A system approach for examination and determination in historical buildings

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ABSTRACT: In thousands of years in civilization history, these values, which were created by directly human beings or with nature, are named today as “Cultural and Natural Heritage”. Conservation of these values is a very important subject that has to be studied. These studies about conservation and restoration of historical buildings that are very important cultural heritage must be aimed at scientific principles, aesthetics, and conservation of their historic values.

Before the conservation, restoration and strengthening of a historical building, study stages have to be define in collecting and evaluating data towards observation and determination studies. In this paper, a system approach towards the criteria’s mentioned above that can be easily applied for each historical structure is proposed.

1 INTRODUCTION

Since early 20th century, some legal obligations such as Carta Del Restauro and Venice Charter are constituted for the studies about conservation and restoration of historical buildings which are very important cultural heritage.

In the past when the building has its own function its permanent maintenance has also provided its conservation. According to the famous Italian expert Piero Gazzolo; “If an architectural monument doesn’t serve to its own function, conservation becomes more than a practical necessity, turns into a cultural responsibility. The attention to this subject is depends on the next generations cultural knowledge and the sensitivity to the conservation of cultural heritage”.

Restoration and conservation methods continuously come into being discussions between the different disciplines. To cope with this problem, it has to determine the method and the conservation level in a point of historical and aesthetic appearance of historical buildings and it has to determine the procedures putting into practise relating the structural damages and their repairs. In these studies, specialists from different disciplines like architecture, archaeology, history of art and engineering have to collaborate.

2 STUDIES ON CONSERVATION

Even if the history of studies on conservation last out to past, the modern technique for conservation begins in 19th century. The congress in Athens in 1931 was the first congress about conservation of historical monuments. The congress expresses that each country constitute official records which shall contain all documents relating to its historical monuments and to deposit copies of its publications with the International Office. After the congress in Athens the principles are approved by Italy and called “Carta Del Restauro” becomes a legal obligation. And it recommends that the specialists from different disciplines have to collaborate and the experts have to agree that before any consolidation or restoration is undertaken. And also it is pointed that contributions of all periods of the building must not be destroyed, the additions which misleads the experts must not be built and the original materials that are come up with the analytic researches must be conserved.

In 1957 “I. International Conference of Architects and Technicians of Historic Monuments” is organized in Paris. In this conference it is explained that cultural heritage is common responsibility and some organizations like ICOMOS, ICCROM was proposed to establish.
"II. International Conference of Architects and Technicians of Historic Monuments" is organized in Venice in 1964. The Venice Charter which is constituted in the conference is examined the problems of architectural conservation in nearly hundred years of European history which become more complex and varied. This charter becomes a solution but not an ending, on the contrary it is affected the discussions in international perspective. Also in our days many associations and organizations are studying about this subject, many national and international conferences, symposiums are organized.

2.1 Venice Charter (1964)

The Venice Charter has an important role about theoretical progress of methods in conservation of historical buildings and monuments, and foundation of associations. It has 16 articles under the definition, aim, conservation, restoration, historic sites, excavations, publication headings. In this paper, as a system for conservation, restoration and strengthening of a historical building approach is proposed, the 9–13 articles are studied.

ARTICLE 9. The process of restoration is a highly specialized operation. Its aim is to preserve and reveal the aesthetic and historic value of the monument and is based on respect for original material and authentic documents. It must stop at the point where conjecture begins, and in this case moreover any extra work which is indispensable must be distinct from the architectural composition and must bear a contemporary stamp. The restoration in any case must be preceded and followed by an archaeological and historical study of the monument.

ARTICLE 10. Where traditional techniques prove inadequate, the consolidation of a monument can be achieved by the use of any modern technique for conservation and construction, the efficacy of which has been shown by scientific data and proved by experience.

ARTICLE 11. The valid contributions of all periods to the building of a monument must be respected, since unity of style is not the aim of a restoration. When a building includes the superimposed work of different periods, the revealing of the underlying state can only be justified in exceptional circumstances and when what is removed is of little interest and the material which is brought to light is of great historical, archaeological or aesthetic value, and its state of preservation good enough to justify the action. Evaluation of the importance of the elements involved and the decision as to what may be destroyed cannot rest solely on the individual in charge of the work.

ARTICLE 12. Replacements of missing parts must integrate harmoniously with the whole, but at the same time must be distinguishable from the original so that restoration does not falsify the artistic or historic evidence.

ARTICLE 13. Additions cannot be allowed except in so far as they do not detract from the interesting parts of the building, its traditional setting, the balance of its composition and its relation with its surroundings.

2.2 Code Ethique (1995)

ICOMOS International Training Committee agreed on responsibilities, documentations, examinations and applications in the meeting in Suomenlinna, Finland in 1995 which is named as "Code Ethique". According to the articles about conservation, restoration and strengthening:

a) As the conservation concept has a large extends and the attention of many different social groups need to be taken, conservation should be studied by trained and experienced person, carried out with the experts who have to collaborate with different disciplines with a scientific point of view and work with mass media associations.

b) Before the conservation, restoration and strengthening applications are constructed; the general conditions, the physical properties, damage reasons and other problems of the historical monument should be examined.

c) According to these examinations, a basic approach for each application must be improved and a conservation method which can be short term or long term must be programmed.

d) There should always be a precise documentation of a technical report of the applications with drawings and photographs and should be copied for public institution archives. And also for the public use a summary report should be written.

e) For the future existence of the monument there should be a limited applications with the examination of each effect through the monument and must be respected to its cultural heritage, environmental integrity, aesthetic, historical, physical originality.

f) There shouldn’t be any damage or changes to the original monument which are documentation of its history during the conservation, restoration and strengthening application.

g) The modern techniques or new materials shouldn’t be used without required experiments, scientific researches and discussions with an expert.

h) The conservation, restoration and strengthening application shouldn’t misled the future studies, if it is necessary, the application can be removed, renewal as possible as can be and congenial with its surroundings (Binan, 1999).
2.3 Conservation studies in Turkey

In our country where there are many historic values and historical varieties, some associations and foundations related to conservation are also constituted. In recent years it is pointed that the symposiums organized by Cultural Ministry or the meetings Historical Cities Associations organized by municipalities are improved the point of view about the conservation of historical monuments and the public remaining interest to the subject. For healthy and permanent conservation not only the legal obligations but also active studies in micro and macro scale based on scientific data must be improved.

There is more maintenance of donations, economic sources for conservation and renovation of the historical buildings compare with the past because of commercial and touristical incomes. This kind of approach brings a danger of rebuilt of the monument or thoughtlessly change of functions. Whatever the aim is civilized usage of a historical monument is to keep the original by permanent attention. The basic and important aim is to keep the original not the damaged or copied one of the historical monument.

From the world heritage point of view our country is takes place on such a geographic place that many civilizations passed through and leave many work of arts which are now called cultural and historical heritage. Istanbul, in the end of southeast of Europe is the only city, which takes place both in two continents, Europe and Asia. Bosphorus flows between two continents, separate the city in two parts. Over 2600 years with a very interesting historical past, Istanbul is a unique city in the world. As a very special city of Turkey and World Istanbul, takes place in the list of historical heritage of UNESCO. So Istanbul is an uncovered laboratory with its historical monuments and buildings as all over our country. Although many of them could not resist to the natural disasters and wars and not exist today but many precious historical buildings have being lasted. Because of this reason these studies in Istanbul is very important by means of universal cultural heritage conservations.

2.4 Legal obligations of conservation in Turkey

The historical progress of the legal obligations of cultural heritage conservation in Turkey is mentioned below;

- In 1869 (Asar-i Atika Nizamnamesi) the Historical Monuments Obligations is constituted. This obligation is applied with some changes until the period of Turkish Republic.
- Property of Antiques and Superior Committee of Monuments is constituted in 1951 under the National Education Ministry related to control and observe the principles and applications of restorations, conservations, preservation of historical monuments and architectural buildings.
- Antiques Law is presented in 1973. The elements need to be conserved, including the residential buildings is attained a required level by this law. Between 1973–1982 years 100 urban sites, and 3442 monumental, 6815 residential architecture samples in 417 site area are officially registrated by Property of Antiques and Superior Committee of Monuments (Ahunbay, 1996).
- ICOMOS National Committee of Turkey is constituted in 1974 according to obligations of “International Council of Monuments of Sites” in Turkey.
- In 1982 Republic of Turkey is approved to participate to UNESCO in accordance with “Conservation of World Cultural and Natural Heritage Charter”. In 1983 Antiques Law is beared and Conservation of Cultural and Natural Heritage Law is constituted. By this law instead of antiques term cultural heritage term is consmued.

The cultural values which are under protection of government and named as Cultural and Natural Heritage are under the responsibility of Cultural Ministry. Conservation of Cultural and Natural Heritage Superior Committee under the Cultural Ministry carried out the cultural and natural heritage services according to the scientific basis.

These are the responsibilities and competences of Conservation of Cultural and Natural Heritage Superior Committee;

a) To define the principles of the services about conservation and restoration of immovable cultural and natural heritage
b) To provide the required coordination conservation committees
c) To determinate the general problems caused by the applications and to assist the ministry by consensus

There are many organizations like TAC, Turing, Chamber of Architects, Foundation of History, Çekil, Galata Society, Zeyrek Conservation Society, Cihangir Society except Government Institutions provides many contributions on determination studies, archives and library services.

The relations between responsibilities of committees about law and obligation regulations related to conservation of historical buildings is shown in Figure 1.
Figure 1. Organization scheme of conservation and restoration in Turkey (Akınçi, 2000).
Every architectural shape is formed in a level of possibilities provided by technology and materials. In order to investigate the concept of aesthetics as much as perception of the building, material properties, applications and technological possibilities must be recognized. In historical buildings in comparison with comparison with today there are less materials and technical possibilities but variety of forms reaches to a high level.

Historical buildings construction typology is masonry. Materials used in masonry buildings, forming its structural system are also influenced its architectural features and its identity. The determination of material properties, which are used for masonry buildings, is very important subject as also for all types of structures. Architect, can design independently for a new structure but for the conservation and restoration of a historical building he has to work by respect to the history of building and its architectural features. In these studies to determine the present situation of building; researches about regional settlements and effects of these settlements, structural system of building and material properties, restorations that had been done before, strengthening and/or extension of building and their effects to the structural system and the examinations of the soil properties in micro and macro scale of building region have to be studied.

In the restoration studies, the properties of original materials must be investigate by experimental methods and the new materials, which will be used to have approximately same properties, must be taken into consideration. Otherwise fatal damages can be occurred and cannot be restored in the means of their aesthetics and historic values. For example; in the 1950's the materials like cement additive mortar and plaster which is very harmful for the historical buildings is applied by a volunteer firm who restored with a good intention in Konya. Because of this application there are significant physical damages on the structural materials like stone and bricks on the many Anatolian Seljuk Period buildings (Tuçoku, 2004).

The conservation, restoration and strengthening of a historical building is concerned measured drawing which is a documentation of architectural measurement and detailed drawings of building, restitution drawings which defines the original with the lost partitions or additions and restoration drawings for the determination of renewals must be prepared. However a healthy and permanent conservation must be carry out by experts with investigation of materials, scientific researches, laboratory analyses, preliminary studies, there is just a technical report which defines original material properties and defining the restoration materials.

There must be preliminary studies like determination of original construction techniques, damages occurred in time and the determination of physical, chemical, mechanical properties of original materials like stone, brick, mortar, plaster, adobe, wood, metal, glass which are used in historical buildings. For the experimental studies on materials the tests are generally performed on specimens taken from the structures. These specimens must be as small as possible for not damaging the building (Akız, 2001). Investigation of material properties of a historical building by using non-destructive methods usually includes rebound test, sonic test, radiographic tests, surface hardness test, permeability test and bonding test (Akız, 2001).

In any case sampling a masonry specimen is not a simple operation also in the case of a regular and solid masonry. Being a highly destructive operation, only one or two specimens can be sampled and the test may be statistically unreliable in the case of a very poor masonry. Therefore, the only way to reach the goal seems to be an in-situ testing on the masonry as a composite (Binda, 1999).

The informations to determine the stages of building, construction dates, unexplained additions to the building can be obtained from a detailed material study of the historical building.

There are authentic construction methods, preparation methods of materials, authentic material properties of many historical buildings point out differences depend on the geographic aspects, construction periods in our country. So as to obtain detailed and straight historical documents and information, conservation and restoration of each building must be studied with material and technological perspective as well as its architectural and artistry perspectives. Otherwise conserving the historical buildings from the conservation studies or recovering the restored historical buildings must be taken into consideration.

4 A STUDY PROGRAM TO DETERMINE MATERIAL PROPERTIES FOR CONSERVATION, RESTORATION AND STRENGTHENING OF A HISTORICAL BUILDING

Before the conservation, restoration and strengthening of a historical building, study stages have to be define in collecting and evaluating data towards observation and determination studies. In Table 1, a study program which is proposed in this paper can be easily applied for each historical structure.

4.1 Determination of the building identity

The original name and current name of the building, its address, original function and current function should
Table I. General study program for conservation and restoration of historical buildings.

<table>
<thead>
<tr>
<th>Study Groups</th>
<th>Study Stages</th>
<th>Explanations</th>
<th>Check List</th>
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<td>Yes</td>
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<tr>
<td>I.GROUP</td>
<td>Determination Of The Building Identity</td>
<td>Name / Original Name</td>
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<td>Address</td>
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<td>Architect/ Constructor or Institution</td>
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<td>Construction Date / Period</td>
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<td>Period: (day/month)</td>
<td>Current Condition</td>
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<td>Past of Building (restoration, renewal, additions)</td>
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<td>II.GROUP</td>
<td>Information About The Building</td>
<td>a) Literature and visual documentation</td>
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<td>b) Plans, sections, elevations and photographs</td>
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<td>c) Permissions from related institutions for the investigations and determinations</td>
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<td>d) Contacts with the responsible persons for studies</td>
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<td>e) Drawing detailed and measured projects</td>
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<td>f) Drawing restoration project</td>
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<td>Period: (day/month)</td>
<td>a) Coding of the elements on plans, sections, elevations with the informations from stage II</td>
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<td>b) Confrontation of the documents with the current buildings in the site area</td>
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<td>c) Determination of the elements, defining the damages by photography</td>
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<td>d) Observation of the damage improvement by scaling and visual studies</td>
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<td>e) Determination of the damage causes</td>
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<td>f) Confrontation the current condition with the documents</td>
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<td>g) Organization of study program by using the codings of elements for observation, measurements and tests</td>
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<td>h) Determination of materials of each elements, measurement of the elements, defining the cracks and damages, detail photographs from required elements</td>
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<td>i) Non-destructive tests and defining the test results on the program</td>
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<td>j) Taking specimens from required and permitted elements</td>
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<td></td>
<td>Period: (day/month)</td>
<td>a) Preparing the samples and specimens for the laboratory tests</td>
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<td>b) Physical, Mechanical, Chemical tests</td>
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<td>c) Investigation of material properties</td>
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<td>d) A statistical relation with the results from the laboratory tests and the non-destructive test for correlation</td>
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<td>e) The determination of the material properties from the elements that no specimens are taken but non-destructive tests are studied by using the statistic correlation</td>
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<td>III.GROUP</td>
<td>Examine Studies on Building</td>
<td>a) The selection of materials for conservation, restoration and strengthening. After the tests, determination of original material and defining the material properties.</td>
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<td>b) Determination of some specimens in the application and investigate the quality, convenience to the original material.</td>
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<td>Period: (day/month)</td>
<td>a) Project preparations, restoration project</td>
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<td>b) Auctioning procedure</td>
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<td>c) Conservation, restoration and strengthening applications</td>
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<td>d) A control system for quality and convenience to the original building and the projects</td>
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<td>V.GROUP</td>
<td>Selection of Materials</td>
<td>a) Preparing the samples and specimens for the laboratory tests</td>
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<td></td>
<td>Period: (day/month)</td>
<td>b) Physical, Mechanical, Chemical tests</td>
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<td>c) Investigation of material properties</td>
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<td>d) A statistical relation with the results from the laboratory tests and the non-destructive test for correlation</td>
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<td>e) The determination of the material properties from the elements that no specimens are taken but non-destructive tests are studied by using the statistic correlation</td>
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<td>V.GROUP</td>
<td>Conservation, Restoration And Strengthening of The Building</td>
<td>a) The selection of materials for conservation, restoration and strengthening. After the tests, determination of original material and defining the material properties.</td>
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<td>Period: (day/month)</td>
<td>b) Determination of some specimens in the application and investigate the quality, convenience to the original material.</td>
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be defined. Before all else architect of the building, the institution or the constructor who organized the construction and constructed date or period must be defined from the documents about the historical building than the information about past restorations, additions, renewals must be taken and current conditions of the building must be examined.

4.2 Information of the building
After determination of the building identity, literature study of the building, plan, section and elevation drawings of the building and the photographic of the building must be researched. So as to begin to investigate on the building area the permissions must be get from related institutions or organizations and contact with the responsible person. At the first stage, there must be visual determination by taking photographs and if there isn't any architectural drawing of the building, the measured, detailed drawing of the building must be studied on the building area.

4.3 Examine studies on building
Before the examine studies the groups must constitute a study program and define every single job as clear as possible.

4.3.1 Coding
The structural or any kind of element in the building must be coded on the projects and the photographs of the building. These elements must be check with the building so as to define current conditions and the damages of the building. This study must be done for also each decoration element on the building as well as the structural elements.

4.3.2 Determination of damages
The study stages and study schedule must be formed from the prepared, coded project. There should be determination of materials and measurement of dimensions from each element, detailed photography from required areas, and determination of damages and examination of the damage causes and investigation of damage improvements by using the visual and measurement methods.

4.4 Non-destructive tests
The non-destructive tests such as rebound test, sonic test, temperature test, humidity test and flat-jack test must be applied to determine the physical and mechanical properties of the materials in winter and summer conditions. Than so as to make studies in laboratory, the specimens must be taken from only required and permitted areas. The aim in taking specimens from a structural element is to investigate the quality of materials as stone, brick, mortar to determine their strengths.

4.5 Laboratory studies
After preparing the specimens and samples taken from the building, physical and mechanical tests must be applied. A statistical relation with the results from the laboratory tests and the non-destructive test must be researched to find a correlation. The determination of the material properties from the elements that no specimens are taken but non-destructive tests are studied must be defined by using the statistic correlation.

4.6 Selection of materials
After the tests, determination of original material and defining the material properties, the selection of materials for conservation, restoration and strengthening studies must be improved. The required tests must be applied to the selected materials. In the application period again some specimens must be taken so as to make tests and investigate the quality, convenience to the original material.

4.7 Conservation, restoration and strengthening of the building
For the conservation, restoration and strengthening studies a restoration project must be prepared after the required tests and selection of materials. So as to define the application firm auctioning method can be used after all the studies, projects and documentations are obtained. There should be a control system for quality and convenience to the original building and the projects after the conservation, restoration and strengthening applications. An educated group of workers should for the proper, conscious and convenient to the original project study in the conservation, restoration and strengthening applications.

There should be expert groups, clarified job descriptions, detailed and defined study programs for each study stages in the study program defined in 6 stages which is mentioned above.

5 DISCUSSIONS
Although this study program seems detailed and long time work for the the conservation, restoration and strengthening studies that has many criterias it obtains determined system for application. The unconscious applications causes unreturn damages to the historical monuments. In this paper, the study program that has proper stages, defined experts and study descriptions and investigate the unconscious application is proposed. For example; Hıramı Ahmet Paşa Masjид which
is restored between 1966–1968 the fresks are removed and exterior facade stone work restored without a respect to the original building with an unconscious study (Kuban, 2000).

The basic problems of restorations are not giving any importance to research studied before applications, lack of material investigations, to remain true to original materials and lack of scientific documentation. In this paper, the suggested study program obtains also detailed documentation, recorded knowledge about the buildings.

6 CONCLUSIONS

As it seen in the study program which is proposed in this paper;
- It may be improved by the experts from different disciplines according to their needs and study subjects
- These programs which improved by the experts may be gathered by director and transfer to the other experts and it may provide different disciplines collaborated study and may be viewed by the director of study program
- Such a study program like this, it may be scientific, aesthetic, conservative to the historical values and a scheduled study by the experts from different disciplines for conservation, restoration and strengthening as it is mentioned in Venice Charter and other documentations of ICOMOS

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