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Consolidation of the “Cassarini-Cavazza” Mansion Timber Floors: an Example of Minimal Conservation Intervention

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Abstract

This study presents an example of structural safety measures for old wooden and beaten earth floors. Accordingly, this study demonstrates that non-substitutive interventions can simultaneously save historical building materials and techniques, make quick interventions, and save money. Located in the province of Como in the Lombardy region of Italy, the ‘Cassarini-Cavazza’ mansion is a late 18th-century building where the floors are realised with a particular but heavy system of wood and earth mortar. Through its uses over the centuries, this system is now in a critical condition from a structural viewpoint and requires conservation. This study first cites the main international documents and guidelines that highlight the topic of minimum intervention. A step-by-step description of the case studio is then presented, as well as the problems identified and the solutions adopted.

Keywords

architectural heritage – compatibility – diagnosis – minimal intervention – preservation – reversibility – strengthening – survey

1 Introduction

Conservation theory and practice adopt the following principles: authenticity, compatibility, durability, distinctness, minimal intervention, and reversibility. This study focuses on the principle of minimal intervention, even if the others are widely respected during the design phase and intervention.

John Ruskin is considered the founding father of the minimal intervention approach. Many other 19th and 20th-century theorists in Italy and northern Europe followed his approach and tried to apply this principle to the conservation of monuments and historical buildings. Article 15 of the 1964 International Charter for the Conservation and Restoration of Monuments and Sites, which is commonly known as the ‘Venice Charter’ (ICOMOS 1964), states: ‘The material used for integration should always be recognisable, and its use should be the least (minimal n.d.A.) that will ensure the conservation of a monument and the reinstatement of its form’.¹

Since the Venice Charter, many other international documents have clearly and diffusely cited the principle of minimal intervention while restoring architectural and cultural heritage.

For example, ratified in 2003 by the ICOMOS 14th General Assembly at Victoria Falls, Zimbabwe, Chapter 3 Remedial Measures and Controls, Article 3.5 of the ICOMOS Charter — Principles for the Analysis, Conservation, and Structural Restoration of Architectural Heritage states: ‘Each intervention should be in proportion to the safety objectives set, thus keeping intervention to the minimum to guarantee safety and durability with the least harm to heritage values’. Article 3.8 states: ‘At times, the difficulty of evaluating the real safety levels and the possible benefits of interventions may suggest ‘an observational method’, that is, an incremental approach, starting from a minimum level of intervention, with the possible subsequent adoption of a series of supplementary or corrective measures’ (ICOMOS 2003).

The English-language Translation of the Principles for the Conservation of Heritage Sites in China by Neville Agnew and Martha Demas, printed by The Getty Conservation Institute in May 2004, also adopts the principle of minimal intervention. Chapter Three, Conservation Principles, Article 19, states that ‘Intervention should be minimal. Apart from routine maintenance, there should be no intervention on parts of a building or site that are not at imminent risk of severe damage. Intervention should only be undertaken when necessary and then kept to a minimum. The main goals of conservation and

1 II International Congress of Architects and Technicians of Historic Monuments, Venice, 1964. Adopted by ICOMOS in 1965.

management measures are to preserve the site's existing condition and to slow deterioration' (Agnew & Demas 2004).

Another international document published by the ICOMOS International Scientific Committee for Analysis and Restoration of Architectural Heritage Structures offers recommendations for the study, conservation, and structural repair of architectural heritage, and edited in 2005, adopted the principle of minimal intervention and impact from a structural viewpoint. Article 1.6 of Part 1 Principles, Chapter 1 General Criteria states: 'The peculiarity of heritage structures, with their complex history, requires the organisation of studies and analysis in steps like those used in medicine. Anamnesis, diagnosis, therapy, and controls correspond to the condition survey, identification of the causes of damage and decay, choice of remedial measures, and control of the efficiency of the interventions. To be cost-effective and ensure minimum impact on architectural heritage, it is often appropriate to repeat these steps in an iterative process'. Furthermore, Article 3.5 states: 'Each intervention should be in proportion to the safety objectives, keeping intervention to the minimum necessary to guarantee safety and durability and with the least damage to heritage values'. Article 3.8 notes that 'At times, the difficulty of evaluating both the safety levels and the possible benefits of interventions may suggest "an observational method", that is, an incremental approach, beginning with a minimum level of intervention, with the potential adoption of subsequent supplementary or corrective measures' (ICOMOS 2005).

Finally, regarding timber structures, the ICOMOS Principles for the Conservation of Wooden Built Heritage were adopted at the 19th General Assembly in Delhi, India in December 2017 as a revision of the first document of Mexico 1999. Article 11 in the chapter titled 'Intervention' states: 'Interventions should preferably be the minimum necessary to ensure the physical and structural stability and the long-term survival of the structure or site as well as its cultural significance' (ICOMOS 2017).

2 The Site

The Cassarini-Cavazza mansion is located in the foothills of the Intelvi Valley, near Lake Como in the province of Como in the Lombardy region of Italy (see Figs 1 and 2).

The small settlement is called Cerano d'Intelvi, and the building assumes the name of the old owners, who still use the mansion for vacations.

The mansion comprises three stages, a cellar, and an attic historically used for storing family no-used items. Owing to the shape of the plot of land and the

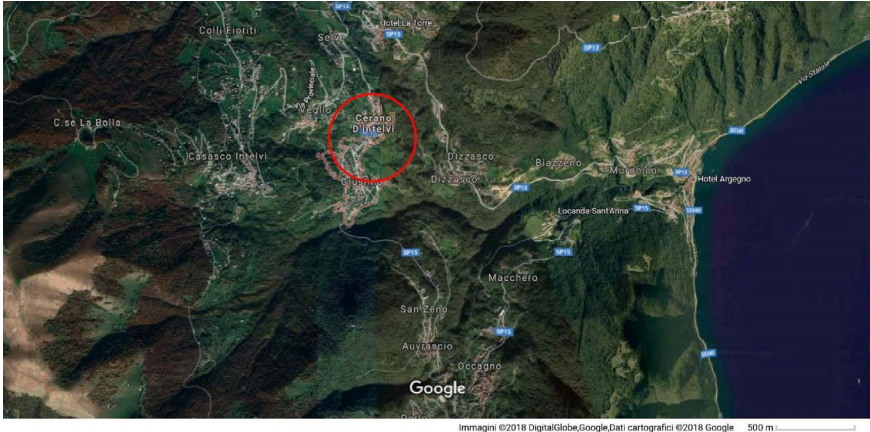


FIGURE 1 Location of Cerano d'Intelvi municipality in the foothills of Lake Como

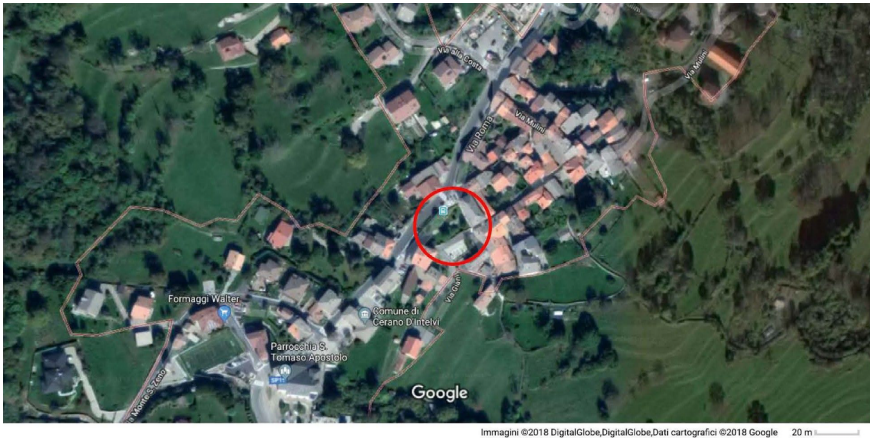


FIGURE 2 Position of Cassarini-Cavazza mansion inside the Cerano d'Intelvi municipality

property borders, the plan of the house is trapezoidal (Fig. 3). A small, enclosed garden is located in front of the main façade (Fig. 4).

Information on the history of the building is not available. From a formal viewpoint, the building resembles a mansion from the late 18th century in the Rococo style.² This observation is reasonable considering the particulars remaining after some refurbishment interventions performed during the

² Rococo is an ornamental style developed in France in the first half of the 18th century as an evolution of the late Baroque. This style arrived mainly in the north of Italy, but a little later.

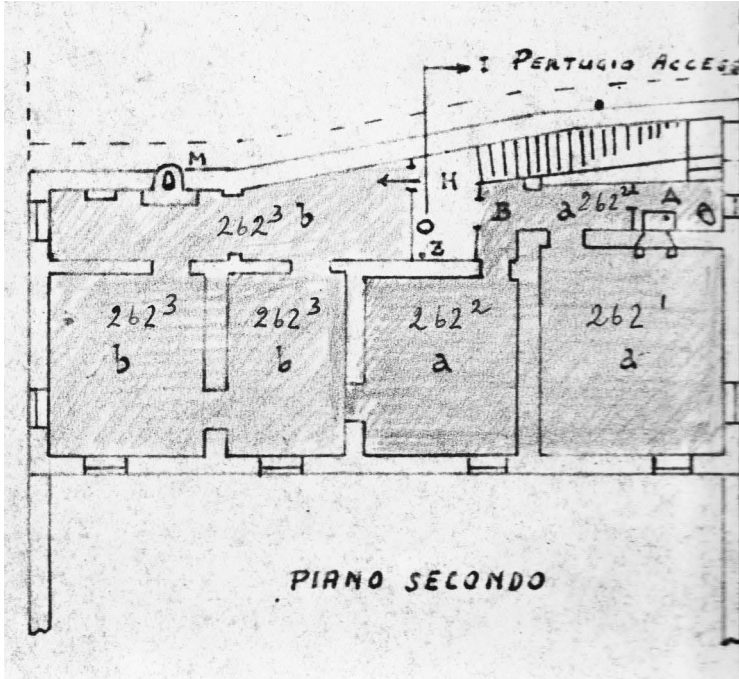


FIGURE 3 Cadastral plan from the 1960s. The interior distribution of the mansion remains almost unchanged today.



FIGURE 4 Main façade of the mansion and enclosed garden



FIGURE 5 Example of stucco decoration on the vaults inside the mansion

20th century. Typical 18th–19th century style frames are visible around the openings on the outside. Gypsum frames that are clearly in the Rococo style are visible inside the mansion, mainly in a room on the ground floor (Fig. 5). The artisans of the Intelvi Valley were famous for being plasterers. In Cerano, a small museum is dedicated to stucco craftwork.

3 The Floor System Technology

The three attic rooms occupy the entire building area (Fig. 6) and the floors are composed of wooden beams and beaten earth mortar with a small amount of lime. Interventions have been designed and performed on three of four floors because one was in reasonable condition. The distance between the beams, which vary in diameter between 15–25 cm, is approximately 70–80 cm.

Beams, which are round or have been partially processed with an axe, are embedded into the rough stone walls (Fig. 7). Wooden laths are fastened at the intrados of the beams with nails. The distance between laths (thickness 4×2 cm) is approximately 10 cm. A layer of straw is placed on this lath net, and the space between the beams on the lath plus straw system is partially (50%) filled with hard earth mortar mixed with lime. The thickness of this mortar plus straw layer is approximately 6–7 cm (Fig. 8).

The extrados of the floor, which are composed of laths, are plastered and decorated with gypsum frames. Mixing the mortar with straw permits the

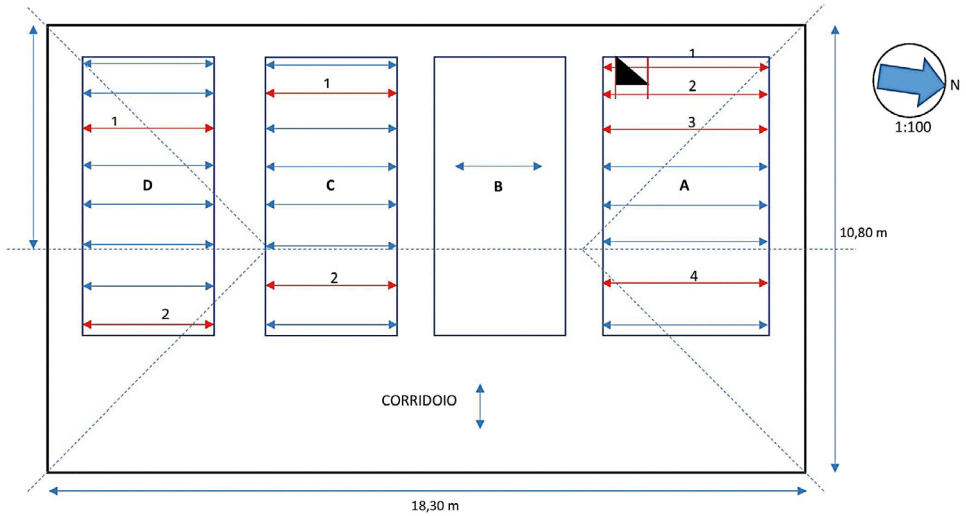


FIGURE 6 Scheme of the three attic rooms (A to D). After the inspection phase, intervention in B was not considered necessary except for the removal of items and cleaning. The red arrows highlight the beams that need to be reinforced.

preservation of heating conditions in a site that experiences a cold in winter (Fig. 9).

4 Problems to Solve

The third-floor ceilings showed significant bending, and the plaster was very cracked, with the risk of thick mortar falling on the owners (Figs 10 and 11).

The first step was knowledge acquisition, so an inspection under the roof was necessary (Riggio *et al.* 2014).

The attic was full of old objects, some of which were very heavy, and some masonry stones from the last maintenance intervention to the roof had been left on the floor. Thick dust covered everything, so we were unable to determine the technology used for the floors and their condition.

The first intervention was to remove everything from the attic floors, clean everywhere with a shovel, and finally use a large vacuum cleaner. Under these conditions, we were able to perform a survey to check the techniques used for the floors, quality of timbers, and problems caused.

The quality of timbers is different sections and ranged from round timbers (the major part) to squared (a few elements). In between them are different shapes. Many beams have very different sections between one end and the



FIGURE 7 Extreme variability of spacing, processing, and diameter of timbers



FIGURE 8 Partially removed upper part of mortar plus straw. The laths net between the beams and the top part of the plastered ceiling are visible.

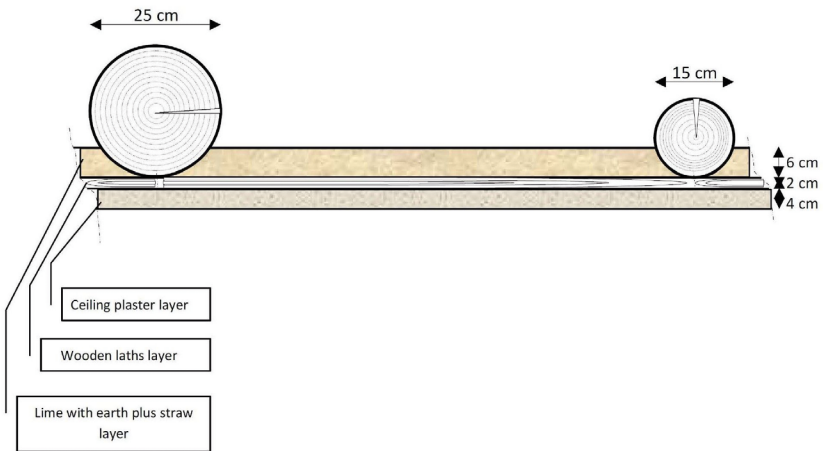


FIGURE 9 Transversal section of the floor techniques and materials



FIGURE 10 View of the ceiling of a room with bending, cracks, and detachment of the ceiling plaster

other; the trend is frequently irregular, and knots are found in as much as 50% of the section.

Generally, a large knot is present at the point of a small beam section or diffusely in the small section elements. Furthermore, timbers, mainly very small sections, are affected by wood-boring insects that cause deep (1–2 cm around the perimeter) decay that reduces the already small section of the beams. Fortunately, no rot attack has been observed.

The small section of the beams, even in a partial absence of deep decay and defects, provoked the bending in the middle of the floor.

Each floor has both conditions (deteriorations and defects). The result is that ceilings show many cracks due to the bends in different positions. (Fig. 11)

The heavy items accumulated in the attic over the centuries, the heavy technology system of the floors, the scarce section of timbers, the quality of the wood, and the wood-boring insect attacks have led to the current dangerous structural condition.

This bending has caused the detachment of some laths, as well as cracks and detachment of the ceiling plaster inside the rooms (Fig. 12).



FIGURE 11 View of the ceiling of a room with bending, cracks, and detachment of the ceiling plaster

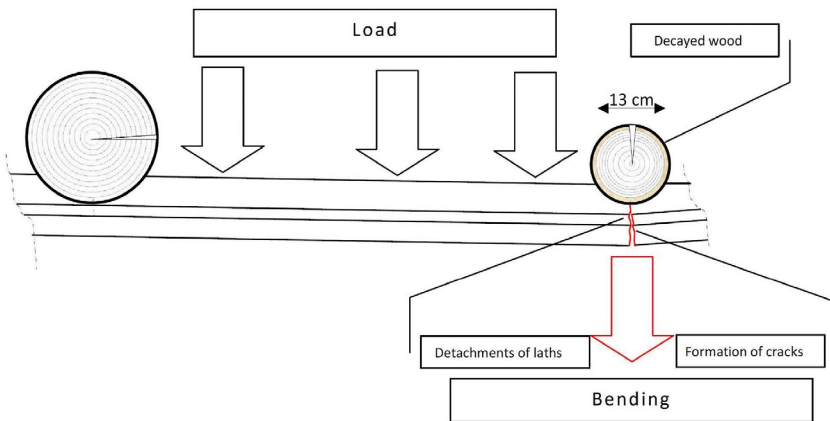


FIGURE 12 Transversal section of the mechanism of ceiling cracks

5 The Project and Intervention

The client asked several construction companies to address the problem. They all suggested replacing all the floors with a new reinforced concrete slab.

Such drastic changes would involve the following:

- (1) Removal of the entire roof.
- (2) Use of a large crane.
- (3) Damage to the historical interiors.
- (4) Large load of reinforced concrete slabs on the stone walls.
- (5) Reinforced concrete slabs are too rigid a solution.
- (6) Missing material culture documents about old timber system technologies.
- (7) Irreversible and incompatible intervention.
- (8) Many days of work for no fewer than 4–5 workers.
- (9) Bureaucracy and time to achieve the necessary permissions.
- (10) Very expensive intervention.

Instead, a very light, fast, and cheaper intervention performed in only two days by two professional restorers without the need for removals, a crane, interior damage, sacrifice of authentic materials, need for permissions, and compatible and reversible, as well as significantly cheaper was proposed.

The intervention consists of a strengthening system that has been used in Italy since the 1980s (Tampone 1983) and uses mid-19th century technologies for industrial building wooden slabs. In many cases, the system is now used in the compatible and reversible intervention on timber systems of historical buildings and monuments. Intervention using thin iron cables, adjusted with a tensioner, which supports timbers and avoids the possibility of bending, is only applied to beams that require it. A 'parachute' system was quickly applied in uncomfortable work conditions.

Different types of interventions with iron cables have been studied based on other problems, conditions, and beam positions that require reinforcement.

Where possible, the walls were used as a point of anchorage for the cables. The anchorage has been performed using a long rawl plug embedded in the wall section (Figs 13 and 14). Sound timbers near problematic beams have frequently been used for anchorage (Figs 15 and 16). Large roof beams have sometimes been used to anchor the iron cables attached to the floor beams (Figs 17 and 18).

In some cases, iron plaques are used to fix the strands because of poor beam conditions.

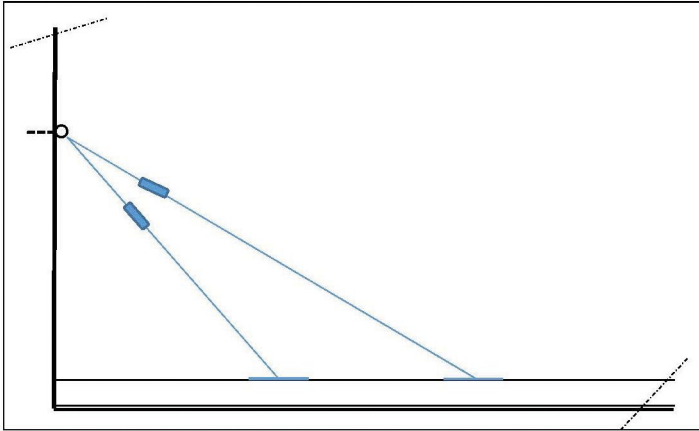


FIGURE 13 Scheme of the solution adopted using wall as point of anchorage for cables. The anchorage is performed using a long rawl plug embedded in the wall section.

These cases require the following steps:

- (1) The punctual, where it was considered strictly necessary, consolidation of wood with brush application of liquid resin (epoxy) (Fig. 19).
- (2) Insert pilot holes for a screw for timber.
- (3) Inject adhesive inside the pilot holes when considered necessary (Fig. 20).
- (4) Fix an iron plaque on wood with wood screws (Fig. 21).

Other minor repairs with long screws have been performed where necessary.

After the reinforcement intervention, the last phase was the complete spray treatment of wood with a chemical preservative (natural pyrethroid) against wood-boring insects and fungi given the low durability of wood and the need to protect wood in the future (Fig. 22).

6 Conclusions

What has been described in this contribution is not an academic experience, even if the author is an academic. The purpose of this work is not to discuss the theory regarding minimal intervention methodology but consider these in terms of facing and solving real-world problems by applying such theory. This work deals with real experience and application in the project and the realisation of suggestions from the official international documents and the



FIGURE 14 Execution phase described in Fig. 13

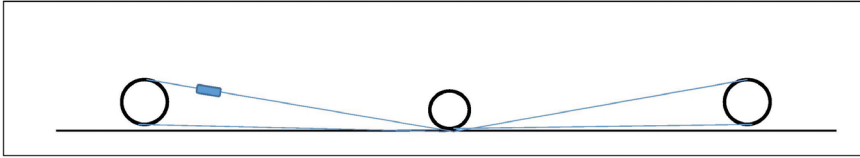


FIGURE 15 Scheme of solution for ends of cables anchored to sound timbers near a problematic one



FIGURE 16 Execution phase described in Fig. 15

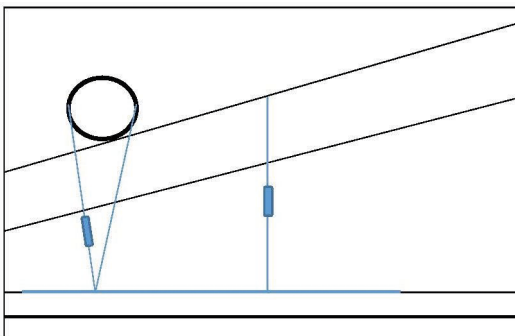


FIGURE 17 Scheme of solution with large roof beams used to hang anchor the iron cables attached to the floor beams



FIGURE 18 Execution phase described in Fig. 17



FIGURE 19 Punctual consolidation is done by brushing the deteriorated sapwood with liquid resin.



FIGURE 20 Injection of adhesive inside the pilot holes



FIGURE 21 Fixing phase of the iron plaque with wood screws



FIGURE 22 Spray treatment with a chemical preservative

principles viewpoint. As is well known, the official documents cited herein do not suggest solutions but rather present reasonable methodology with the aim of the conservation principle of 'primum non nocere' (first, do no harm).

As a direct witness, the author emphasises that preservation intervention that is minimal, reversible, compatible, and cheaper can be carried out.

The proposed intervention led to the customary conflict between the client, who, of course, needs to solve the problem quickly and cheaply, and the architect-conservators, who need to save authenticity and the material culture that every historical building brings with it, as well as to perform an easy-to-perform, compatible, reversible, and cheap intervention. Because of condition of the ceilings and some beams, the suggestion was made that owners avoid using the space to store heavy items as was the case before the intervention. We do not know if the solution that was implemented was the best one.

However, the intervention is compatible and reversible, thereby allowing future designers to disassemble it and change it to a better one.

The proposed and realised intervention will certainly permit future generations to appreciate the authentic materials and technologies of the historic building.

All interventions were carried out following the recent international guidelines and principles on heritage building conservation (CIB Commission 2010).

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