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Engineering Vision in Historical Building Rehabilitation

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Abstract:

An engineering vision in the rehabilitation of historic buildings aimed at preserving the historical and cultural value of buildings while meeting the needs of modern society and achieving sustainability. This vision includes several principles and practices in the rehabilitation of historic buildings, including:

Respect for historical values: Attention is directed to preserving the historical and architectural characteristics of buildings, such as heritage details, original materials and unique designs. These values are preserved through the use of appropriate maintenance and restoration techniques.

Past-present compatibility: Historical elements are combined with modern techniques and materials to improve building functions and meet users' modern needs. Modern fittings are provided proportionately to the historical environment.

Use of sustainable materials: Sustainable and environmentally compatible materials are selected to reduce environmental impact and ensure the sustainability of historic buildings. Materials such as sustainable wood and high efficiency thermal insulators can be used.

Technical innovation: Modern technology and innovation are used in restoration and rehabilitation processes to facilitate the process and improve results. Such as the use of 3D modeling and 3D printing techniques to provide complex details and pieces.

Transparency and communication: All relevant parties, such as architects, designers, local populations and government entities, are involved in the rehabilitation of historic buildings. Continuous communication and consultation are encouraged to achieve overall compatibility and acceptance.

Keywords: Engineering Vision, Historical Building, Rehabilitation

Introduction:

Sustainability: The concept of sustainability is taken into account in the rehabilitation of historic buildings through improved energy efficiency, water management, effective use of resources and enhanced local environmental vitality.

These principles and practices reflect a comprehensive engineering vision in the rehabilitation of historic buildings. It aims to preserve and promote the architectural and historical heritage, as well as to improve and meet the needs of modern society and ensure the sustainability of buildings in the future

Historical Buildings are result of human thoughts and culture, also Considered that nations have been always known and studied through their culture and civilization, it is reasonable to state that architecture is an important entrance to understand privacy of specific society that have been formed through an interaction among social, economic and other aspects. technology evolved much further than anytime Accordingly, it is clear how crucially important to think in a certain way to deal with those building, to protect, revive and work to improve its sustainability and convenience by using advanced techniques and technologies, also to measure how suitable it is to being preserved by those techniques. Consequently, reaching to a reasonable and clear method to achieve its preservation and to preserve its historical and various properties.

As a result, the general axis for the research is identified with: The existence of informative gap in the current method of urban preservation, while the research's problem is the lack of clarity in the informative knowledge that should be available to achieve the protective preservation (Sustainable) for architectural heritage. Accordingly, that shows the research's target clearly, that is to identify suitable advanced methods to achieve the protective preservation (Sustainable) for architectural heritage.

The research depends on analytic and descriptive method, which includes forming an informative theoretical framework about the historical and heritage architectural buildings, preservation, protective preservation (Sustainable) and to brief most important variables and indications for each term. Accordingly, the research has conducted that preservation of historical and heritage buildings is related to design in the first place, and it is possible for creative thoughts and techniques to vary according to the design vision. And analyzing those thoughts within functional variables, as well as temporal and spatial enriching have shown that whenever taking a decision for a functional change, the new function turns up with clarity and purposely, which comes with a clear program and undergoes to the protective preservation's terms when preserved and directed

The rehabilitation of historic buildings refers to the renovation and restoration of existing historical buildings with the aim of preserving their historical value, culture and beauty, while making them capable of meeting modern and future needs. Rehabilitation of historic buildings is an artistic and technical challenge that requires specialized knowledge and skills to preserve the original features of buildings and balance heritage with contemporary needs.

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The rehabilitation of historic buildings includes several steps and phases, including:

Situation assessment: The building's condition is assessed and its historical, architectural and structural features are analyzed. This includes analysis of damage, erosion, structural damage and assessment of the original impact of the building.

Design and planning: A plan and strategy for the rehabilitation of the building is developed based on the previous assessment. This includes defining objectives and requirements and identifying appropriate measures to preserve heritage and improve the building's function.

Restoration and renovation: This phase involves repairs for restoration and renovation, including repair of the structure, restoration of historical elements, decorations and renovation of roofs, floors, walls and ceilings.

Advanced technologies: Advanced technologies such as 3D modeling and building scanning can be used to help design, implement and ensure the accuracy of work.

Use of traditional materials: Traditional and original materials are preferred in restoration processes to maintain compatibility with the historic building. Traditional techniques can be used in the manufacture and installation of materials to achieve authenticity and quality.

Follow-up and maintenance: After the rehabilitation of the building, periodic maintenance must be provided to maintain the condition of the building and ensure the continuity of the preservation of its historical value and structural stability.

The importance of rehabilitating historic buildings lies in preserving the community's architectural and cultural heritage, promoting tourist attraction and promoting local identity. Rehabilitation processes must be carried out with high professionalism and in cooperation with competent

authorities and the community to ensure that the cultural and historical values of historical buildings are preserved.

Steps to restore old buildings:

Restoring old buildings is a meticulous process that requires careful planning and execution. Here are the general steps involved in restoring old buildings:

Assessment and Documentation:

Conduct a thorough assessment of the building's condition, including its structural stability, architectural features, and historical significance.

Document the existing condition of the building through surveys, photographs, and drawings.

Research and Planning:

Research the historical background of the building, including its original design, materials, and construction techniques.

Develop a restoration plan that outlines the objectives, scope of work, and timeline for the project.

Obtain necessary permits and approvals from relevant authorities.

Structural Repairs and Stabilization:

Address any structural issues by conducting necessary repairs and reinforcements to ensure the stability and safety of the building.

Replace damaged or deteriorated structural elements while preserving the original design and character.

Preservation of Architectural Features:

Identify and preserve the building's unique architectural features, such as ornamental details, decorative elements, and historical artifacts.

Repair and restore damaged or deteriorated architectural elements using appropriate conservation techniques and materials.

Restoration of Interior Spaces:

Restore interior spaces to their original design and functionality, including walls, floors, ceilings, and architectural details.

Repair or recreate decorative elements, such as moldings, trim, and fixtures, in line with the building's historical style.

Mechanical, Electrical, and Plumbing (MEP) Upgrades:

Upgrade the building's MEP systems to meet modern safety and efficiency standards, while minimizing the impact on the building's historic fabric.

Integrate modern technologies and energy-efficient solutions into the building's infrastructure, such as HVAC systems and electrical wiring.

Finishes and Finishing Touches:

Apply appropriate finishes and coatings to protect and enhance the building's exterior and interior surfaces.

Pay attention to details, such as paint colors, textures, and materials, to maintain the historical authenticity and character.

Landscaping and Site Development:

Enhance the surrounding landscape and site elements to complement the restored building.

Pay attention to the site's historical context, incorporating traditional landscaping elements and preserving any significant outdoor features.

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Ongoing Maintenance and Monitoring:

Establish a regular maintenance plan to ensure the long-term preservation of the restored building.

Monitor the building's condition and address any issues promptly to prevent further deterioration.

It's important to note that the specific steps and approaches may vary depending on the building's unique characteristics, historical significance, and local regulations. Hiring experienced professionals, such as architects, engineers, and preservation specialists, is crucial for a successful restoration project.

Study of the building's current situation:

Begin by conducting a comprehensive study and assessment of the building's current condition. This includes inspecting both the interior and exterior of the building, as well as its structural elements, architectural features, and systems.

Identify any damage, deterioration, or structural issues that need to be addressed during the restoration process.

Document the building's existing state through photographs, measurements, and detailed notes to serve as a reference throughout the restoration project.

• Historical research and documentation:

Conduct thorough research on the building's history, including its original purpose, architectural style, and significant events or occupants.

Gather historical documents, photographs, and records related to the building, if available, to gain a deeper understanding of its original design and characteristics.

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Consult with local historical societies, archives, or experts to gather additional information about the building's historical significance.

• **Define restoration objectives and scope of work**:

Determine the goals and objectives of the restoration project. This could involve preserving the building's historical integrity, enhancing its structural stability, or adapting it for a new use while maintaining its original character.

Clearly define the scope of work, including the specific areas and elements that will be restored and the desired outcome.

• **Develop a restoration plan:**

Create a detailed restoration plan that outlines the necessary steps, timeline, and budget for the project.

Consider factors such as the availability of skilled craftsmen, availability of historical materials, and any local regulations or preservation guidelines that need to be followed.

• **Engage a team of experts:**

Assemble a team of professionals with expertise in historic preservation, architecture, engineering, and other relevant disciplines.

Collaborate with architects, engineers, historians, and preservation specialists to develop a comprehensive restoration approach that aligns with the building's historical significance and meets modern safety and functional standards.

• **Implement restoration measures**:

Begin implementing the restoration plan, which may involve various activities such as structural repairs, masonry restoration, woodwork repairs, window restoration, roof repairs, and interior finishes.

Use traditional and compatible materials and techniques to maintain the building's original aesthetic and ensure the longevity of the restoration work.

• **Periodic inspections and adjustments:**

Conduct periodic inspections throughout the restoration process to assess the quality of the work and make any necessary adjustments or corrections.

Monitor the building's progress and address any unforeseen challenges or issues promptly to ensure the successful completion of the restoration project.

• **Ongoing maintenance and preservation:**

Develop a long-term maintenance plan to preserve the restored building's integrity and prevent future deterioration.

Regularly inspect and maintain the building's structural elements, systems, and finishes to extend its lifespan and retain its historical value.

It's important to note that the restoration process should always consider the unique characteristics of the building, adhere to local preservation guidelines, and involve consultation with relevant authorities and stakeholders to ensure the preservation of the building's historical significance.

Application of soil tests and basic building materials:

When it comes to the restoration of old buildings, soil tests and analysis of basic building materials are crucial steps to ensure the success and longevity of the project. Here's an overview of these steps:

Soil Tests:

Conduct soil tests around the building's foundation to assess its load-bearing capacity and stability.

Determine the soil composition, moisture content, and other relevant factors that may impact the building's structural integrity.

The soil tests will help determine if any modifications or reinforcements are necessary to support the building properly.

Analysis of Building Materials:

Identify the original building materials used in the construction, such as bricks, stones, timber, mortar, plaster, etc.

Assess the condition and durability of these materials to determine their structural integrity and suitability for restoration.

Conduct material testing and analysis, such as mortar composition testing, to understand the properties and characteristics of the existing materials.

Compatibility Assessment:

Evaluate the compatibility of new building materials that may need to be introduced during the restoration process.

Consider using materials that match the original ones in terms of composition, appearance, and performance.

Ensure that the new materials will not negatively impact the structural stability or historic value of the building.

Structural Integrity Evaluation:

Engage a structural engineer or a team of experts to assess the building's structural integrity.

Evaluate the load-bearing capacity of the existing structural elements, such as beams, columns, and foundations.

Determine if any reinforcement or repairs are needed to ensure the building's stability.

Preservation of Original Materials:

Prioritize the preservation and reuse of original building materials whenever possible.

Assess the condition of existing materials and identify any areas that require restoration or replacement.

Employ conservation techniques to repair or stabilize the original materials, preserving their historic value and authenticity.

Selection of Suitable Replacement Materials:

If replacement materials are necessary, choose materials that closely resemble the original ones in terms of appearance, texture, and performance.

Consider using reclaimed or salvaged materials to maintain the historic character and reduce the environmental impact of the restoration.

Quality Assurance:

Ensure that all building materials, whether original or new, meet quality standards and conform to relevant regulations.

Work with reputable suppliers and contractors who have experience in historic building restoration.

Monitor the quality of materials during the restoration process and conduct periodic inspections to ensure adherence to specifications.

By conducting soil tests and analyzing building materials, you can make informed decisions during the restoration process and ensure the use of

suitable materials that will enhance the structural stability and authenticity of the building. Consulting with professionals and following best practices in historic preservation will help you achieve the desired results while maintaining the building's historical significance.

Restoration is an essential part of the rehabilitation of historic buildings. The restoration process involves many steps and procedures that are followed to restore the construction to or near its original state. Here's an overview of the restoration process:

Preparation and evaluation:

Study available documents and information on the building, including original drawings, historical documents and photographs, if any.

Assess the condition of the building and identify problems and damage that need repair and restoration.

Planning:

Develop a detailed plan for the restoration process that includes objectives, tasks, timetable and budget.

Identify appropriate techniques and materials for restoration and provide them.

Remove damage:

Perform operations to remove damage and pollution, such as cleaning surfaces and removing corrosive or inappropriate layers.

Repair of basic structure and restoration:

Repair damaged structural elements such as walls, columns, ceilings, and flooring.

Replace bad or damaged elements with new ones that mimic the original shape and material as much as possible.

Restoration of architectural and decorative elements:

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Restoration and repair of distinctive architectural elements such as windows, doors, decorations, and statues.

Use sculpture and forming techniques to restore decorative details and historical authenticity.

Restore colors and finishes:

Identify the original colors and finishes of the building and restore them to their original condition.

Use appropriate coloring and finishing techniques for materials used in restoration.

Future documentation and maintenance:

Document every step and process done in the process of restoration through photography and written documentation.

Develop a future maintenance plan for the building to maintain its condition after restoration and avoid future damage.

With the restoration process, standards and guidelines must be adhered to preserve historical construction, collaborating with a team of experts specializing in the preservation of cultural and architectural heritage.

Re-employment of heritage buildings:

The re-employment or adaptive reuse of heritage buildings involves repurposing these buildings for different functions while preserving their historical and architectural value. Here are some steps and considerations for the re-employment process:

Feasibility Study:

Conduct a feasibility study to assess the viability of repurposing the heritage building for a new use.

Evaluate factors such as market demand, economic viability, and compatibility of the building's features with the proposed use.

Preservation and Conservation:

Ensure that the re-employment plan respects and preserves the historical and architectural significance of the building.

Identify and protect the original features, materials, and character-defining elements during the renovation process.

Functional Adaptation:

Assess the building's layout and structural elements to determine the necessary modifications for the new use.

Ensure compliance with building codes, accessibility requirements, and safety regulations.

Synergy with Surroundings:

Consider the integration of the heritage building within its surroundings and the local community.

Explore how the new use can complement the existing urban fabric and contribute to the overall revitalization of the area.

Sustainable Design:

Incorporate sustainable design principles and practices in the re-employment process.

Implement energy-efficient systems, renewable energy sources, and sustainable materials to minimize the building's environmental impact.

Collaborative Approach:

Engage a multidisciplinary team of professionals, including architects, engineers, historians, and community stakeholders.

Foster collaboration and consultation to ensure that the re-employment project aligns with the needs and aspirations of the community.

Public Engagement and Education:

Involve the local community in the decision-making process and raise awareness about the value of heritage buildings.

Develop educational programs and public exhibitions to showcase the history and significance of the re-employed building.

Ongoing Maintenance and Monitoring:

Establish a long-term maintenance plan to preserve the building's integrity and prevent future deterioration.

Regularly monitor the building's condition, address maintenance needs promptly, and adapt to changing requirements.

The re-employment of heritage buildings offers opportunities to revitalize urban areas, promote cultural heritage, and contribute to sustainable development. It requires careful planning, collaboration, and a deep appreciation for the historical and architectural value of the building.

The Public Monuments Act No. 21 of 1988 is the law governing the protection and preservation of Egypt's cultural heritage and monuments. The Act aims to regulate the legislative and executive process on public effects and to achieve their conservation and sustainable management. The main provisions of the Public Monuments Act are outlined below:

Definition of general effects:

The law includes a comprehensive definition of public monuments, including archaeological sites, historical buildings, antiques, movable monuments, churches, mosques, monasteries, etc.

Protection of effects:

The Act provides for the protection of public effects from damage, sabotage, bulldozing, unlawful encroachment and illegal transfer.

The law contains strict provisions providing for legal penalties for those who commit crimes of damage or destruction of public monuments.

Management of impacts:

The law provides for the establishment of the Egyptian Antiquities Authority, which is responsible for the management, preservation and implementation of policies to preserve public antiquities.

Laws and regulations deriving from the Act stipulate that licenses and permits must be obtained from the Authority for any activity related to public effects.

Sustainable development and real estate projects:

The law urges that real estate and development projects be directed to take into account the protection and preservation of public effects.

The law requires an assessment of the environmental and cultural impacts of potential real estate projects and consultation with the Commission before they are approved.

Addressing smuggling and illegal trafficking:

The Act contains provisions aimed at eliminating smuggling and illegal trafficking of monuments, including strengthening international cooperation to restore the plundered effects.

The Public Monuments Act No. 21 of 1988 is an important legal framework for protecting Egypt's cultural and historical heritage and ensuring that public monuments are preserved for future generations. The law is implemented in cooperation with many authorities concerned with preserving the country's heritage.

The Environmental Protection Act No. 12 of 1995 regulates the protection and preservation of Egypt's environment. The Act aims to preserve and improve the quality of the environment and reduce pollution and

environmental damage. The most important provisions of the Environmental Protection Act are outlined below:

Classification and Evaluation:

The law includes a classification of human activities and projects that may affect and damage the environment.

The law provides that environmental impacts of new activities and projects should be assessed before implementation.

Authorization of activities:

The law requires environmental licenses and permits for activities required by the law's implementing regulations.

Appropriate implementing regulations require environmental performance standards and environmental protection controls for licensing.

Pollution Reduction:

The Act provides for the reduction of pollution and the preservation of the purity of air, water, soil, marine environment and wetlands.

The Act establishes limits and standards for emissions and environmental disposal of industrial plants, agricultural operations, transport and others.

Reduce noise and vibrations:

The law requires the identification of standards and limits for noise and vibrations resulting from industrial activities, construction, transportation, public works, etc.

Waste management:

The Act provides for the regulation and management of the disposal of solid, liquid and hazardous wastes and encourages recycling and the effective use of resources.

Environmental Protection Act No. 12 of 1995 aims to ensure environmental protection, control of pollution and preservation of Egypt's ecosystem. The law is implemented by the Ministry of Environment and

other regulatory bodies concerned with environmental protection in the country.

The life of a building:

The life of a building refers to its lifespan from the time of its construction to its eventual demolition or repurposing. It can be divided into different stages, each with its own characteristics and considerations:

Design and Construction: This stage involves the planning, design, and construction of the building. Architects, engineers, and construction professionals collaborate to create the building's design and ensure its structural integrity.

Occupancy and Use: Once the building is completed, it enters the occupancy and use stage. It is occupied and utilized for its intended purpose, whether it's residential, commercial, industrial, or institutional. During this stage, the building requires regular maintenance and operation to ensure its functionality and safety.

Maintenance and Upkeep: Proper maintenance is crucial to prolonging the life of a building. Regular inspections, repairs, and upgrades are necessary to address any structural issues, mechanical failures, or cosmetic wear and tear. This stage also includes the management of utilities, such as electrical systems, plumbing, and HVAC (heating, ventilation, and air conditioning) systems.

Renovation and Retrofitting: Over time, buildings may require renovations or retrofitting to accommodate changing needs, comply with updated building codes, or incorporate new technologies for energy efficiency and sustainability. Renovations can involve interior modifications, facade improvements, or system upgrades.

Repurposing or Demolition: As a building ages, its original purpose may change or become obsolete. In such cases, the building can be repurposed

for a different use, such as converting a factory into loft apartments or turning an old school into office space. If repurposing is not feasible or cost-effective, the building may be demolished, and the site can be used for new construction.

It is important to note that the life of a building can be extended through proper maintenance, adaptive reuse, and sustainable practices. Additionally, considerations for environmental impact, energy efficiency, and longevity should be taken into account during each stage of a building's life to promote sustainable development and reduce the carbon footprint associated with construction and demolition.

Policy for the rehabilitation and adaptive reuse of constructed buildings:

The policy for the rehabilitation and adaptive reuse of constructed buildings focuses on promoting sustainable development, preserving cultural heritage, and maximizing the potential of existing structures. Here are some key elements that are typically included in such a policy:

Preservation and Documentation: The policy emphasizes the importance of identifying and preserving buildings of historical, cultural, or architectural significance. It may include guidelines for documenting the building's original features, materials, and construction techniques.

Assessment and Feasibility: The policy outlines the process of assessing the condition and structural integrity of existing buildings to determine their potential for rehabilitation and adaptive reuse. This may involve conducting surveys, feasibility studies, and cost-benefit analyses to evaluate the viability of the project.

Regulatory Framework: The policy provides a regulatory framework that governs the rehabilitation and adaptive reuse process. It may include

guidelines, codes, and standards for building safety, accessibility, and conservation.

Design and Planning Guidelines: The policy provides design and planning guidelines to ensure that the rehabilitation and adaptive reuse projects are carried out in a sustainable and aesthetically pleasing manner. It may encourage the use of environmentally friendly materials, energy-efficient technologies, and innovative design approaches.

Financial Incentives: The policy may offer financial incentives, such as tax credits, grants, or low-interest loans, to encourage property owners and developers to undertake rehabilitation and adaptive reuse projects. These incentives can help offset the costs associated with renovating and repurposing existing buildings.

Stakeholder Engagement: The policy emphasizes the importance of involving stakeholders, including local communities, heritage organizations, and experts in the rehabilitation and adaptive reuse process. Collaboration and public consultation can ensure that the projects align with community needs and aspirations.

Monitoring and Evaluation: The policy establishes mechanisms for monitoring and evaluating the outcomes of rehabilitation and adaptive reuse projects. This helps assess the effectiveness of the policy and provides valuable insights for future projects.

By implementing a comprehensive policy for the rehabilitation and adaptive reuse of constructed buildings, communities can revitalize urban areas, preserve cultural heritage, reduce urban sprawl, and promote sustainable development.

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Conclusion:

In conclusion, the engineering vision in historical building rehabilitation plays a vital role in preserving our cultural heritage, promoting sustainable development, and ensuring the longevity of these valuable structures. By applying engineering principles, expertise, and innovative approaches, we can breathe new life into historical buildings while respecting their historical and architectural significance. The rehabilitation process requires a multidisciplinary approach that considers structural integrity, preservation of original features, energy efficiency, and accessibility. Additionally, sustainable materials, technologies, and construction practices should be employed to minimize environmental impact and enhance the building's performance. Collaboration between engineers, architects, historians, and local communities is crucial to ensure that rehabilitation efforts align with cultural and societal needs. Through a well-executed engineering vision, historical buildings can be transformed into functional, safe, and sustainable spaces that contribute to the cultural identity and economic vitality of our cities.

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