# Modern comfort in historical buildings

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## ABSTRACT

In this paper we will present some reflections upon the use of heating facilities in monumental buildings, especially in buildings that fall into special categories such as churches, castles, convents, old school buildings, etcetera.
This kind of buildings were realised when the comfort standards of its visitors and inhabitants were not as high as they are today. Now that standards have been raised generally, these buildings need to be equipped with installations that satisfy modern demands and that are capable of minimizing energy consumption, whilst raising the environment quality of its inside spaces.
Case studies will be illustrated, explaining technologies that have been experimented in some historical buildings in the region of Emilia-Romagna.

- Parish churches of St. Valentine (Castellarano) and St. Michael (Pieve Modolena, Reggio Emilia);
- Castle of Viano;
- Riverzana village.

## KEYWORDS

Historic buildings, modern comfort, reversibility, non-invasiveness.

## INTRODUCTION

Just as historic cities have managed to adapt to the new demands and functions society requires from them, our historical buildings also are prompted to offer an improvement in their performance as to modern standards of comfort (safety, energy efficiency, environmental quality)
Building regulations are often oriented towards new development and the introduction of contemporary technology in buildings of historical value is thus to be entrusted to the individual sensibility of the architects, designers and professionals.
Each historic building is a "unique" object, that our civil society wants to preserve; not only in its artistic, cultural and testimonial values, but also in its material aspect.
It is for these reasons that more and more the need is felt for a knowledge-campaign of the single building. Through the analysis of the historical and stylistic evolution of the monument, such a campaign will be of great use in assigning the right value to the object, be it generally (the building, parts of it) or in its specificities (building details, finishing, etc.)

Only through careful analysis a map can be drawn up of the invariants of the project, which in combination with the functional and structural requirements will form the canvas of the project of restoration and modernisation.

It is through this method that for the introduction of modern technological systems a "map of the planned cancellations" can be made, which will include the various passages of the technological systems, respectful of the historic pre-existence and capable of not causing harm to the monument.
The 'spontaneous' insertion of technological systems in monuments has caused damage not only to the cultural aspects of these buildings, but also often affected the stability of the same.
In Mediterranean areas, where earthquakes of a certain intensity happen frequently, the lack of structural analysis, that takes into account the insertion of technical facilities in the renovation of historic monuments, is very dangerous for their survival.

Historic buildings are often built using poor technologies (cavity walls, field stone masonry poorly sketched, etc.) that do not withstand cuts, local reductions in thickness or other ‘mutilations’. In recent seismic events we had evidence that such interventions, effected for the insertion of technological equipment, were contributing factors to the structural collapse.

In the awareness that the environmental quality and comfort desired can’t always be obtained (due to the height of the volumes to be heated and lighted, to the difficulties in achieving integration of alternative energy sources in historical context, an also due to the wish to maintain the established environmental values contained in the monuments), the principles that have guided the examples below can be summarized as follows:

• reversibility
• non - invasiveness
• consistency with the reading of the monument

Figure 1. Panoramic view of Riverzana village

**PIEVE MODOLENA PARISH CHURCH RESTORATION**

CLIENT: Parish of St. Michael
PERIOD: 1998 – 2000
LOCATION: Pieve Modolena – Reggio Emilia (RE)

A masterpiece of the architect Giovan Maria Ferraroni (1662-1755), this church belongs to the scenographic tradition of the Emilian region, and shows a perfect synthesis between architecture, painting and sculpture.
Some of the most important artists of the Este court, like Francesco Vellani e Antonio Schiassi, collaborated in the creation of this monument.
The restoration consisted not only of the structural consolidation, but also of recovering the original interior colours, replacing the interior floors, changing the technical installations and adapting the apse zone to the modern liturgy.
The modern heating facilities were placed under the newly posed floor in terra cotta tiles.

Figure 2. Interior of the church

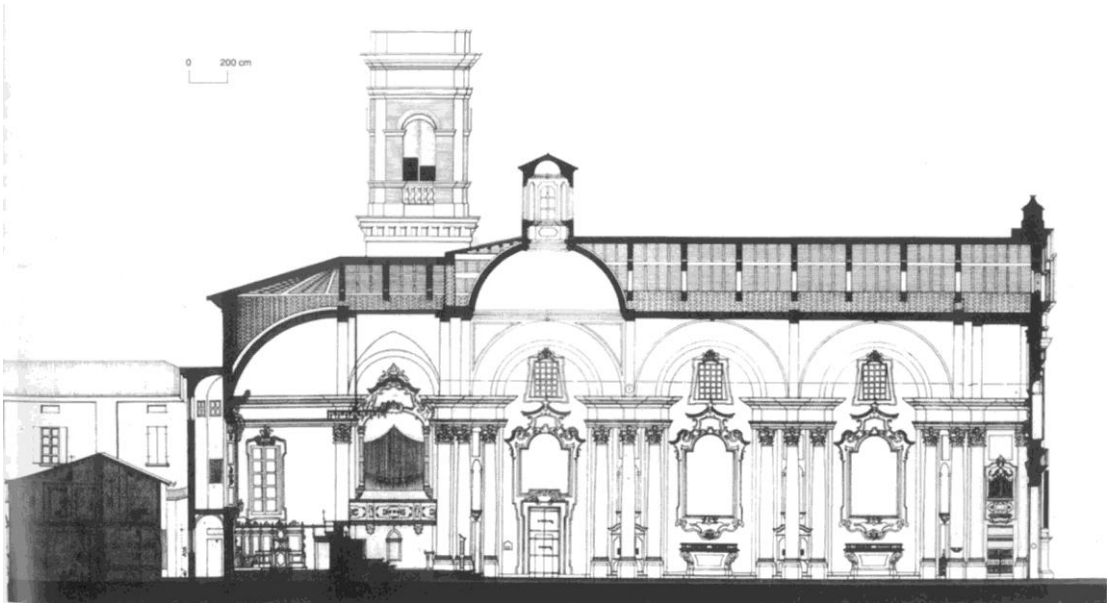


Figure 3. Section

**PARISH CHURCH ST. VALENTINE**

CLIENT: Parish of St. Valentine
PERIOD: 2009 – 2011
LOCATION: San Valentino – Castellarano (RE)

The project for the new heating facilities started from the desire to modernize the church building, but at the same time not to jeopardize the already precarious structural conditions (masonry stone partially squared) and not to damage its historical characteristics, such as the antique floor of terracotta tiles, dating from the eighteenth century. After a careful analysis of documentary sources, combined with the reading of the monument, it was decided not to intervene with the more popular radiant panel system, but to introduce a hot air system located in the shapes and dimensions that might be of less impact.
While the floor in the main part of the church is of high value, in the side chapels it was in need of restoration, after damage caused by structural failure. The side chapels thus could be used to allocate the dorsal parts of the heating system. The old heating system that had damaged the walls of the monument, is replaced with steel laminas along the intercolumnio.

Figure 4. Before restoration

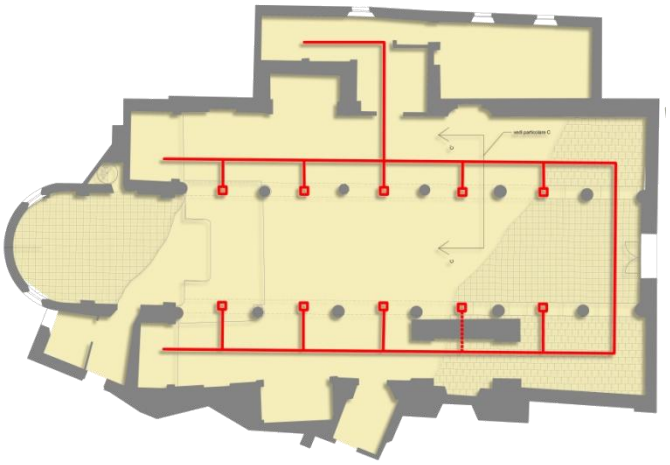

Figure 5. Layout of heating system

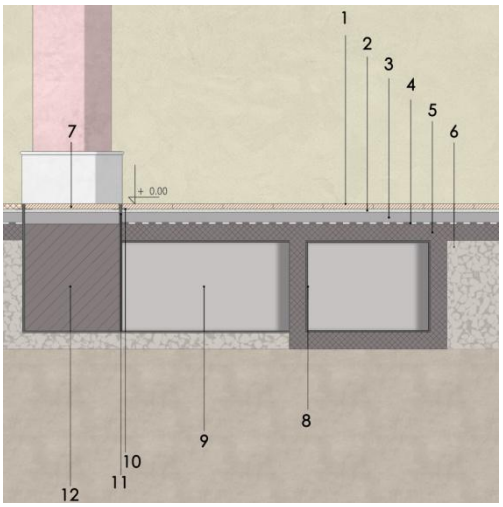


Figure 6. Section detail

Figure 7. After restoration

**CASTLE OF VIANO**

CLIENT: Municipality of Viano
PERIOD: under construction
LOCATION: Viano – Reggio Emilia (RE)

Viano Castle occupies the top of a relief along the valley of the Tresinaro river.
The fortification occupies a large area and encompasses the original village with sections of the defensive walls and buttresses. The fortified structure consists of a tall square tower, with battlements, and a residential building with circular tower.
Between these two buildings the village is located, consisting of a row of linear houses for the servants.
The foundation dates back to 1596 and after a long period of neglect the castle and the village were subjected to a first restoration in the seventies of last century.
The current project takes into account thermal engineering, the procurement of hot water, heating and air-conditioning facilities with the use of a central heat pump, located in a place of low visual impact.

Figure 9. The residential building with circular tower

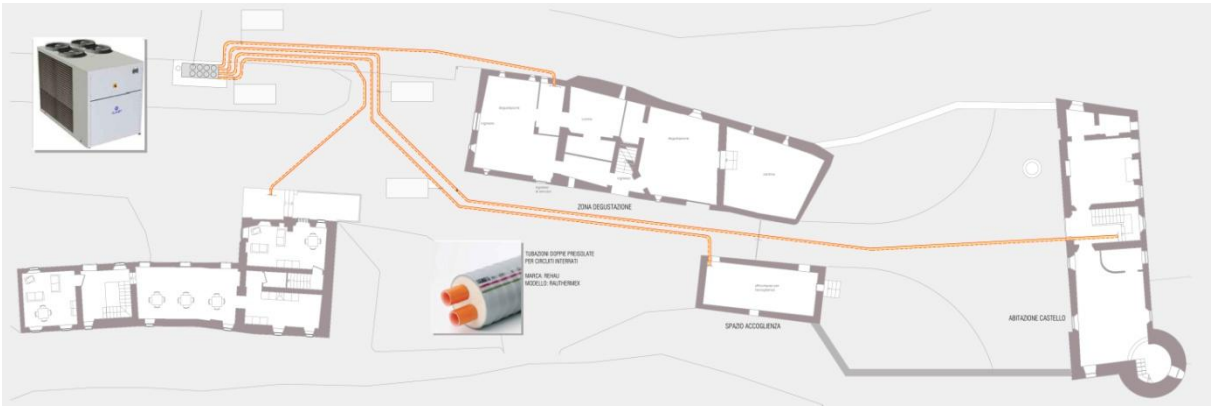


Figure 10. Layout of heating and air-conditioning facilities

**RIVERZANA VILLAGE**

CLIENT: private
PERIOD: under construction
LOCATION: Canossa – Reggio Emilia (RE)

Riverzana is a small village centre, located on a hill near Canossa with a panoramic view of the valley. It consists of a series of buildings to be renovated in order to create hospitality; in the village a restaurant is planned with meeting rooms, residence accommodations for guests and a spacious wellness area.

As in the previous case, a centralised heating system was applied using condensation to distribute its energy to the final users through electropumps.

The installations for heat emission use a medium or low temperature and, according to the different areas, the radiators can be of the "skirting board" type or of the radiant panel type with reduced thermal inertia.

Figure 11. Plan of Riverzana village

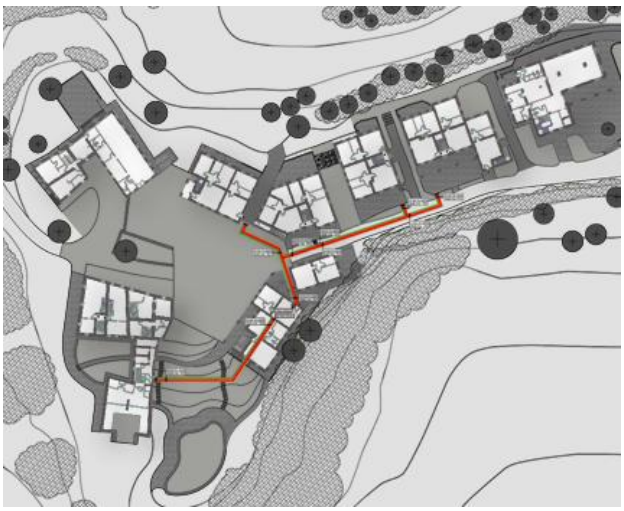

Figure 12.  Panoramic view

Figure 13. Layout of installations