The Documentation of the Failures of the Timber Structures in the “Nominations Files” and in the “ICOMOS Evaluations”, for the Inscription in the World Heritage List

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Introduction

The dossiers of the World Heritage List are composed of two principal documents: the Nomination File, which is the documentation prepared by the State Party to describe the proposed site, and the ICOMOS Evaluations, which is prepared by ICOMOS. From the complete analysis of these documents, kept in the ICOMOS Documentation Centre in Paris, we found what the states party’s general trend is in relation to the structural failures of the timber structures of the monumental heritage.

All the comments on this topic are only referred to the dossier for the inscription in the World Heritage List and their consequent ICOMOS Evaluation, and that it is not a general opinion about the common practices in every cited State Party. The documents of the inscription in the World Heritage List are very important because they represent all the most important sites in the world. They have to be taken as the example for all the other monuments not yet inscribed and they represent the ethic to follow for their conservation.

It is very interesting to note that this lack of study and comprehension of the failures of the wooden structures is present in all the categories of the heritage: vernacular architectures, industrial heritage, historic centres etc. Wherever the wood is present as a material for construction, we found this lack of study.

The aim of this paper is to summarize some examples taken from all the analysed dossiers, expressing a judgement on the widespread practices.

Different kinds of documentation of the failures

The documentation of the failures of the timber structures is present in the dossiers under some different forms:

1. Only one or more photos, without any explanation of the failures, to represent the need of the maintenance, as in the case of the Estancias of Córdoba in Argentina.

Figure 1. Crash of the rafter in correspondence with the chord joint
From: Argentina, 1999, World Heritage List Nomination of “Jesuit Block and Estancias of Córdoba”
The representation of the general decay of a site with pictures is very common. Wooden structures, in most of these cases, are waiting for a complete replacement with the consequent and progressive loss of authenticity of the whole site.

**Figure 2.** Bishop San Nicola at Morelia, Mexico: crash of the ceiling in *mudéjar's style*


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**Figure 3.** City of Zabid: crash of a ceiling


**Figure 4.** Ruins of Moenjodaro: deformation of the beam


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Sometimes a picture with the representation of a structural failure contributes to document the picturesque, as in the case of this house in Valparaíso, Chile.

**Figure 5.** House in Avenida Gran Bretaña n°761, Valparaíso, Chile: lack of a structural element

2. Description of strengthening works without any explanation of the structural failures to justify these interventions. This is a very widespread practice: a list of all the interventions on the structures of the monument to demonstrate the great dedication on its conservation.

3. Replacements, ablations or modification of structural elements without any explanation of the structural failures to justify this interventions as in the case of the Muzibu-Azaala-Mpanga (the main tomb building) in Uganda.

Figure 6. Detail of the Muzibu-Azaala-Mpanga: traditional structure and concrete columns.

From: Uganda, 2000, World Heritage List Nomination of "Tombs of Buganda Kings at Kasubi"

From the Nomination for the inscription of this site, we extracted the description of the interventions for the demonstration of the authenticity: "Starting in 1938, however, the tombs have gone through several processes of restoration and modification in order to diminish the threats of structural failure and meet maintenance needs". Without understanding what kind of structural failures affected the building, we found the following description of the interventions: "...some modern materials were used including a steel structure, a few concrete columns, and some fired clay bricks. Fortunately, however, this structural work is invisible, as the traditional materials cover all the visible parts of the structure."

It is unfair to criticize such old interventions, but the fact that they have been accepted in the documentation, dated 2000, without any study of the reasons that led to them is quite serious.

4. Propping of a monument without any explanation of the structural failures as a reason for these interventions, as in the case of the church of Nercón in Chiloé, Chile. This church is made of wood of cypress and larch (40 metres in length, 15 metres in width, the tower is 25 metres in height). In this case we found only quotations about some refurbishments of the constructive elements since its construction (1890). The propping system shown in the picture and in the drawing is not explained.

5. Complete reconstruction of a timber structure without any explanation of the structural failures to justify these radical interventions. This is very common but it is very difficult to demonstrate what the structural failures of the timber structures were before the whole reconstruction.

6. Seeming lack of structural failures. Unfortunately, this custom represents the normality. Pictures of sites are usually taken so as to show them as perfect ones, as if they were amusement parks for large crowds of stupid tourists. The presence of a possible structural failure is voluntarily hidden, and probably not studied, not interpreted... In fact during the inscription procedure the general trend is to represent perfect sites which need only periodical maintenance.
Since 1978, unfortunately, the trend has not changed. The failures of the timber structures are usually hidden in pictures, graphic documentations and in the reality. This is often unintentional, though, and only due to widespread practices. The problem is that these practices may prove very dangerous as they tend to replace structural elements instead of repairing the existing ones, with consequent loss of authenticity.

The study and the consequent understanding of the mechanical behaviour and failures of the timber structures is very important because the survival of the monument depends on them. The common mistake is to repair or to replace the single element without any effort to understand the origin of the problem and the behaviour of the complete structural system.

With the exception of some very famous and exceptional specimens, such as the Church of Transfiguration in Kizhi Pogost (Russian Federation), whose problems were reported since the very beginning, for nearly all the other sites the situation is different.

What are the causes of the structural failures of this fragile heritage made of wood? The causes are very intuital but very important to understand. We can cite the wrong geometry of the structural system and of all the structural elements, the undersized structure compared with the excessive stress, the mechanical properties, the quality of wood, and the presence of the biotic decay (fungal attack or insects). Structural failures are also caused by subsidence, earthquakes or hurricanes. Let’s not forget the neglect, when a wooden architecture has been abandoned for a long time, the causes of decay are various and the structural failures, little by little, start to appear and can cause the architecture to collapse.

The case study of Kizhi Pogost

As for the wooden architectures of the open air Museum at Kizhi Pogost on the Onega lake, we can talk about them as an exception, because their structural problems were reported since the very beginning. This was probably due to the universal knowledge of these structures and to the fact that their failures were too evident and
that an international aid was badly needed. This first consideration, though, is not completely true. In fact, although the structural problems, particularly of the Transfiguration Church, have been known since the beginning, technical reports and detailed descriptions have started to appear in the last few years but never in the official ICOMOS documents. Below, we will try to list all the information found in the ICOMOS documents.

We analysed the first description of the state of preservation/conservation in the Nomination file for the inscription dated 1989: “The walls of the church of the Transfiguration and the church of the Intercession have substantial progressing deformations caused by timber bio deterioration and mechanical damage as a result of repairs (...)

In an article by Håkon Christie, dated 1989 and maybe attached to the Nomination form, he explains that, in spite of the use of a simple corner joint in log construction, (in Scandinavia they use this simple corner joint called vagenov in more simple buildings), the damage observed in the church is probably due to the settling of some parts of the walls of this extremely tall and heavy building.

In the ICOMOS Evaluation (1990) we found the same critical situation, with regard to the comprehension of the structural failures, as in the first Nomination form. In the last part of the document, then called “ICOMOS Observations” they express the ICOMOS interest in the previous and proposed restoration projects after the interior was shored up and the iconostasis dismantled in 1988. No other information is present in the official document.

In the same dossier, with all the documents for the inscription, we found the documentation about the “Project of the Request for Technical Co-operation”, prepared in March and June 1991 by the Soviet ICOMOS Committee and the Ministry of Culture. The causes for the structural failures listed in this project were:

- aging of the construction
- short lived construction material used (timber)
- damp climate of the North and Human activity
- construction without foundations
- mistakes made during repairing and restoration.

In the same dossier we found another “Request for Technical Co-operation” dated 1992; attached to this new one is a very interesting document analyzing the deformation of this church:

- Time factor (the average service term of the used timber is about three hundred years.
- Mechanical damages of the timber (notches in joints, deep cracks stretching to core-layers).
- Unsuitable repair works of the log house (substitutions of rotten logs without usage of lifting jacks with logs of smaller diameter, the usage of improper cut joining causing list deformations; errors in the methods of fastening of the first octagon, this produces the squeeze of some logs; ineffective way of fastening of the second transitional rectangular cage.
- Inaccuracies in the original design (the basis construction of the second root is made without bottom ties – this mistake induces the squeeze of logs in that substructure and the damage of some incisions at this level; base logs of the transitional frame cage under the upper octagon are overloaded. There are not enough ties between first and second octagon for their mutual work under stress.
- Biological injuries of timber.

It is very rare to find a post-dated document in a dossier for the inscription in the World Heritage List, all the other documents like scientific and technical reports, mission reports etc, are kept elsewhere.

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1 Russian Federation, 1989, World Heritage List Nomination of “Kizhi Pogost”
2 Soviet ICOMOS Committee and Ministry of Culture, 1991, Project of the Request for technical Co-operation
3 Ministry of Culture, Russian Federation, 1992, Request for Technical Co-operation
In the two cases above described we found very specific results of analysis on the structural failures of the church, but without schemes or drawings. To find interesting drawings representing the structural problems of the building we have to search in documentation not included in the dossier as in the case of this longitudinal section. Anyhow, no mention about the analysis of the structural problems is included in the original documentation (Nomination Form by the State Party and ICOMOS Evaluation), although information about the structural failures of this building have been disseminated since the beginning.

**The case study of the Independence Hall in Philadelphia**

In some cases, such as in the dossier of the Independence Hall in Philadelphia, inscribed in the World Heritage List since 1979, all the interventions of strengthening, repair and replacements are proudly boasted but without mentioning what constructive criteria and diagnosis of the structural failures brought to this kind of extreme interventions. In the Nomination form of the site are only quoted problems of displacement of ceilings and floors without any explanation of the real causes. In a documentation dated 1976 and not included in the dossier, we found the same trend: description of the interventions of strengthening, without any study and comprehension of the structural problems.

**The case study of the Wieliszka Salt Mines**

The case of Wieliszka Salt Mines is very interesting. It was inscribed in the World Heritage List in 1978 with a positive judgement about its state of conservation. Only ten years later this site was inscribed in the List of the World Heritage in Danger with a
devastating documentation on its state of health without any analytical and mechanical description of the failures and without any mention at possible strengthening techniques to save the original propping systems of the mines.

Figure 10. Gospoda Room (Level I), destruction of the protection carpentry
Figure 11. Gaisruok Room (Level III), destruction produced by the ground weight

From: Dossier of "Wieliczka Salt Mine", kept in the ICOMOS Documentation Centre, Paris

Conclusions

The study of the structural failures of the timber structures is very important. It is the first step to produce a correct intervention of conservation or restoration. We found a widespread lack of this kind of documentation in the attached files of the Nomination Forms for the inscription in the World Heritage List. We speak about attached files because this kind of request is not present in the form prepared by UNESCO for the inscription.

The only point that allows a description of the structural failures is perhaps the point 4 of the Form: State of Conservation and factors affecting the Property. Concerning this point we can quote the following explanations: “The information presented in this section constitutes the base-line data necessary to monitor the state of conservation of the nominated property in the future. Information should be provided in this section on the physical condition of the property, any threats to the property and conservation measures at the property. For example, in a historic town or area, buildings, monuments or other structures needing major or minor repair works, should be indicated as well as the scale and duration of any recent or forthcoming major repair projects.”
This section should provide information on all the factors which are likely to affect or threaten a property. It should also describe any difficulties that may be encountered in addressing such problems...

All information requested from UNESCO doesn’t lead the State Party to produce a technical documentation. The Form for the inscription should change so as to allow a different approach to the consequent conservation/restoration project and to the consequent preservation of the timber monumental heritage.

If institutions like ICOMOS, which works for the conservation and protection of cultural heritage places, don’t contribute to change something, the problem will become serious and we will have to admit that it has never really been dealt with.

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4 UNESCO e Intergovernmental Committee for the Protection of the World Cultural and Natural Heritage, (1st February 2005), Operational Guidelines for the Implementation of the World Heritage Convention, UNESCO World Heritage Centre