

Kurdistan Region - Iraq
University of Cihan – Sulaymaniyah
Department of Architectural Engineering



Building Rehabilitation

LECTURER: SARKO HASSAN SLEMAN

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1. Introduction of Rehabilitation

- ▶ **Rehabilitation** is defined as the act or process of making possible a compatible use for a property through **repair, alterations,** and **additions** while preserving those portions or features which convey its historical, cultural, or architectural values.

2. Importance of Rehabilitation

There has been a growing concern both in a developed and developing countries concerning **the rehabilitation problems in structure**. People need to live in a shelter. Therefore, the need to accommodate a growing population and the **concern for the old buildings** "for their aging and deterioration" have drawn the attention of engineering professionals and governments at the local, state and federal levels.



Rehabilitation of heritage buildings is the result of the need to improve existing buildings for new conditions of use, and also of the recognition of the importance of conservation of the architectural heritage.

Existing buildings are subjected to processes of degradation with time, which leads to a situation in which they became not able to achieve the purpose for which they have been built. Sometimes, there is also the need to improve the conditions offered by the existing buildings or to adapt them to new functions

3. Reasons For Rehabilitation

- ▶ Need for more space
- ▶ Availability of old buildings
- ▶ Cost-effectiveness
- ▶ Government motivation for such work.
- ▶ The existence of visible failings in the building;
- ▶ Damage after a particular event that affects its stability (earthquake, etc.)
- ▶ The change of the use of the building for most severe conditions

4. Principles for Rehabilitation

The **Venice Chart** (1964), for example, which is one of the **reference documents** for the rehabilitation of architectural heritage, protects the adoption of the following principles:

- Guarantee of structural safety
- Respect for the cultural value of the building;
- Minimum intervention
- Reversibility of the intervention;
- Integration on the whole building;
- Compatibility of the materials;
- Minimum cost.

5. Standards for Rehabilitation

- ▶ 1. A property will be **used** as it was historically or be given a new use that requires **minimum change** to its distinctive materials, features, spaces, and spatial relationships.
- ▶ 2. The **historic character** of a property will be **retained** and **preserved**. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be **avoided**.
- ▶ 3. Each property will be **recognized** as a physical record of its **time, place, and use**. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.
- ▶ 4. Changes to a property that have acquired **historic significance** in their own right will be retained and preserved.
- ▶ 5. **Distinctive materials, features, finishes, and construction techniques** or examples of craftsmanship that characterize a property will be preserved.

- ▶ 6. **Deteriorated** historic features will be **repaired rather than replaced**. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be proved by documentary and physical evidence.
- ▶ 7. **Chemical or physical treatments**, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.
- ▶ 8. **Archeological resources** will be protected and preserved in place. If such resources must be disturbed, modification measures will be undertaken.
- ▶ 9. **New additions**, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property.
- ▶ 10. New additions and adjacent or related new construction will be undertaken in a such a manner that, if removed in the future, **the essential form and integrity** of the historic property and its environment would be undamaged.

6. THE EXISTING INFORMATION ON THE BUILDING

6.1. Documented data about the building

- A. The historical survey
- B. Survey of the construction of the building
- C. Survey of the defects in the building

6.2. Preliminary assessment defects in the building

- A. Degradation of building materials
- B. Damage to building elements

6.1. Documented data about the building

A. **The historical survey**

Any intervention (meditation) for structural rehabilitation of a heritage building needs information about its past, namely, about the **concept of the building**, as well as about the phenomena to which the building has been subjected.



B. Survey of the construction of the building

The construction of the building, including its shape, the types of structural components, and the materials used, are aspects that will need considerable attention. Important points on this survey are the **identification of the building materials and of main structural system of the building**, as well as the detection of irregularities or weak points in the building that can have influenced its structural behavior.



C. Survey of the defects (weakness) in the building

The survey of the existing weaknesses in the building is usually called **preliminary inspection** (primary checking) of the building. This survey will be carried out through **visual inspection** of the building, eventually, with the help of simple **optical devices** (binoculars, etc). In some cases the opening up of the surface of elements of the building, will be required.

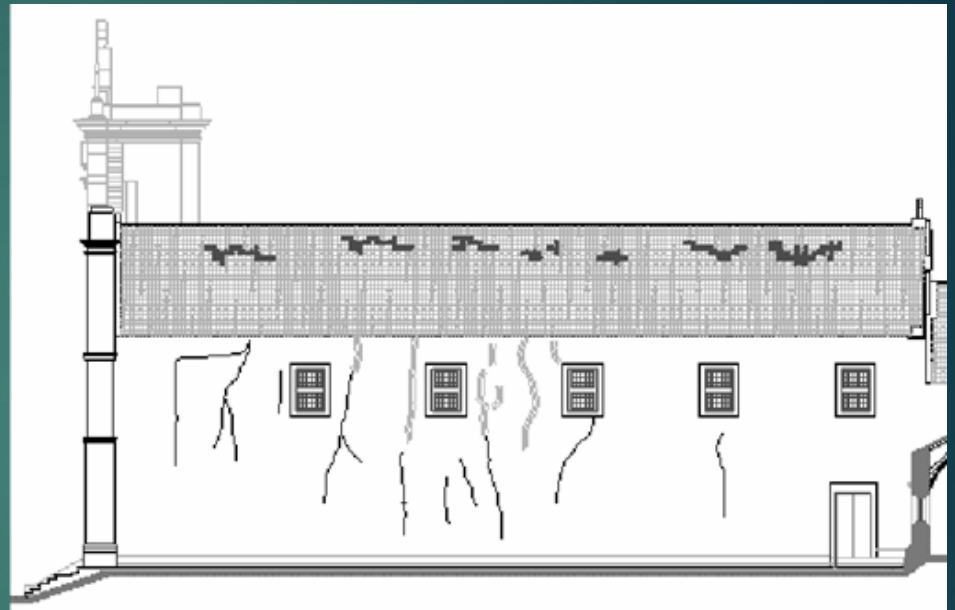


Figure.1 :Mapping of the failings in a building

6.2. Preliminary assessment (calculation)

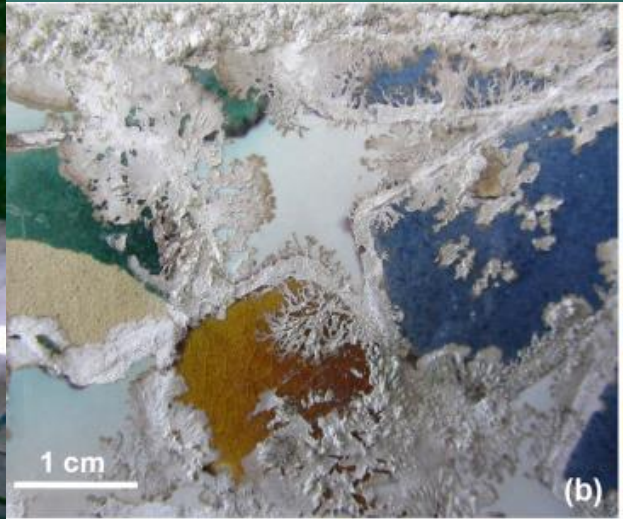
After the preliminary inspection, and taking into account the documented information, a preliminary assessment of the situation in the building will be carried out. This preliminary assessment aims to decide about the need to continue (or not) the investigations and about the final need for urgent measures to be undertaken, related, namely, to the continuation of the use of the building, or to the installation of temporary supports.

A. Degradation of building materials

1. **Masonry:** The degradation of masonry is linked to the characteristics of the **basic materials:** bricks, blocks (of stone or concrete), and mortar filling the joints. It will be necessary to **correctly identify the materials:** the stone (limestone, sandstone, etc.), the bricks (fired or sun dried, etc.), and the type of mortar (cement, lime, etc.).



Figure.2: Degradations
in stone masonry






2. **Timber:** The main causes of the degradation of timber are the attack by **fungus and insects**.

Timber with all types are variably liable to degradation and attack, so, a very important issue is the **correct identification** of the specie of the timber element. The favorable conditions for the development of fungus in timber are **water content** higher than about **20%** and high temperatures (**25 to 35°C**). The insects (worms, etc.) develop in drier environments.



Figure.3 : Timber degradation



3. **Steel:** The greatest problem with steel and iron elements is **corrosion**, in particular, of the connections by rivets or bolts.


Another important problem to be taken into consideration is the last corrosion of the steel elements inserted in masonry elements, which can lead to the separation of those elements, due to the increase of volume resulting from the rust. It is also to be noted that the iron or steel of old buildings are, in general, less ductile and less resistant to fatigue than the iron or steel produced nowadays.

b. Damage to building elements

1. **Walls and columns** The relevant actions for the damage to walls and columns are, in general, the vertical loads: self-weights, weights of the floors, etc. Lateral actions, namely the thrust of arches and earth pressure, and, particularly, the effects of earthquakes are also, sometimes, very relevant.
2. **Arches, vaults and domes** In arches, vaults or domes in masonry the main source of problems is the movement at the supports, with the development of tension, and, as a consequence, the opening of cracks.



Figure.4 : Damage in walls due to earthquakes



3. Towers and chimneys These types of elements are characterized by being, in general, subjected to high compression stresses in the bottom zone, which can lead to the development of vertical cracks, as referred to for walls.

4. Framed elements The main problems encountered with framed elements of timber or steel, used as the structure of the roofs or floors of buildings, are the deformation of the elements or of the joints, due to excessive loads or to actions not taken into account in the design, such as earthquakes.



Figure.5 : Cracks in a masonry vault



Figure.6: vertical cracking in masonry chimney

Thank You

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