Ancient Timber Structures in the Alpine Area of Piedmont: Building Systems, Failures and decay the Case Study of Thures

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The research and the site

The aim of the research presented here, which is a particular aspect of a larger study, is the knowledge of timber structures in the Susa valley, in the province of Turin (Piedmont, Italy). More exactly, the area corresponds to the Thuras valley, above Cesana Torinese (1500-1800 m above sea level). The decision to study this valley, and in particular the hamlet of Thures, is due to its exceptional historical-architectonic remains, which maintain almost entirely their structural and constructive features. This small hamlet has almost thirty buildings built between the 17th and 19th centuries, all made of wood and stone, where the timber frame is present for three or four levels from the ground and where materials and building techniques are almost entirely original.

At the same time, the significant state of decay in which most of the buildings of the hamlet can be found, while still comprehensible on the whole, immediately requires a complete examination of the architectonic items, so that structural rehabilitation and re-use procedures (considered the only possibilities to avoid the total decline and neglect) can be possible.

The construction of Thures followed specific rules related to particular needs of a community life, with multi-functional buildings, inside which there are residential areas, animal shelters and agricultural commodities, almost all in direction south-west, so that they can receive the best light. The buildings are medium-large and are characterized, as already mentioned, by three or four floors, so that they can achieve the economical and residential needs of many large families. The different units are built around the fundamental architectural buildings: the church, the cemetery, the bakery and the
monumental 17th century fountain. Some buildings also preserve inscriptions with the year of construction.

**Figure.** The architectonical centre of Thures, illustrated in the *Catasto Rabbini* map, 1867-1868. Archivio di Stato di Torino, Sezioni Riunite, *Catasti*. (Turin State Archive)

Most of the buildings were built during the 18th and 19th centuries, although there are still
earlier examples. There was a gradual neglect of the buildings during the first half of the 20th century.

Analysis of the building systems shows that timber and stone are the materials mostly used in the Thuras valley. Traditional construction has preferred materials which could be easily found locally, such as “calcescisti” (a metamorphic rock), “dolomie” (a sedimentary rock), and the larch of the surrounding conifers.

Final coverings of roughcast made of lime are frequent, and characterize many buildings in the residential areas for hygiene and health reasons. Ochre limestone, typical of the traditional building system of Cesana, is used in decorative elements, in more relevant items or in particular parts, such as doorposts and connecting angles. Gypsum, available in the nearby quarries on the slopes of Comba d’Imbert, is used for walls, originally inside, of the civil areas inside the multi-functional buildings. Gypsum is installed with the help of a timber structure.

If the building base is always made in stonework, joined with mortar, the upper floors, used to preserve hay and cereals (high floors, loggias, galleries) are entirely realized with timber, using semi-squared trunks such as beams, differently oriented planks and bracing frameworks. The covering structures are characterized by large trusses and horizontal elements which almost never end in the walls. This allows the perception of larger interior spaces. This last characteristic seems to be contradictory to the common small mountain buildings, realized following a criterion whose aim is to ensure faster and easier heating. “Scandole”, fluted parallelepiped elements in larch wood, are the traditional material used for the covering mantle.

![Figure](image1.png)  
**Figure.** Thures. Particular of the timber structure and gypsum curtain walls of a building with mixed functions.

![Figure](image2.png)  
**Figure.** The timber structure and curtain walls of a multi-functional building.

**Building systems, failures and decay**

The peculiarity and the potentiality of these historical-architectonic buildings required the development of a specific knowledge process, so that restoration works could be possible. In this way, this research studied the building systems of what still remains, through the analysis of the timber elements and the way they connect to each other. This approach has led to a profound understanding of the statics of the structure, revealed strains, failures, cracks, and catalogued the different kinds of material decay, producing a specific analysis whose aim is to preserve these important buildings. The research indicated the characteristics of the inter-connections, including their geometry and dimensions, the macroscopic identification of the timber species – this was always larch in the particular example of Thures – the estimation of wood humidity; the visual classification, based on defects, of the mechanical quality; the estimation of decay and the definition of those sections which actually react where there is a larger
A particular section concerned the assembling method of each timber element, named “unions” or connection points, whose state of preservation has been analyzed. Regarding the wood decay, the preservation state of each single element is usually good, not so damaged by xylophages insects (such as woodworm and beetles), in particular by “Capricorno”. The external surfaces, especially in the lower floors, where the junctions with the walls bases are located, present a rust-coloured biological patina, typical of lichens, very common in mountain areas. Absorption of water by the timber and rot due to humidity, with the consequent presence of fungi, are isolated cases and are related to the covering structure failures.

Cracks are usually more concentrated in the end sections of the main girders of the floors. In these positions, timber is in contact with the stonework basis and so more exposed both to atmospheric agents and concentrated loads, which can cause admissible values of resistance to be overcome. But these cracks, the results of reduced resistance of the material, have not changed over time, and the performance of the structures is absolutely acceptable.

The definition of the resistance characteristics of the structural elements and tensions have been based on the methodology of the UNI standard 1119/2004: on the base of the results achieved by research on the premises, and of defects, the timber has been classified in three categories. For each of these, the values of the maximum tension related to the larch species (Larix spp), have been defined.

It seems possible to conclude that, in most cases, cracks and disconnections of the timber structures are strictly related to failures of the building base. This happens because they try to react to deformations, in the lower parts of the buildings, caused both by settlements and advanced decay, such as crumbling of mortar.

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**Figure.** Thures. The complex timber skeleton inside one of the buildings.

**Figure.** Cracks near connections.
Conclusions

Knowledge of the exact conditions, in which these particular buildings are, is quite difficult and complex because many different elements are involved. In fact, the outcome depends on the presence of different effects, due to environmental agents, to the natural characteristics of the materials and their transformation over time; alteration elements which interfere, in a complicated and different way either with the morphological characteristics or with the different robustness of each building.

Because each situation is different from the others, it is necessary to operate on a “case-by-case” basis, developing a “quality project” with specific actions, different procedures, and solutions related to the real and particular situation of the building involved.

The philosophy which guided this research is certainly the same as that of the “Icomos Paper – Carta Icomos” (1999) *Principles for the Preservation oh Historic Timber Buildings*. In the Thuras valley, and more generally in the whole High Susa Valley, transformation and alienation of the architectonic timber heritage has been caused both by the choice to abandon mountain hamlets and the agricultural economy, preferring instead to live where industry is located, and by the loss of skills and knowledge of traditional design and construction technology, used for many centuries and then completely abandoned during the 20th century.

References to the “Carta del 1999” and, more particularly, to the guidelines of the previous and more complete “Carta di Venezia, 1964”, define the general conservative-restoration criteria and express the necessity of an exact, verifiable and scientific cognitive approach, which has to be preparatory to all restoration or preservation actions. In this way the concept of “historical monument” can be extended to an urban or rural environment which is proof of a particular civilization and culture.

Every kind of process on the timber structures here analyzed, must follow specific
guidelines, suggested by the present preservation discipline: compatibility, reversibility, differentiation, “minimum operation”, together with respect of the authenticity, guaranteeing, in this way, a correct approach to what exists. These guidelines can be correctly applied to timber structures, where consolidation, reinforcement, carried out with different technologies, guarantee the maintenance of the historical element and avoid substitutions.

To conclude, it is necessary to underline the particular weakness of these architectonic goods: until a few decades ago, these buildings were considered examples of a bad and uncomfortable way of living and so were transformed, substituted, or simply abandoned. Today, they are considered as part of our cultural heritage, as memories of the historical-constructive tradition, important elements of our landscape. Our aim is to preserve, maintain and insert them - through an integrative preservation process – in the economical, social and cultural process.

Bibliographical References

Lucio Gambi, 1964, *Per una storia dell’abitare rurale in Italia*, RSI, XXV.

1 This research, carried out in different moments, but always with the same methodological approach, concerned also the timber constructions of the pre-alpine Canavese area, in Piedmont, in the north of the city of Turin. On this subject, see the essay of Monica Naretto, presented in this same meeting: Ancient timber structures in the alpine area of Piedmont: building systems, failures and decay. The heritage of the Canavese valleys. See also Rosalba IENTILE, Filiberto CHIABRANDO, Monica NARETTO, Jean-Marc TULLIANI, Conoscenza e conservazione di testimonianze storico-architettoniche: il nucleo aggregato di Thures nell’Alta Valle di Susa, in Claudio D’AMICO (a cura di), Atti del IV Congresso Nazionale di Archeometria Scienza e Beni Culturali, Pisa 1-3 febbraio 2006, Pàtron Editore, Bologna, 2007, pp. 209-220.

2 ASSOCIAZIONE CULTURALE LA VALADDO (a cura di), Lous Escartoun, Alzani editore, Pinerolo, 2002.

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Through a visual analysis, by preferring the ones more easily reachable through a direct survey.


5 Hylotrupes bajulus.


7 The defects of timber which have been studied are: chamfers, fractures, flaws caused by frost, shakes, single panel point or group of panel points, fibres inclination, and radial cracks due to contraction.

8 Adopted by ICOMOS during the 12th General Meeting – Mexico, October 1999.

9 How the prologue of the Carta ICOMOS (ICOMOS Paper) of 1999 expressly declares.

10 Even if it is known that reversibility is not always easily applicable.

11 “New members or parts of members should be discretely marked, by carving, by marks burnt into the wood or by other methods, so that they can be identified later”. Carta ICOMOS 1999, art. 11.

12 Also see Carta ICOMOS 1999, art. 6.

13 Adopted by ICOMOS during the 12th General Meeting – Mexico, October 1999.

14 First of all traditional. Where this is not possible, contemporary technologies can be utilized, such as the use of resins, steel or carbon fibres reinforcements.

15 Already in 1975 the “Carta Europea del Patrimonio Architettonico” (the European Document of Architectonic Heritage), subscribed by the Comitato dei Ministri del Consiglio d’Europa (European Minister Committee) proclaimed: “The architectonic heritage includes not only the most important monuments, but also groups of elements which form our ancient cities and our traditional villages, in their natural or built environment”. The actual “cultural landscape” concept has been introduced in Europe since the Convenzione Europea del Paesaggio (Consiglio d’Europa, Congresso dei poteri locali e regionali d’Europa, Firenze 2000) - European Landscape Convention, after which, in Italy, the First National Conference on Landscape took place.

16 The term “integrative preservation” has been enounced in the European Document of Architectonic Heritage and in the Declaration of Amsterdam in 1975.