In this research, we have explored the significant role of transparency in the preservation and treatment of heritage and historical buildings, considering the unique nature, environment, and cultural value of each building. As the nature, environment, and culture of each heritage building vary, we have drawn the following conclusions:

1. Transparency is an approach that can be adapted to suit different types of treatments in order to preserve the cultural and historical heritage of the building.
2. Transparency is a means that reflects the value of history and civilization that the heritage building expresses.
3. The success of transparency in dealing with heritage buildings and preserving them depends on the type of materials, design and objectives to be achieved in the heritage building.
4. Transparency through transparent materials or through visual permeability can express the civilized characteristics of architecture, the interior architecture of a building because it is characterized by achieving the desired aesthetic, functional and moral aspects.
5. Transparency is achieved by using advanced transparent materials and optical permeability, an open space characterized by flexibility, efficiency and effectiveness, controlling privacy, vision and clarity, achieving overlapping spaces, linking the design internally and externally, controlling the proportion of light and temperature, as well as close contact with nature and The surrounding environment .
6. The use of transparency in the complete and partial reconstruction and construction helps in rebuilding and integrating the building, visualizing the shape and structure of the heritage building, preserving its value and identity while benefiting from it again in a contemporary way.
7. The use of transparency in the rehabilitation of heritage buildings helps to use the building again while preserving its importance as well as rehabilitating it to accommodate a new function inside that does not conflict with the value of the heritage building.

8. Transparency helps in the development work by adding new elements that keep pace with development by using raw materials, as well as meeting the needs of the building and benefiting from it without harming it.
9. Transparency is widely used in extensions and additions to heritage buildings so as not to affect the building and not to hide its features. It also adds to the building new functions that keep pace with the development of the era.

7. Discussion:

Transparency can be achieved not only through materials characterized by inherent transparency but also through visual voids. Cognitive spaces can be categorized into perceptual spaces, which achieve transparency through materials, and visual spaces, which achieve transparency through permeability. If a void is absent, transparency is achieved perceptually through the materials; if a void is present, visual permeability achieves transparency.

Materials that enable transparency can be classified into three types: those with inherent transparency characteristics such as glass, those with added properties to achieve transparency like polymers and fabrics, and those that achieve transparency through optical spaces (transmittance) such as wire and metal mesh.

Technological development can have both negative and positive effects on heritage buildings. It can either harm the building or facilitate an appropriate integration of the heritage building with contemporary requirements and design.

Conclusion:

In this research, we focus on the significance of transparency in the preservation and treatment of heritage and historical buildings in relation to their cultural and civilizational value. By utilizing advanced materials to incorporate transparency, heritage buildings can be harmoniously integrated with modern treatment methods, thereby establishing a suitable approach to managing heritage in line with contemporary needs. This fosters a culture of appropriately revitalizing heritage buildings to align with development trends, utilizing contemporary designs to introduce positive changes that facilitate the integration of new functions and activities while upholding aesthetic and functional aspects. Furthermore, transparency serves as a means to showcase the historical and civilizational significance expressed by heritage buildings, bridging the past and present through contemporary designs.

Recommendation:

Heritage and historical buildings need special treatment and awareness for preservation, therefore, it is recommended to:

1. It is essential to ascertain the type and identity of the heritage building before initiating any treatment, in order to understand its characteristics and requirements, and to select the appropriate methods for its preservation and treatment.

2. The use of heritage and historical buildings, and deriving benefit from them, should affirm the value, identity, and significance of these valuable structures, without diminishing or altering them.
3. The success of the use of transparency in the methods of treatment and preservation of heritage buildings depends on the concept and type of design and on the objectives and nature of the factors chosen in the design.
4. The design concept should achieve the connection between the inside and the outside while reflecting the value of the heritage and history of the building and its importance and emphasizing its identity and cultural characteristics.
5. When deciding on the treatment for the interior architecture of heritage and historical buildings, it is crucial to select materials that interact sustainably with the building's environment, control the surrounding climate, and make the interior space adaptable to its surroundings.
6. This approach should be environmentally friendly and considerate of the building's ecosystem. The selection of a contemporary design that aligns with the building and its intended function should be based on a comprehensive study.
7. Selecting new functions and activities to be added to the heritage building should depends on their suitability and appropriateness to the building's nature and history.

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