



The role of architect in earthquake protection of cultural heritage

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Abstract

Cultural heritage, both tangible and intangible, is a unique expression of human achievement in the past and provides invaluable insights into our evolution and identities. The meaning and the treatment of cultural heritage through the history has been constantly exposed to changes but in the last century it finally takes the rightful place. Historical buildings, monuments and archeological sites are constantly exposed to the adverse impacts of natural factors. In high seismicity areas, earthquakes were the dominant factor which cause damage and partial or complete collapse on many historic structures. Protection of cultural heritage is multidisciplinary task that combines tradition with modern techniques and includes professionals from different fields. Generally speaking, the process of historical buildings protection is radically different and more complex than the repair process of common structures, due to the priority of preserving the aesthetic, architectural and historical values in relation to keep the building functionality. A team of experts from different fields, such as archaeologists, conservators, civil engineers, art historians and other professionals, is vital for successful protection of every historical monument, but the architect is the one who coordinate the whole process and unite all the participants. This paper aims to present the methodology for proper and effective protection of historic buildings in seismically active regions, primarily through the coordinating role of the architect. It highlights not only that the architects needs to develop a wide array of skills and knowledge to carry out any work on historical buildings and sites, but also that an architect have an essential role in identifying the potential challenges and opportunities of historic buildings, extend its lifetime and enhance the values.

Key words: cultural heritage, earthquake protection methodology, team of experts, role of the architect

1 Introduction

The main foundation of every society and country is its culture. Culture is not something we create in a day, but a long process that lasts and develops for centuries. Cultural heritage is the legacy from past generations and plays an important role in our everyday life. It connects us to the past, promotes a sense of social and common identity and provides economic development and poverty reduction, [1].

United Nations Educational, Scientific and Cultural Organization (UNESCO), generally, classifies cultural heritage as tangible or intangible. Tangible cultural heritage has a physical presence and includes architectural heritage and artistic creations of human creativity. Intangible cultural heritage represents wealth of knowledge, skills, tradition and rituals that are transmitted from one generation to another. Architectural heritage refers to sites, monuments and buildings with outstanding cultural, historical, emotional and physical values that have been increased over the years. These standing witnesses from past generations should be preserved at the present and, in all their uniqueness and authenticity, passed on to the next generation, [1, 2]. But, without the right care and attention, great part of our heritage faces an uncertain future. It is estimated that during the twentieth century almost 50 % of Europe's tangible cultural heritage was lost. Adverse impacts of natural and technological hazards, atmospheric pollution, excessive tourism and urbanization lead to gradual degradation and in some cases destruction of movable and immovable heritage. Lack of maintenance and the loss of traditional knowledge have also increased the vulnerability of cultural heritage assets in many regions of the world, [1, 3].

The idea of preserving our cultural heritage, especially architectural heritage, has existed for many centuries, but started to implement during the 19th century, when it became clear that great part of it was permanently lost. In the second half of the XX century, especially after the post war period, this idea was brought on international level. Many organizations were involved in promoting and support of cultural heritage protection and were engaged in developing educational programs, training professional staff and supporting research in this area, [3].

Especially challenging is the preservation of cultural heritage located in seismically active regions. In areas with high seismicity, earthquakes were the dominant factor and cause of partial or complete collapse of many historic buildings. We cannot reduce the intensity of the earthquakes, neither to predict the earthquakes, but we can take appropriate measures to reduce the vulnerability and potential damages on the buildings. Safety of the monuments is compared with the need for conservation, [4].

Modern conservation of cultural heritage refers to protection, maintenance and care of historic buildings and sites, [2]. It requires a multidisciplinary approach and brings together professionals from many different fields, like architects, engineers, historians, archaeologists, landscape architects etc., [5, 6]. Architectural preservation refers to protection of architecture elements or values that are considered significant. It im-

plies simultaneous care of two different aspects: the historical material and the artistic value of the works. In this process, the architect combines art and science, tradition and modern techniques in order to preserve architectural, aesthetic, cultural and historical values of the monument, [2].

2 A brief history of international organizations for cultural heritage protection

Until the end of the 19th century, architectural heritage was only a matter of national character. Cultural heritage associations existed in every country, but their scope did not exceed the national borders, [3]. The Athens Conference (1931) and the Athens Charter (1933) represent a major step forward, as for the first time in history the concept of international cultural heritage is introduced. The idea of creating an international movement for the protection of cultural heritage emerged as a result of the two world wars, especially after the Second World War with the establishment of United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1946, as one of the independent specialized agencies of the United Nations to promote international cooperation in the field of education, science and culture. Then in 1954 Hague Convention followed and it was the first international agreement focusing exclusively on the protection of cultural property in armed conflict and now it is ratified by 133 countries worldwide, [7].

The first congress of architects and specialists of historic buildings, held in Paris in 1957, points out that there is a lack of a central organization in the protection of historic buildings, so in 1959 all UNESCO members created the intergovernmental center ICCROM (the International Center for the Study of the Preservation and Restoration of Cultural Heritage), which currently has 137 member states. The role of ICCROM was to promote protection of all forms of cultural heritage, to support research in this area, to develop educational programs for the training of professionals and to raise the standards of restoration processes. For these needs, a specialized library, training programs, courses and research projects have been developed, [4].

At the Second Congress of Architects and Specialists in Historic Buildings, held in 1964 in Venice, 13 resolutions were adopted. The first one was the Venice Charter and the second one, in 1965, led to the creation of ICOMOS (the International Council on Monuments and Sites), [7] as a non-governmental organization of individual experts which are devoted to improving the preservation of heritage and promoting methodology and techniques for architectural and archaeological heritage protection, [8].

The Venice Charter has been and continues to be one of the most important international conservation documents. This Charter defines the internationally accepted standards of conservation practice relating to architectural heritage and sites. It sets out the principles of conservation based on the concept of authenticity and the importance of maintaining the physical and historical context of buildings or sites as a historical witnesses and not just as a work of art, [9].

The last in the series is Blue Shield International, in 1996, formed by the four main non-government organizations (ICOMOS, ICA-International Council of Archives, ICOM-International Council of Museums, IFLA-International Federation of Library Association and Institutions), in order to protect world cultural heritage from armed conflict and natural disasters, [10]. Conceived as the “cultural equivalent of the Red Cross”, its name derives from the blue shield - a symbol used to denote cultural sites protected by the 1954 Hague Convention (Fig. 1).



Figure 1. Logos of major international organisations in heritage protection, [10, 15]

The role, achievements and countless missions of all these international organizations in preserving cultural and architectural heritage of the world is irreplaceable and unique.

3 Protection of historic buildings located in seismically active regions

Historic buildings are surviving witnesses of the past generations and traditions that have functioned as a whole in a period of hundreds and thousands of years and as such deserve special attention. Those buildings have architectural, aesthetic, historical, documentary, archeological, economic, social and many other values, but the first impression is always emotional and connect us to the specific times, places and events from the past, [2, 9].

Historic preservation includes much more than simply saving the old buildings, it provides cultural, educational, environmental and economic values that gives a community its unique character. A crucial part in every protection strategy is the protection of historic buildings located in seismically active regions. Earthquakes pose a big threat to heritage buildings. Those buildings are constantly under a risk of being seriously damaged or destroyed. Their vulnerability comes from the characteristics of each earthquake and the characteristics of the structure itself. During the long period of existence, historic buildings underwent kind of a natural selection, so only those that were well designed and constructed survived, which is sometimes accepted as proof of their safety. But being exposed to many earthquakes these structures were systematically damaged and today exist with many hidden weaknesses. Heritage buildings suffer not just from disasters but also from inadequate and uncoordinated post-disaster activities, [1, 4].

Because earthquakes are not predictable, and often causes huge or irreversible damag-

es to cultural property, organizations responsible in this area, suggests measures that should be performed in three key phases: (1) measures before earthquake, (2) short-term measures with a plan of activities (immediately after the earthquake), (3) long-term protection of historic buildings, (table 1).

“We must always be aware that we live between two earthquakes”, [4].

The behavior of historic buildings under seismic impacts is closely related to the maintenance activities and conservation practice. Safety of these monuments is compared with the need for conservation.

Table 1. Measures for earthquake protection in three phases, [4]

Measures before earthquake	Short-term measures	Long-term protection
Full inventory of all cultural resources	Transport all movable cultural property in safe places	Profound assessment of the damage
Protection of the existing documentation	Achieve cooperation with local civil and military authorities	Establish priorities for restoration or repair
Ensure photographs and technical documentation of all the buildings and other artistic objects	Assess damages	Estimate the cost of restoration activities
Train professionals in seismic resistant design and historic building inspections	Secure objects from further damage	Organize multidisciplinary teams to propose projects for repair and reconstruction of the damaged buildings
Development of seismic maps and hazard assessment on the places	Inspection of ruins and broken remains collection	Evaluation of alternative schemes that balance degree of intervention and loss of values
Regular and correct maintenance of monuments	Seek international help	Define the typical collapse mechanisms
Regular inspections and reports	Provide temporary protection on artistic elements	Engage multidisciplinary team of expert in repair activities
Secure all movable objects against vibration	Provide temporary structural security on the buildings	Perform structural repairs
Establish equipment for help in centers outside the seismic zones		Improve the earthquake resistance of the buildings

4 Conservation of architectural heritage

Architectural heritage refers to buildings, monuments and sites with outstanding values and authenticity. Over the years, the conservation of architectural heritage has undergone throughout numerous changes. Not more than a few decades ago, the conservation process mainly involved measures that involved only the physical condition of the buildings and implies care for visible and tangible elements. Changes and develop-

ment in many fields of science have also brought changes in the perception of the conservation process and the importance of preserving not only the physical but also the semantic aspects. Conservation of the physical aspects includes interventions on the materials and physical parts of the building in order to provide durability and resistance. Conservation of the semantic aspects refers to assessment and protection of intangible aspects that refers to cultural, economic, historical and aesthetic values. Every conservation activity starts because the building is valuable, in that context, all the decisions depend on these values, [2].

Heritage conservation is a multidisciplinary activity that involves knowledge from many scientific disciplines. It brings together professionals of diverse fields and expertise. Collaborative work of architects, archaeologists, conservators, civil engineers, art historians and other professionals is necessary to ensure multidisciplinary approach to problem solving. As so many disciplines are involved, a clear concept is essential to ensure well-managed project.

As part of the team, the architect's challenge is to unite all the participants into a whole and find the potential challenges and opportunities of historic buildings that will enable to maintain their authenticity and the values for which they have been listed, [11, 12].

5 Conservation process and the role of the architect

Understanding and identifying the existing values of the heritage is a priority before any conservation activities take place. Depending on the function of the building, each architectural heritage has different values to preserve so there isn't a standard pattern for the conservation of the values, [2, 11]. The conservation of the physical and material aspects is also a complex process due to the fact that each historic building is a unique artistic creation of its time and culture. Conservation techniques can vary and include different activities depending on the requirements. International heritage organizations and institutions such as the Paul Getty Conservation Institute, GCI and ICCROM, which are responsible in this area, still haven't agree on the existence of a standard procedure for heritage protection that will satisfy all the requirements, but accept that there are certain steps (phases) that must be followed in every conservation process, [13]. The process consists of six important steps:

1. Initiation
2. Assessment
3. Options
4. Project development
5. Implementation
6. Operation

Phase 1: Initiation

This is the first phase of the process, generated due to a problem or an opportunity. At this stage it is important to understand the need for the intervention and to clearly define the problem to be solved. The project goals, objectives and the schedule of activities are defined according to this step. The documents collected and verified during this stage include existing plans of the facility, information about the constructional techniques, assessment of the existing condition and the processes of decay and damage, the changes that have been made and finally its present state. This phase involves all participants due to the need for each of them to get acquainted with the problem.

The architect is usually consulted at the beginning of the process, concerning the condition, integrity and usability of the building and may also play a significant role in assessing the heritage significance and values.

The final result of this phase is a clear concept of the work that is usually presented in the form of a report, [6,13].

Phase 2: Assessment

Often, the available information for the building, located in archives and libraries, is not sufficient and the collected data may be incomplete. To gather all the missing information, additional research, investigation and analysis are necessary. The records produced during this phase give complete information about the heritage resource, its history and its cultural significance.

At this stage the team is formed. Architects were (and still are) part of the team that first studies the specifics of the monument and makes precise drawings. Those accurate recordings of the initial, current and later post-intervention condition are essential for all future activities, [12, 13]. Measured drawings are usually done in two stages, field and office stage. In the field stage the building is measured, recorded and photographed, and in the office stage those sketches are turned into scaled and precise drawings. The drawings can be prepared by architects or architectural technologists. On the other hand, the analytical part requires the skills of an architect to evaluate the condition of the monument and the original materials. Therefore, the architect should possess knowledge and understanding of various architectural periods and styles as well as the ability to identify and interpret all the materials used in the building, [6, 14]. The final result of this phase is a written report of all collected and produced data like graphic drawings, photos, description of the material, construction, physical condition of the building and degree of damage. Due to the complexity of the work, individual reports that in the past were produced by different professionals, nowadays are coordinated by the architect and are generated as an integrated research report.

Depending on the results of the investigation, the research report also suggests alternative preservation strategies. This important step ensures that the preservation strategy respects the building's historic and architectural character, [6].

Phase 3: Options

At this stage, the team has a clear idea of the current condition of the monument, thus defining what is important to conserve. Several conservation approaches are considered during this stage. Many laboratory tests and on-site tests are performed to define the techniques to be applied and their effectiveness. For each approach a cost estimate and time frame are made. Advantages and disadvantages of each approach are also identified and a recommendation is made. Architect should be able to visualize solutions to complex problems and propose preservation strategies that require minimum intervention so that the essential historical values are preserved.

The end result of this phase is the selection of the best conservation approach that will enable most appropriate preservation treatment, [13].

Phase 4: Project Development

At this stage, the proposed approach should be turned into a well-defined, complete project. All professionals are involved in making the specifications, drawings, detailed budget and work schedule. Those prepared documents are the basis for obtaining the necessary funds for work from the relevant institutions.

The end result of this phase is complete prepared project, [13].

Phase 5: Implementation

Prior to this stage, the team is engaged in research, examination, testing and activity planning. However, in this phase, all planned activities and research are materialized in accordance with the documentation prepared in the previous phase. Records produced in this phase include work progress, photographic documentation from different levels of work, maintenance regulations, samples of the used material and other important electronic data. At this stage the architect may be involved in overseeing the progress of the work and assessing the effectiveness of proposed methods. Sometimes, the coordination of construction activities may be particularly challenging because the scope of work cannot be fully known before the conservation process begins.

The end result of this phase is entirely finalized project, [6, 13].

Phase 6: Operation

At this, last stage, all the records made in the previous stages is archived. Program for maintaining the life cycle of the monument is established and manuals that will specify the buildings maintenance in the future are prepared. Architect is involved in these activities and also should be engaged in training the team responsible for maintaining the building. Based on the evaluation of the work, a final report defining the quality of the work is prepared. This phase includes ongoing monitoring of the condition of the monument and maintenance.

The end result is a well-managed project, [6, 13].

Information sharing is vital for successful conservation process. Whether it is the structural engineer, who provide a survey of cracks and structural system, historian who illustrates building phases, the conservator who maps decay phenomena, or architects and planners, each of them is important part of the team and provides valuable information from its field of expertise. The complexity of the work often leads to difficulties for team members to work together as a heterogeneous team, so the architect's challenge is to unite all the participants into a whole and ensure a well-managed process, [13, 14]. Heritage conservation is a dynamic process that can be presented as a cycle flow, Fig. 2, where the next stage begins only when the previous one is completely finished. After the last stage, the project may start again if a new need or opportunity appears, [13].



Figure 2. Diagram showing the steps of conservation process and the outcome in each stage, [13]

6 Conclusion

Architectural heritage is a fragile and indispensable cultural resource that reflects the achievements and traditions from the past generations and provides a sense of social identity. It is permanently exposed to the adverse impacts of natural factors that increase its vulnerability. Throughout the history, earthquakes were the dominant factor for partial or complete collapse of many historic buildings and sites. The aim of safeguarding heritage is to maintain its authenticity and preserve its material and semantic values. Therefore, any conservation process should be based on a clear concept that requires minimum intervention. Conserving architectural heritage usually requires a multidisciplinary approach, involving a variety of professionals. Architects, as part of the team, have an essential role to play in every step of the conservation project, from assessing the heritage values until providing maintenance manuals for further activities.

References

- [1] Geddes, S.Z., Soz, A.S. (2017): Promoting Disaster Resilient Cultural Heritage. World Bank Group, Washington.
- [2] Taher, Tolou, Del, M.S., Saleh Sedghpour, B., Kamali Tabrizi, S. (2020): The semantic conservation of architectural heritage: the missing values. *Heritage Science* 8, 70, doi: <https://doi.org/10.1186/s40494-020-00416-w>
- [3] European Commission (2009): Preserving our heritage, improving our environment, Volume I – 20 years of EU research into cultural heritage. Publication office of European Union, Luxemburg.
- [4] Feilden, M.B. (1987): Between two earthquakes: Cultural property in seismic zones. CA: ICCROM, Getty Conservation Institute, Rome.
- [5] Hirszenberger, H., Ranogajec, J., Vucetic, S., Lalic, B., Gracanin, D. (2019): Collaborative projects in cultural heritage conservation – management challenges and risks. *Journal of Cultural Heritage*, Volume 37, 215–224, doi: <https://doi.org/10.1016/j.culher.2018.10.006>
- [6] Dugay, G. (1992): The Architectural Preservation Process. Heritage Notes, Alberta Culture and Multiculturalism, Historic Sites and Archives, Edmonton, Alta.
- [7] History, ICOMOS-International Council on Monuments and Sites, <https://www.icomos.org/en/about-icomos/mission-and-vision/history>, (accessed 16.01.2020).
- [8] ntroducing ICOMOS-International Council on Monuments and Sites, <https://www.icomos.org/en/about-icomos/mission-and-vision/mission-and-vision>, (accessed 16.01.2020).
- [9] Jokilehto, J. (1998): The context of the Venice Charter (1964). *Conservation and Management of Archaeological Sites*, Volume 2, Issue 4, 229-233, doi: <https://doi.org/10.1179/135050398793138762>
- [10] The Blue Shield, ICOMOS-International Council on Monuments and Sites, <https://www.icomos.org/en/get-involved/inform-us/heritage-alert/heritage-at-risk-reports-2/> (accessed 17.01.2020).
- [11] ICOMOS Charter (2003): Principles for the Analysis, Conservation and Structural Restoration of Architectural Heritage. ICOMOS 14th General Assembly, Victoria Falls, Zimbabwe.

- [12] Feilden, M.B., Jokilehto, J. (1998): Management guidelines for world cultural heritage sites. OGRARO, 2nd edition, Rome.
- [13] Letellier, R. (2007): Recording, Documentation, and Information Management for the Conservation of Heritage Places. The Getty Conservation Institute, Los Angeles.
- [14] Embaby, E.M. (2014): Heritage conservation and architectural education: "An educational methodology for design studios". HBRC Journal, Volume 10, Issue 3, 339-350, doi: <https://doi.org/10.1016/j.hbrj.2013.12.007>
- [15] ICAM's 2018 Annual Meeting, under the patronage of UNESCO, AWHF, ICCROM and ICOMOS Italy, (2018): Discover Sicily's Argimusco – a Holistic Approach to Heritage Management. Montalbano Elicona, Province of Messina, Sicily, Italy.