I. Introduction and overview

The structures and building materials of the monuments visited in Kosovo have suffered not only from the normal deterioration process caused by the physical environment and by lack of maintenance in the past years, but also from structural failures caused by shelling and bombs. Building materials such as stone, brick and mortars invariably undergo deterioration processes. The rate and symptoms of such processes are influenced by different factors, and also depend on the properties of the materials.

Before starting any restoration plans in Kosovo for historic buildings with distinct architectural value, a diagnostic study is required. The deterioration study should go through various cycles of evaluation to obtain an optimal benefit from all available data and to develop a programme of treatment.

Any serious restoration work consists of two phases:
- data gathering, diagnosis, and preparatory studies
- application of treatment.

1. Historical and architectural study

A comprehensive monograph should be prepared on each building. The collection and evaluation of data related to the history of the building should include:

- Collecting data exhibited by the monument itself
- Collecting data derived from the structure (wall thickness, foundation)
- Deducing data from the monument through the study of ancient graphic surveys
- Collecting data from published literature
- Collecting data from graphical retrospective documentation (e.g. old photographs)
- Collecting and checking data from endowments, documents and ancient manuscripts
- Documentation of the actual situation by photos

2. Site and building survey
Site and building surveys, including sets of drawings, should be made to determine different levels of the site and the buildings. Surveys should be conducted through photogrammetry and rectified photography as well as using Total Stations to collect complete data about the buildings.

A complete architectural documentation for the buildings including interior and exterior walls as well as important details such as inscriptions and decorations. This should include drawings with suitable scale (1/50, 1/20, 1/5) for plans, elevations, sections and details. Visual stone deterioration maps are also essential. The drawings should be produced through qualified digital forms (computerized).

3. Mineralogical/ petrological study of building materials

A diagnostic study of materials is essential. Physical and mechanical tests, as well as chemical and mineral analysis should be carried out for stone and mortars. A mineralogical/petrological study of building materials should involve sampling and investigation of stone samples, mortar samples, screed samples, paving tiles and pigment samples.

Analytical techniques should include:

- Chemical treatment of samples
- Optical microscopy, using a polarizing microscope
- X-ray diffraction (XRD), using automatic X-ray powder diffractometer
- Scanning electron microscopy (SEM).
- Chemical analysis, atomic absorption spectrometry
- Infrared (FT-IR), Raman spectrometry
- Study for the pigment sample using polarizing microscope
- Pores size and pores distribution by mercury

4. Geotechnical investigation

Investigations of the soil and foundation should be undertaken to determine the main structural problems. For the subsurface stratigraphy at the building location, the geological investigation should involve drilling of at least 2 or 3 mechanical boreholes and excavating test pits.

In all boreholes, Standard Penetration Tests (S.P.T) are to be performed at a distance of 1m to 1.5m. Disturbed bulk samples at 1m intervals as well as undisturbed samples should be obtained to determine the density/consistency of the soil.

Laboratory tests on both disturbed and undisturbed samples of the various lithological horizons are to be performed for determining physical and mechanical parameters of the soils. In case of ground water, at least one plastic standpipe (Pizometer) should be installed for
water level measurements. A full chemical analysis of ground water samples is also recommended.

Manual exploratory pits should be excavated in order to evaluate the soil foundation conditions and to obtain information on the building foundation.

5. Endoscopic tests

To investigate the masonry walls composition, mortars typology and condition, presence of hollows or cracks, it is strongly recommended to make endoscopic tests; this is necessary for realizing mathematical models and assessing safety coefficients for walls, domes and flooring of the building.

6. Monitoring of cracks

To evaluate statics problems of a building, a complete monitoring system should be installed to determine if the damage is still increasing. Monitoring is realised by gauges for measuring the crack widths, by surface clinometers for checking the slope variation and the out-of-verticallity, by thermal and relative humidity gauges and the direction and speed of the wind.

Crack width gauges with conductive plastic material race with a double support for the working stem realised through bearing, with long life and low sliding friction, which permits a remarkable mechanical durability and a precise placement. - Thermal gauges are of the thermo-resistance type; the recording system is based on the measurement of the resistance (Ohm) of a platinum cable, the value of which is a linear function of the temperature. - Surface clinometers are used for determining e.g. the minaret rotation, in particular potentiometric gauges with high sensitivity and a precision of 0.05 % of the full range. - Relative humidity gauges are realised by a sensitive element with a condenser in a capacitive transducer thin film. - The anemometer measures the speed and direction of the wind. The measuring range of speed is 0 – 60 m/s and direction is measured with a flag between 0° to 360°. - The sensor is to be fixed over the top of the dome or minaret with a metallic shelve. The 0° direction is North and the positive signal is in clockwise direction.

7. Environmental investigation on site

Air temperature, stone surface temperature and relative humidity measurement inside and outside the building should be recorded day and night to determine the dew point temperature.
Salt detectors determine the presence of electrically conductive salt contamination on the surface of damp walls. Tests should be carried out on internal and external walls.

On site chemical analysis of salts deposited on facades provides the degree and type of contaminated salts. Normally, certain nitrates and chlorides are deposited by evaporation of ground water (rising damp) on the surface of walls.

Dampness should be measured on the internal wall surface at 0.5m and 1.5m from the floor level. The dampness identification colours on the instrument (red, yellow and green) indicate the degree of urgency of action. Deep wall measurements are also recommended.

Measurement of PH value*: for determining the acidity or alkalinity of a wall surface it is recommended to determine the cleaning material. The PH value can be determined visually by using PH indicator strips in comparison with colour scheme as mentioned below.

* - A very acid solution has a PH value of 1  - \([H^+] > [OH^-]\); more hydrogen ions than hydroxyl ions.
- A neutral solution has a PH value of 7  - \([H^+] = [OH^-]\); equal numbers of hydrogen and hydroxyl ions.
- A very basic solution has PH value of 14  - \([OH^-] > [H^+]\); more hydroxyl ions than hydrogen ions.
8. **Structure Study**

A structural assessment study should be made to determine the current structural conditions of a building. A mathematical model should be developed using the finite element technique and taking into account all features of the building such as openings, doors, arches, minarets etc., so as to study the building behaviour in response to various loading conditions and to assess the state of stresses within the building and the minaret walls under these conditions. That study also helps determine the structural safety of the mosque and the minaret. Finally, it is recommended to adopt the necessary measures and techniques for strengthening and retrofitting the historic building.

9. **Soil structure interaction study**

The main objective of the soil-structure interaction study is to consider the effect of the soil stratification underneath the building foundation on its behaviour. It is thus possible to evaluate the loads acting on the building’s various components and assess through visual inspection the structural integrity of the building and the points of weakness. The scope of this study includes:

- identifying the soil parameters under dynamic and static loading conditions such as modulus of elasticity, angle of friction, and cohesion
- developing a three-dimensional finite element model that accounts for the superstructure and the soil stratification underneath the foundation. The model should be used to depict the structural response under vertical and lateral loads.
- evaluating the stresses and deformations of the superstructure, taking into consideration the soil effect.

II. **General recommendations**

1. **Reconstruction**

The authenticity is the most important issue in the evaluation of the Kosovo reconstruction programme. The question is: why reconstruct? When construct? How far should one proceed with reconstruction?

Reconstruction of cultural property should be in conformity with the principles and policies recommended by the International Council on Monuments and Sites (ICOMOS) and UNESCO, such as the Venice Charter (1964) of ICOMOS(cf. Article 15: Ruins Maintenance and Ruins Reconstruction), the ICOMOS Charter for the Protection and Management of the

The Australia ICOMOS Burra Charter for places of cultural significance (revised 1999) and the International Charter of Krakow, Poland (2000) are also reference documents.

Reconstruction should be limited to the completion of small parts where it is necessary for the survival of the cultural property or where it recovers its cultural significance; it should be based on precise and indisputable documentation. Reconstruction should be identifiable on close inspection as being a new work. It is only acceptable if there are exceptional social or cultural motives related to the identity of the entire community.

2. Restoration and authenticity

Restoration of cultural heritage should be made in accordance with the Venice Charter of 1964 (Articles 9-13), the Washington Charter on the Conservation of Historic Towns and Areas (1987), the Australia ICOMOS Burra Charter (revised 1999, Articles 13-16), and the Nara Document on Authenticity (1994). Restoration has been defined in the Venice Charter.

The aim of modern restoration is to reveal the original state within the limits of still existing material; it thus differs from the past aim of bringing back the original by rebuilding a lost form.

The objective of a restoration project should be defined by identifying the values (emotional, cultural and use value) of the cultural property in question and by placing these values in order of priority. In this way the essential messages of the monument or site will be respected and preserved.

UNESCO’s Operational Guidelines for the Implementation of the World Heritage Convention of 1972 refer to four issues of authenticity that should be respected, namely authenticity in design, authenticity in the material, authenticity in workmanship and authenticity in setting.

Restoration of monuments should be worked out in the context of an urban rehabilitation project for the surrounding area.

UNESCO’s World Heritage Convention (1972) invites the States Parties to adopt a general policy which aims to give the cultural heritage a function in the life of the community; the objective is to ensure the involvement of the inhabitants in a fruitful sustainable development.

3. Protection

Protection is the process of applying measures designed to affect the physical condition of a cultural property by defending or safeguarding it from deterioration, loss or attack, or to cover or shield the property from danger or injury.
4. **Structural and material decay assessment**

The structure and materials assessment of architectural heritage requires qualified experts in diagnosis and restoration. The doctrine for analysing, conserving and restoring the structure of architectural heritage was defined by the ICOMOS International Scientific Committee for Analysis and Restoration of Structures of Architectural Heritage in its recommendation adopted on 13 September 2001.

5. **Public awareness**

Article 27 of the World Heritage Convention highlights the need for States Parties to strengthen appreciation and respect by their peoples of the cultural heritage and to keep the public broadly informed of the dangers threatening this heritage.

Efforts undertaken in Kosovo to restore the monuments damaged during the hostilities should be accompanied by targeted efforts to raise public awareness of the common property of cultural heritage and of the common responsibility for its protection and preservation. This important issue could serve as an argument for beginning a dialogue between all stakeholders.

To this end, the municipal authorities and the PISG Ministry of Culture, Youth and Sports may wish to arrange for hearings or public gatherings during which factual and detailed information is presented on the scope of restoration and protection work. Historic documentation and information materials on the project activities could be presented to the public by exhibitions and publications.

6. **Training**

The Institute for the Protection of Monuments in Pristina has hardly any qualified restoration architects, restoration engineers or heritage management experts. It is therefore urgent to launch a training programme for governmental staff, free architects and contractors. The university of Pristina could start a diploma course in conservation and cultural heritage management.

UNMIK and specialized IGOs and NGOs could provide assistance through fellowships and locally held training courses.

7. **Preventive maintenance**

It should be borne in mind that conservation alone can never rescue a cultural object. Conservation measures must be combined with preventive steps aimed at reducing the degradation factors to a large context. All mechanisms can be assessed and their relative impact accurately weighted; a minimal intervention strategy aiming at preserving any monument in its most pristine condition should be designed.

- Prevention is the highest form of conservation. If causes of decay can be removed, or at least reduced, something worthwhile has been achieved.
- Sources of atmospheric pollution can be reduced or eliminated by town planning
and governmental measures. Maintenance and precautions against the hazards and risks of natural disasters can go a long way towards reducing damage to cultural property.

- Administrative procedures and rehearsals of disaster drills reduce confusion and lead to the implementation of well-tested plans.
- Documentation is an essential aspect of preventive maintenance in its widest interpretation.
- Accountancy procedures, which identify recurring trouble spots in maintenance work, contribute to preventive maintenance, allowing the causes of the trouble to be identified and corrected.
- Wherever possible, maintenance tasks should be integrated into a scheduled routine, which would cover:
  - daily tasks, including cleaning and polishing
  - weekly tasks
  - monthly tasks, e.g. control of plant growth on buildings and sites
  - quarterly tasks
  - seasonal tasks, e.g. spring and autumn
  - annual tasks
  - quinquennial tasks

The scheduled routine should also have some degree of flexibility so as to allow emergency tasks to be tackled promptly, e.g. in cases of heavy rain or snow storm, high winds, fire, earthquake, flood or other natural disasters.

8. A detailed workplan for conservation and rehabilitation

The following activities can be undertaken according to the situation of each building:

A- Structural Works

Dismantling deteriorated floor tiles or wooden floor boards outside and inside the building.
Dismantling deteriorated floor tiles outside the building.
Dismantling deteriorated roof tiles and lead cover.
Dismantling deteriorated window metal screen and lattice.
Dismantling deteriorated wooden doors, windows leaves and windows shutters.
Removing deteriorated plaster from building walls.
Excavation of soil inside and outside the building.
Grouting of foundation walls, cleaning and repointing of joints.
Execution of rainwater collection project.
Refilling inside building and repaving with new tiles.
Reconstructing deteriorated roofs.
Installing of roof rain metal gutters
Cleaning and repointing of original walls and treatment with strengthening and water repellent material.
B- Restoration works

I- Stone works
Cleaning all stone and marble surfaces.
Treating with fungicide where necessary.
Desalinating of (internal and external) wall surfaces.
Replacement and / or plastic repairing for severely deteriorated stones.
Repointing joints where necessary.
Treating stone surface- inside and outside- with strengthening material.
Treating stone surface - inside and outside – with water repellent material.

II- Wooden works
Removing modern paints from wooden structural elements, windows and shutters, wooden doors.
Treating of all wooden structural elements, wooden windows leaves and shutters, wooden doors, with termicide where necessary.
Repairing all deteriorated wooden structural elements, wooden windows leaves and shutters, wooden doors where necessary.
Dying of wooden structural elements, wooden doors, wooden stair flights.
Manufacturing of new carpentry works for missing elements.
Re-housing of all wooden elements after treatment and repairing.

III- Plaster works
Cleaning plaster surface from new paint.
Repairing Plaster where hollow areas exists.
Replacing deteriorated plaster with new plaster in areas defined by conservation architect.
Consolidation of detached original painted plaster.

IV- Iron works
Removing paint from all iron elements (iron screens, iron lattice and iron structure ties).
Cleaning all iron elements.
Surface treatment against rust for all iron elements.
Repairing deteriorated iron elements where necessary.
Painting all iron elements with protecting paint coat.
Re-housing of iron elements after repairing.
V- Fine works

Minbar
Removing new paint applied to wooden minbars.
Repairing where necessary.
Dying and painting for wooden minbars.

Wa‘z stool
Removing new paint applied to wooden stool.
Treating with termicide where necessary.
Repairing where necessary.
Dying and painting.

Mihrābs
Cleaning.
Desalinating
Fixation of detached decorations on surface.
Consolidation with strengthening material.
Treating with water repellent material.