Building Heritage, in order to develop the first legislation that would allow a legal conduit for the reconstruction of damaged heritage. The absence of earthen seismic resistant construction experience, research, builders and masons skilled to perform the great task of restoring historic churches, manor houses, museums and public buildings built of this material resulted in the decision of using the experience developed in Peru.

The inclusion of Peruvian engineering by the Committee of the Standard allowed the quick development of a legislative draft, which was submitted to the Ministry of Housing and Urban Development (MINVU). After a period of discussion, MINVU collected observations and issued the official version. The document clarifies that it is not aimed at promoting new buildings, but rather the reconstruction of the existing earthen heritage. Adobe, rammed-earth, *quincha*, and stone masonry with earthen mortar are the techniques covered in the document.

Characteristic values of the allowable stresses for adobe masonry are encompassed, as well as the design, by analysis methods and traditional calculation. These include reinforcement recommendations with materials resistant to traction and compatible with the earthen material, such as the synthetic mesh developed at the Pontifical Catholic University of Peru. The main chapters of the Standard are intervention, structural and economic criteria, structural design (design philosophy); diagnosis of the monument; registry of the building (description); analysis and verification of the design and the geometry; mechanical properties of the material, design and calculation basis; structural intervention plan, restoration, reinforcement system, implementation and maintenance.

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PREVENTIVE CONSERVATION: A CONCEPT SUITED TO THE CONSERVATION OF EARTHEN-ARCHITECTURAL HERITAGE?

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Theme 8: Charters, Standards and Guidelines for Heritage and Construction
Keywords: traditional practices, risk, management

Abstract

The concept of preventive conservation (PC) is relatively old, as the term was already in use as early as the end of the 19th century. As the definition implies, the theory of preventive conservation was developed mainly in the context of work on movable heritage. Yet the concept appears to be equally applicable to built heritage, and more specifically to earthen-architectural heritage whose basic raw material is usually fragile by nature and in some circumstances, can decay relatively fast.

Though earthen architecture is varied, one of its characteristics is that for each typology, there is always a specific way of ensuring durability or minimizing the risk of damage. This is achieved by implementing a variety of measures that depend on the physical, economic and social context of the site. What is interesting is that all of these measures are aimed at protecting and extending the life expectancy of the structures in question, thus linking them to the concept of preventive conservation.

This leads to the conclusion that preventive conservation is by its very nature a concept well adapted to earthen structures. Taking into account climate change, which brings about unusual situations, reinforces the suitability of the concept, which allows us to anticipate natural disaster.

This paper examines the suitability and limits of applying the concept of PC in the conservation of earthen architecture through theoretical analysis and practical examples. It concludes with recommendations for its adoption, taking into account intrinsic specificities, and both the tangible and intangible values of the heritage being considered for conservation.

1. INTRODUCTION

The concept of preventive conservation is relatively old, having been in use as early as the 19th century. Yet it has not been widely utilized by practitioners. It was only in recent times, after the acceptance of the failure of the more commonly used methods of 'remedial conservation' that the concept reappeared in the 1970s, gained ground in the 1980s, and acquired recognition as a specific discipline in the early 1990s.

The concept was widely disseminated, mainly through the efforts of ICCROM (International Centre for the Study of the Preservation and Restoration of Cultural Property ICCROM (de Guichen, 1999) posited that preventive conservation should be defined as follows: "*The full range of actions designed to safeguard or increase the life expectancy of a collection or an object.*"

As this definition implies, the theory of preventive conservation was mainly developed in the context of work on cultural material, primarily by ICCROM, but also by other organizations, such as the Association of Art, Archaeology Restorers with University Education (ARAAFU) or the International Institute for the Conservation of Historic and Artistic Works (IIC).

However, at the beginning of the 1990s, North American professionals enlarged the field of application to historic buildings and housing artifacts, by adopting the New Orleans Charter (APTI/AIC, 1990-1993). This initiative did not move further, though the concept of 'risk management', which is nowadays quite widely considered, is similar, but in general is limited to disasters.

By the mid 1990s, a partnership with ICCROM (1) led CRAterre to explore the possibility of applying the concept of preventive conservation to the conservation of the Palais Royaux d'Abomey in Bénin. The results of this experience being quite promising, CRAterre decided to continue this exploration. This was the start of a series of field activities throughout the world in which preventive conservation was considered as a priority for the definition of conservation strategies and, further, for their implementation. The following is the result of this exploration, and the current state of our reflection on this question.

Fig.1 and fig.2 Preventive measures at the Royal Palaces of Abomey, 1996, Prema Project, ICCROM, CRAterre, DPC Benin (credits: Thierry Joffroy, 1996)

2. ADAPTATION OF PREVENTIVE CONSERVATION TO THE PRESERVATION OF EARTHEN-ARCHITECTURAL HERITAGE

When we started to consider preventive conservation, we quickly agreed with the idea that the concept could be applied to built heritage. However, if the problems of conservation and destructive phenomena were similar, it was also clear that the environmental factors, the scale of the work and the budgets involved were different and more complex. But adaptation was possible, and the old adage "*prevention is better than to cure*" is probably hard to question. The financial savings that this could bring was also evident, and this was a very important consideration for CRAterre, which works in the field of low-cost housing. The concept was also quite well expressed by what became a motto in the framework of the GAIA project (2): "*Maximum understanding, minimum intervention*" (A. Alva).

In trying to adapt the definition of preventive conservation to immovable cultural heritage, it was quite natural to just complete the existing so that it could apply at the same time to both immovable and movable heritage. Thus, the definition was extended as follows: "*Preventive conservation is the full range of actions designed to safeguard (or increase the life expectancy of) cultural heritage, artifacts or built structures*".

Looking at the specificity of immovable heritage, and more specifically, its related environmental and scale limitations (as compared to museum objects), we formulated an additional concept: "*ensuring that the risk of damage is reduced to a minimum*". The fragile nature of earth as a construction material is a factor that makes preventive conservation even more suitable. In certain circumstances, the destruction of structures built with earth develops quite fast. Hence, the importance of anticipating damage risks, and in many instances, the need to be able to intervene quickly so that the process can be arrested before pathologies develop to an irreversible stage.

An observation or review of the various traditions used for building earthen structures makes it clear that durability is often aspired to and that it is achieved by implementing a whole variety of measures. These are often complementary with specific choices/uses that are adapted to the specificities of the physical, economic and social context of the site. What is interesting to note, however, is that all these measures are aimed at protecting and extending the life expectancy of the structures in question. Thus many of those can be associated with preventive-conservation measures, which leads on to the conclusion that preventive conservation is by its very nature a concept well adapted to earthen structures.

Such traditional measures include:

- The use of architectural shapes that generate minimal damage;
- The carrying out of regular maintenance work on a larger or smaller scale;
- The protection of earthen structures by other, more resistant, materials;
- The physical-chemical stabilization of earth with natural products that improves its physical properties.

It is, therefore, logical to assume that in order for preventive conservation to be successfully implemented at a specific heritage property, it is appropriate to first and foremost:

- Gain awareness of the range of these traditional measures in order to be able to identify those that are/have been used in the construction of the relevant structure(s);
- Have a good understanding of the circumstances and processes of degradation;
- Evaluate the validity of these solutions for the heritage in question;
- Look at the range of other possible preventive measures, including those that might be required in order to adapt to climatic change, and with a specific outlook to 'living' heritage;
- Envisage the consequences of their implementation;
- Look for the adaptations needed to ensure integration, taking into account the evolution(s) of the cultural, social and economic environment.

In this respect, it is important not to lose sight of the fact that in certain cases, the durability of the structures has not traditionally been the main objective. We need to recognize that in some cases, on the contrary, this relative durability linked with the possibility of recycling the raw materials presents endless opportunities for adapting or modifying structures, if not rebuilding them from scratch.

This, therefore, allows the user to adapt his immediate environment as he pleases, as his needs and wishes evolve. These instances of traditions very much caught up in a process of evaluation raise what are specific conservation questions, because to a large extent the authenticity of these structures lies in this ongoing evolution. In some cultural areas, earth structures have gradually been reinforced, covered or partly replaced by other more resistant materials, just as a natural development process.

In the same line it is important to recall here that conservation is to be value-oriented and that in addition to technical considerations, the values and the elements carrying them need to be well identified. In the field of earthen-architectural conservation, the issue of patina and its significance often leads to dilemma when taking conservation decisions.

Fig.3 Traditional rendering of the Askia tomb by the overall population of the city, Gao, Mali (credits: Aldiouma Yattara, 2014)

3. IMPLEMENTATION OF PREVENTIVE CONSERVATION

The following presents a proposal for an intervention methodology constructed around 10 steps and points to be considered towards the application of the principles of preventive conservation to an earthen architectural heritage. The technical approach described does not exclude a participatory approach. On the contrary, working with stakeholders and sharing decisions with them is most of the time a plus towards an effective and successful implementation of preventive conservation. Some recommendations:

A) Examination of the site:

- Documentary research;
- Supplementary documentation of the building(s);
- Study of the physical, social and cultural context;
- Identification of the parties involved – individuals and interest groups.

B) Identification of causes of damage (diagnosis):

- Examination of the building in the light of its function (in connection with the way its durability is assured);
- Gathering of information (previous studies, works already completed);
- Repair of the 'disease' (effects of damage);
- Identification of definite causes (circumstances and processes);
- Identification of probable causes, and those still requiring verification.

C) Classification of causes according to risk level:

- Damage;
- Progression of damage (active or passive);
- Risk of damaging effects following one after the other ('domino' effect);
- Elaboration of a risk hierarchy;
- Risk prioritization.

D) Urgent measures:

A first series of urgent measures can be implemented. These can include:

- Provisional repairs, consolidation, stabilization;
- 'Permanent' (see point G below) repair;
- Specific treatment (against insects, animals…);
- Others.

Some of the above-listed measures may require a research-development phase before application, so as to ensure that the result is as close as possible to what is expected.

Fig.4 Traditional preventive measure of snow removal from a wall and wall base in Khiva, Uzbekistan (credits: Thierry Joffroy, 2003)

E) Implementation of regular inspection (monitoring):

- At least once a year and,
- In the wake of specific events (exceptionally heavy rain, storms, fires).

These inspections must cover most of the activities described in points 1 and 2 above. The assessments submitted will facilitate the elaboration of an annual conservation plan.

F) Regular maintenance:

It is desirable that maintenance should be the focus of a practical memorandum stipulating not merely what actions need to be taken but also within which time span, as well as the personnel, financial resources and equipment necessary.

It shall include activities of various types, such as:

- Tidying up and de-weeding the territory surrounding the earthen architectural heritage;
- Repairing and maintaining surface drainage;
- Treating roof timbers;
- Re-plastering.

Regular maintenance can also include ongoing work to eliminate secondary risks, which were not covered by the initial plan for urgent measures.

G) Repair:

Despite well-advanced efforts to avoid all damage, repairs of varying magnitude (preventive conservation) can prove necessary as a result of:

- Accidents or vandalism;
- Certain materials wearing out;
- Or in order to make a structure suitable for use again (rehabilitation).

In such cases it would be appropriate to proceed with repairs of a temporary or permanent nature (at the same time the concept 'permanent' should be used cautiously, since no materials last forever). 'Permanent' repairs, of course, cannot be undertaken unless sufficient documentation (tangible and intangible, movable and immovable) is available to make it possible to proceed with due respect to the authenticity of the site. If doubts remain, repairs can still be carried out, as long as it is made clear where the repairs start and the original structure ends. In the case of earthen structures, it can prove difficult to mark that demarcation. It is, therefore, necessary to keep a thorough record of the intervention.

Recent research has made it possible to perfect or apply technical solutions, which can prolong the life of earthen materials considerably. It is, however, appropriate to thoroughly evaluate:

- Their effectiveness in relation to the type(s) of earth available;
- The cost of the envisaged repairs;
- How easy they are to implement;
- If the authentic nature of the site is being respected.

In many instances, research will be necessary to ensure that the treatment suggested is giving the expected results (physical, aesthetic properties).

H) Developing or nurturing expertise:

Preserving skills is essential in order to ensure that work will be carried out with due respect for the authenticity of the building(s). Initially, documentation relating to expertise should involve the following:

- Identification, selection and recruitment of skilled personnel;
- Research into documentation on the relevant expertise;
- Research and experiments, if the relevant expertise has been lost or new solutions are planned.

If traditional channels for the transmission of the relevant expertise appear undermined, it would be appropriate to take steps to revive it by:

- Practical training (in the case of a large number of traditions);
- On-site training;
- Specialist training;
- Academic training.

Promotion and market research in connection with expertise are also a solution, which has to be considered, since facilitating practical experience and making it an integral part of modern life represents a major guarantee for the survival of expertise.

I) Natural resources

In some cases, the conservation of heritage and of the practices traditionally linked to it depends on the availability of the natural resources. These could include:

- The earth itself: this may involve several qualities and, therefore, several quarries;
- Vegetal infusions, such as trees, plants that are used as additives;
- Animal infusions like hair, dung.

Regarding the work itself, water is often very much required. Taking this into account, it is also important to verify that these resources can be available, both on the short and long term. For example, in some cases, the protection of a quarry can be paramount to ensure that the right building material is available. The improvement of access to water can also be a very important factor facilitating the continuation of some of the traditional conservation practices of regular rendering of historic structures. Besides that, the protection, and when

Fig.5 Test walls at Loropeni, Burkina Faso, WMF project (credits: David Gandreau, 2004)

Fig.6 Preventive measure with sacrificial capping, Fayaz Tepa, UNESCO-Japan-Fund-in-Trust project, Uzbekistan (credits: Thierry Joffroy, 2003)

necessary, the regeneration of tree species that are used for lintels, roofs, and beams can also be a paramount factor for ensuring that proper conservation work is implemented.

J) Equipment:

Many of the proposed interventions presented above can only be implemented if specific equipment is available. In some cases, the acquisition of modern equipment (mixer, crane) can be a good alternative for diminishing the load of work, and might be required when social practices have diminished. Equipment that can be useful includes:

- The means for regular inspections, such as transport, cameras;
- Equipment required for condition surveys, like ladders, templates;
- Site-work equipment, such as transport, tools;
- Equipment for research and experimentation, like laboratory, templates, experimentation facilities;
- Organization of the documentation, such as hardware and software, files, shelves.

4. SPECIFITIES WITH REGARD TO ARCHAEOLOGICAL SITES

Archaeological sites have several specificities:

- They are prone to plunder and to the impact of public works;
- They do not have their traditional protection and so are often very much unstable, though, generally, they have deteriorated into a relatively stable shape (Tepa); when excavated for research, their relatively stable shape is changed and often renders the structures prone to quick decay.

These considerations lead to the necessity to:

- Ensure that impact studies are undertaken before large public works are planned;
- Ensure that sensitive sites are protected/guarded;
- Ensure that conservation measures are planned together with the excavations, with the possible use of temporary shelters, backfilling, and/or work that ensures stability and renders possible the visibility of the revealed artifacts/structures.

This last proposal is paramount, because poorly conducted excavations or those abandoned can lead to rising damp at the base of structures; poorly regulated surface drainage is extremely dangerous for earthen structures, and can result in complete destruction of the discovered structure.

5. FINANCE AND MANAGEMENT

Even though preventive conservation is an economical way of conserving heritage, it can only be put into practice if regular financial resources are available to enable the implementation of the full range of the proposed measures. In fact, it is still difficult to make a complete separation between the concept of preventive conservation from the broader one of 'heritage management', which involves legal, administrative and institutional issues, the exploitation and promotion of the site, permanent and/or temporary staff, operational partnerships, as well as technical and financial resource considerations.

In this context, all efforts (activities) undertaken in connection with the development of the site can be regarded as preventive conservation, as soon as they are aimed directly or indirectly at generating resources and thus at making possible the provision of regular financial support, at a level adequate to ensure that the site concerned is monitored and regularly maintained. Paradoxically, this could extend as far as partial reconstruction (naturally based on thorough documentation) provided that it enables visitors and decision-makers to appreciate the site better. At some point, there is an intervention at the site, those who pay for it are often interested to 'see the difference'. That might need to be addressed, at least partially. At the same time, such cases must remain the exception, knowing as we do that there are numerous other ways for promoting a site effectively, like guidebooks, publications, maps, panorama plinths, exhibitions, organization of cultural events.

Considering that all these actions can prove to be effective and useful in relation to high-quality conservation of the site, it is desirable to consider a preventive-conservation approach as part of the site's management plan. It is appropriate to remember the cultural significance and the attractive features of a site to be conserved, and that these are crucial for a correct identification of the conservation aims, the activities and measures adapted to the conservation of the site in question and their prioritization. Finally, over and above the elaboration of such a plan, only a dynamic vision of the future is effective. It is, therefore, appropriate to periodically revise the plan so as to adapt decisions and objectives in light of research being carried out and results obtained. If the site evolves, the interest in it will also rise. One also needs to take into account the evolution of the site's physical, social and cultural context.

6. CONCLUSION

As long as preventive measures are very common in the traditions of building and living in earthen buildings, preventive conservation appears to be naturally suited to the conservation of earthen architectural heritage. In our changing world, and more specifically, with regard to climatic changes, such a preventive approach also appears to be very compatible, as it can easily include the risks linked to it (risk management). In the context of a possible long-running economic crisis, its capacity to lead to low-cost solutions is also a very strong advantage.

This paper has proposed a methodological approach for its implementation and provides a list of points that probably needs to be considered when trying to apply it. Through the reflections presented herein, one can realize that preventive conservation cannot be implemented without putting it into context of a larger management scope, which obviously also implies the involvement of stakeholders and, to a certain extent, sharing decisions with them.

Furthermore, we also need to realize that in its basic concept, preventive conservation may lead us to freeze heritage in the state in which we found it. But as developed herein, the very nature of this heritage might evolve and freezing it might not be the right way to respect its authenticity. In the same vein, especially when dealing with living heritage (historic centers, cultural landscapes), it is also important to take into account the other recommendations that have recently been established by the conservation community (e.g. the Vienna Memorandum) that opens the reflection on the need for changes (acceptable changes) to ensure that living in heritage remains possible, a primordial condition for its conservation.

Preventive conservation cannot be applied strictly in every situation, but it is a very useful concept for all those who wish to conserve earthen architecture but have limited means available to them. It also often leads to decisions that had naturally come to those who built and, later on, maintained these heritage structures, ensuring the authenticity of the interventions.

Notes

(1) A partnership between ICCROM and CRAterre was established in the framework of the PREMA program (Prevention in Museums in Africa) at the occasion of a major field project at the Royal Palaces of Abomey, Bénin, a World Heritage Site.
(2) The GAIA project was a joint initiative by ICCROM and CRAterre developed between 1988 and 1998, which included advocacy, research and training activities.

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INTERNATIONAL HERITAGE CONSERVATION PRINCIPLES IN EARTHQUAKE ZONES, JAPAN

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Theme 8: Charters, Standards and Guidelines for Conservation of Heritage and Construction
Keywords: Lima Declaration 2010, Venice Charter 1964, Nara Document 1994, World Heritage

Abstract

The Lima Declaration, adopted at the "International Symposium on Disaster Risk Management of Cultural Heritage; Sustainable Conservation of Urban Cultural Heritage in Seismic Zones" on December 3, 2010, says at its beginning that "*World is divided into seismic and non seismic areas. Earthquakes occur mainly along two big circles: The Circum-Pacific where more than 95% of seismic energy is dissipated and the Eurasian circle. Following the International Conservation Charters and conservation policies, now we address the cumulative damage to cultural heritage associated with severe earthquakes prone areas.*"

Japan and Peru are both located on the Circum-Pacific Seismic Zones, and also have rich cultural heritage, including many UNESCO World Heritage cultural sites. The structures of these heritage are mainly constructed with earthen, stone or wooden material, all ecological and natural materials, easy to reuse again for the reconstruction works after the earthquake disasters. For their sustainable protection and safety for human life, we need to constantly take care for the structures and be prepared for the next earthquake disasters based on management plans. Heritage values after reconstruction deeply depends on craftsmanship, one of the four tests of authenticity in the evaluation of World Heritage sites. Our heritage values are thus deeply related with intangible values, like techniques and community traditions.

The Venice Charter in 1964 and the Nara Document on Authenticity in 1994, both guiding principles for the World Heritage system, and both adopted in seismic countries like Italy and Japan, do not have enough tools necessary for sustainable protection against earthquakes. We need careful understanding of existing conservation principles, but if they are not enough, we have to examine a new principle to solve this problem. This paper intends to clarify the above points, introducing recent disaster experiences in Japan, especially the case of East Japan Great Earthquake in 2011 and Kobe Earthquake in 1995.

1. INTRODUCTION

East Japan Great Earthquake, which occurred at 14:46 on the afternoon of March 11, 2011, with a magnitude 9.0, caused great tsunami disasters along the northeast coast of Japan. There was almost 19,000 victims from the tsunami, with the visual images of the devastation dramatically broadcasted through TV news to all over the world. The people in the affected areas are now slowly rehabilitating near their old towns and villages, and they have huge works to reconstruct their own houses in a safer way and also to re-start their industry, with the help of central and local governments and many volunteers. But they also need the recovery of communities and cultural traditions, through the reconstruction of tangible and intangible cultural heritage for their own sustainability.

This paper intends firstly, to introduce Japanese experiences in the recovery restoration of Western-style historic buildings after the Kobe earthquake disaster in Japan on 1995, and then to investigate the fact that so many World Heritage sites are

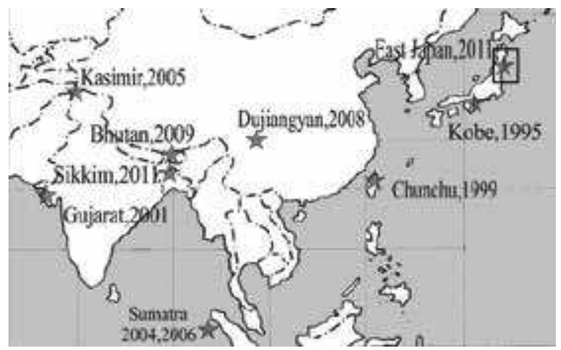

Fig.1 Recent big earthquake disasters in East and South Asia (credits: Mendoza Shimada, 2011)