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The research and the site

The aim of the research presented here, a particular aspect of a larger study, is the appraisal of timber structures preserved in the pre-alpine Canavese area, in the province of Turin (Piedmont, Italy). The analyzed territory corresponds to the Orco and Soana valleys. Part of it is included inside the area of the Gran Paradiso national park and borders the southern part of the Aosta valley: over the centuries the two areas have exchanged cultural and constructive models.

Figure. Scenery of the Soana valley, with historical architectonic centres, built near the principal road, which goes through the valley, and near the Soana stream.
If the rural architectonic heritage of the Aosta valley – characterized by a large use of timber in the multi-functional buildings and in those with functions related to agriculture – has been studied through analytical and scientific researches – the similar one of the Canavese area – generally rarefied and in a significant state of decay – is today not so known and analyzed.

In the Orco and Soana valleys, the building structure is made of stone, realized through the use of local *gneiss* (scabbling or ashlars), either fitted in a dry way or with mortar. The timber elements, chestnut and larch in particular, are used in the covering structure, floors, galleries, external or internal stairs at the upper levels, and in the in common covered passages.

![Figure](cover-of-prealba-chapel-sparone-orco-valley-system-timber-trusses.jpg)

**Figure.** Covering of the Prealba chapel (Sparone, Orco valley). System of timber trusses.

In the municipal area of Ronco and Valprato (two hamlets in the Soana valley), some buildings are built through two different and overlapping techniques: the skeleton is made of timber, while walls are made of stone. These are particular remains which developed from the “Walser” constructive models, used in the near Champorcher, Valgrisenche and Valsavaranche valleys.

These are rural buildings created in order to shelter animals and store hay and corn, characterized by a stonework base, above which there are one or more wooden levels of logs either squared or simply barked, connected through a ‘*mezzo legno*’ system. The species are again larch and chestnut.

The walls – perpendicularly interconnected – are sometimes tied by wooden collar-beams; the timber roof frame is completed by a covering made of “*lose*” (shingles - natural-split sheets, cut by hand and overlapped). Although the most ancient remains date back to the 14th and 15th centuries, most buildings date back to the 17th and 18th centuries. Two buildings have an inscription with the year of construction on the timber door lintels.

Today this typology – which was once undoubtedly more widespread – is limited to nine
permanent elements, almost all of which have fallen into disuse and are important cultural and material witnesses of great value. These buildings, located in historical hamlets and villages in the mountains at altitudes between 1400 m and 1800 m, were once used to run an agricultural economy. Three of them have an independent plant, while the others are associated with other architectonic buildings.

The structure of these buildings is strictly connected to their original function of *rascard* or *raccard*, a term that, in the Franco-Provencal language, indicates the building where cereals were threshed and stored. The timber structures guarantee a good insulating capacity and a stable airing through the openings between the plank joints. For this reason these were either used to store sheaves and hay or as a threshing place.

The research started by cataloguing all the preserved buildings: the cadastral (land registry) data, the analysis of the context, the chronology of the buildings, the typological elements, materials, and a general examination of the state of preservation. These data have been collected in a specific document.

**Building systems, failures and decay**

The authenticity and uniqueness of these historical-architectonic remains, together with their significant state of decay, require a correct knowledge acquisition process, so that restoration and preservation works can be possible. From this point of view, this research carried out detailed architectonical surveys, by analyzing the building system (examining timber elements and the way they connect to each other), cracks, deformations, typical failures, and by listing the forms of decay, the general state of preservation of the buildings.

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*Figure.* The three timber collar-beams that close the gable facade.

The timber buildings of the Soana valley, characterized by squared or rectangular plants,
with sides of 5-8 m, open spaced, without internal divisions, and with a basement which
contains one or more spaces, are used as a cowshed.
In most buildings the constructive features are uniform. The structure is made either by
logs, squared using an axe, or by thick planks obtained by sawing the log in the centre
line: in this case the homogeneous finishing, gained through the saw, is usually placed
outside. These elements lay horizontally and are based directly on the head of the
stonework base. These form the walls which are perpendicularly interconnected with the
typical “a mezzo legno” (half timber) system, called “blockbau” system in some
geographical areas.
The structure is reinforced by wooden collar-beams, placed in the front centre line, at
least in the two gable facades: two vertical uprights, one inside, one outside, are
connected by two short elements, which are perpendicular to the wall section, and locked
with wooden round beamsvii.
On the other hand, the large Chiesale rascard is characterized, for the large dimensions
of the facades, by three collar-beams placed side by side on the two gable facades and
by two others on the free north-east facade.
The coverings, taking advantage out of the compliance of the structure, are characterized
by a double roof frame with the ridge laid on the gable vertex, the main parallel beams
and rafters, placed following the line of maximum slope, completed by a covering made
of “lose”. Openings have large dimensions to allow loading of hay and cereals and have
wooden single or double doors.

Figure. Rascard of Cugnone. Opening with double door and timber door lintel, on which there is an inscription
(1685).

Only one building, the small rascard of Ronchietto a Valprato, presents timber elements
that are perfectly preserved, thanks to its continual useviii. Its characteristics are different
from the other buildings: the wall logs are round, simply cleaned, and the covering
structure is made of rafters placed side by side, which are parallel to the ridge and are
connected, using the typical "blockbau" system, with the wall elements and supported by a strut in the middle of its opening.

![Figure. A building in Pianetto. Particular of the timber roof frame.](image)

These can be considered more "archaic" characteristics, which lead back to a previous period, probably between the late Middle Ages and the 16th century, if the dating methodology applied to the Aosta valley heritage is used.

The building systems are also evidence of the practice of re-using the wooden elements, which originally had been utilised somewhere else in the same building or in parts of more ancient buildings: kerfs and offsets on the buildings in Piamprato and Chiesale reveal this.
Traditionally, in relation to ever-changing necessities, it was not unusual to “disassemble” and “reassemble” the timber structure, keeping the statically efficient elements and replacing the decayed ones.

The research concerned the identification of the characteristics of the interconnections, their geometry and dimension; the macroscopic identification of the timber species – especially larch (*Larix decidua* Miller) *, sometimes red spruce (*Picea abies* L. Karsten) **, the visual classification, based on defects, of the mechanical quality: the estimation of decay and the definition of the sections which actually react where there is a larger stress***. In particular the preservation condition of the “unions” or connection points has been analyzed: checking on connections between the different structural elements is fundamental. Next, an estimation of wood humidity will be performed.

Regarding the decay****, the state of preservation of each single element is quite good. The attack of insects xylophages (such as woodworm and beetles), in particular by the Longhorn (*Helitrupes bajulus*), which produces the typical oval holes, is generally present, but not able to cause damage to the reactive sections. The lowest timber elements of the walls, where the bearings of the wall base are located, show a biological patina, in particular musk developed on insubstantial deposits and lichens.

![Musk, lichens and biological patina on timber.](image1)

![Holes in connection panel points](image2)

The attack of fungi, demonstrated by typical holes in the wood, is quite widespread, especially in the end sections of the logs, where the connections between perpendicular elements are located, in the areas where the decay process is made easier by humidity.

![Flaws due to frost.](image3)

![Rascard of Cugnone. Subsidence of the wall base and deformation of the wall logs in the north-east part.](image4)
The defects of timber have been studied and listed: chamfers, fractures, flaws caused by frost, shakes, single panel point or group of panel points, inclination of fibres and radial cracks due to contraction. Longitudinal cracks due to frost are quite frequent: these elements are, during the winter, exposed to a significant temperature gradient, which produces a different contraction in the section of the log.

The static behaviour of the structures depends on their particular configuration, composed of bi-directional beams connected to each other, by the timber floor beams and by the roof frame, which form, all together, a "single structure, where each element contributes to the overall stiffness of the structure" xiv. From a structural point of view, the walls are the main load-bearing element.

The weakest part of these buildings is where the junctions with the wall bases are located. In these points, the weight of the structures, although light on its own, when taken together with heavy loads due to the covering stone mantle and to snow, contribute to a heavy load when transferred to the lower floor, made of stone, a material with different mechanical characteristics.

In the Chiesale rascard, subsidence has produced, in the north-east part, the typical overturned parabolic cracks in the wall base, with the consequent deformation of the timber logs in the upper wall. The main cause of this phenomenon is the rotation of the elements located where the interconnections are located.

The definition of the resistance characteristics of the structural elements and tensions have been based on the methodology of the UNI standard 1119/2004 xv: on the basis of the results, achieved by research on the spot, and of defects, timber is classified in three categories. For each of these, the values of the maximum tension related to the wood species, have been defined. Regarding the state of preservation, the analyzed buildings can be generally classified in two categories. In the first can be found those that are essentially complete, where decay and defects are present, but without deformations that reduces stability. In the second one can be found buildings in which the covering has collapsed, either partially or totally, due to neglect, and structural weakness has started to be produced. This develops very quickly and compromises the statics of the vertical structures and of the floors, that are in this way exposed to the atmospheric conditions.

Figure. Rotation of elements where the panel point is located.
Conclusions

The uniqueness and authenticity of this heritage requires a correct and accurate preservation approach. It represents a memory of self-sufficient methods and constructive knowledge that today has been lost, related to the use of natural resources. For this reason it has to be part of our “cultural landscape”, an essential element of our urban landscape and, still, testimony of the diffusion of cultural models in geographical areas now separated, but once connected through valley-routes\textsuperscript{xvi}. To avoid the total decline and neglect, structural rehabilitation and re-use procedures, which respect the constructive system of the buildings and guarantee material subsistence, are the best options.

According to a recent and strongly supported methodology, backed up by precise cultural assumptions, the vulnerable heritage of historical timber structures must be the object of a specific knowledge process, so that restoration works can be possible\textsuperscript{xvii}. Only through this, it will be possible to understand the differences and peculiarities of each building, which, even though belonging to a “constructive typology”, is always a unique testimony. Every kind of process must follow specific guidelines, suggested by the present preservation discipline: compatibility, reversibility, differentiation, and “minimum operation”\textsuperscript{xviii}.

A final short consideration to maintenance procedures which allow to preserve buildings without significant radical operations\textsuperscript{xix}. These procedures have allowed, through small replacements and adaptations, the transmission of these important architectures.

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1 Walser architecture remains can be found in Piedmont, also in Macugnaga, in the Sesia valley (Valsesia).
2 To know more about analogies and differences between the heritage of the Aosta valley and of the Canavese area, see Danilo Marco, *Le costruzioni in legno di Ronco Canavese e Valprato Soana. Caratteri e relazioni con il patrimonio valdostano*, in Rosalba IENTILE, Monica NARETTO, *Conservare per il paesaggio cit.*, 2006, pp. 126-129.
3 The term “a mezzo legno” indicates that two carvings are made on each element located in the head part. These two carvings fix in the below perpendicular element and, at the same time, receive the overlapping element.
4 One of the rascard of Chiesale has on the door lintel the inscription “1685”, interposed by the “trigramma” of Christ “HIS”, surmounted by the Cross; an other inscription, datable at the beginning of the 17th century, today not readable anymore, was on the rascard of Ronchetto and proofed by Giancarlo SANDRETTI, *Architetture in legno: i rascard della Val Soana*, in “Il Canavesano”, Ivrea, 1994, pp. 121-123.
5 The list, first step of the whole research, has been published in Rosalba IENTILE, *Catalogazione delle “case di legno” individuate nella Valle Soana*, in AED, Monica NARETTO, *Conservare per il paesaggio cit.*, 2006, pp. 116-125.
6 On the base of the declarations expressed by ICOMOS in different occasions, which will be specified later.
7 In the buildings of the Aosta valley, collar-beams are more frequently located on each facade. Analysis made in Champorcher and Pontbosset, dated these buildings between the 17th and 18th centuries. This chronological indication is also applied to the buildings of the Canavese area. The rascard of Cugnone (Valprato Soana), in which this technique was used, was built, as the inscription on the door lintel tells, in 1685. (see note 7). To know more about the Aosta valley, see Claudio REMACLE, *L’âge du bois, une donnée scientifique pour comprendre l’évolution des maisons anciennes*, in “Revue valdôtaine d’histoire naturelle”, n. 45, 1991.
8 Still, small buildings used to store tools generate an environmental state of decay and damages the context of the building.
11 Red spruce, also known as “peccio”, can be especially found in Ronco Canavese. IDEM, cit., pp. 106-107.
12 Through a visual analysis, by preferring the ones more easily reachable through a direct survey.
16 Modern transports and the development of roads at the bottom of the valley caused the neglect of the paths at high altitude and hindered the traditional cultural exchanges. Paradoxically, this contact will be soon re-established, through the construction of modern ski lifts which, by crossing over the Col Laris, will connect the Soana valley to the Champorcher one.
17 Guidelines related to timber elements are outlined in the *Carta ICOMOS Principles for the Preservation of Historic Timber Buildings*, adopted by ICOMOS during the 12th General Meeting – Mexico, October 1999. The reference of this document, together with the contemporary ones of the Patrimonio edilizio vernacolare (Vernacular building heritage) and of the Turismo Culturale (Cultural Tourism), is certainly the “Carta di Venezia, 1964” document, which defines the general conservative-restoration criteria.
18 Carta ICOMOS, 1999, artt. 5, 6, 9, 10, 11.
19 Precisely recommended by the Carta ICOMOS 1999, art. 3: “A coherent strategy of regular monitoring and maintenance is crucial for the protection of historic timber structures and their cultural significance”.