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Reuse of an ancient church: thermal aspect for integrated solutions

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Abstract

The definition of intervention strategies for the restoration and the functional actualization of historic and high artistic quality artifacts, postulates a systemic approach for the different variables that contribute to the definition of the project. This paper presents an emblematic case study of an historic building, the church of St. Francis in San Giovanni in Persiceto near Bologna, one of the most representative of the architectural construction of Bolognese Baroque, built by Alfonso Torreggiani. The expected new functions as exhibition hall and/or concert activities, requires a search for integrated strategies to ensure indoor comfort requirements (thermo-hygrometric, acoustics) and to define HVAC plant equipment for the reduction of energy consumption without affecting the historic values and artistic perception of the building.

Therefore, the analysis of the church in the survey phase, besides the usual historical and architectural investigations, should investigate the potential issues and the critical aspects of structures, like the multilayered floor and refined decorations that lines the walls of the nave. Understanding the intimate rationality of the building (presence of any shafts, steps etc .) is a prerequisite for the inclusion of plant components without altering the visual perception and to optimize the acoustic and the climatization plant systems.

Although the use of renewable energy are required today for all new plant systems, in this case it was decided to exclude invasive elements that could have altered the image of the entire monumental complex of which the church belongs. The proposed HVAC plant, after an analysis of dynamic thermal behaviour of the building, is an air-conditioning system coupled to radiant heating system to ensure, in a climate context with high humidity levels, the optimal temperature and humidity not only for comfort conditions but also for preservation of the building itself and of artistic works.

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1. Introduction

The need to protect the urban environment and to restore its historical heritage to the collective use, requires that individual cultural goods have a highly compatible feature. This need is already sanctioned with the concept of 'integrated conservation' in the Amsterdam Declaration [1] in which the monument is designed as an integrated element in its urban context, assigning a function so as to ensure its use.

The "function" is not the main objective, but simply the means of achieving the goal of conservation according to the criteria of good restoration, conceived as an act of culture as well as technical competence. The reuse, then, allows the artifact to maintain historical memory and to perform those maintenance actions which are the true guarantors of its preservation. All works related to functional recovery must also be designed according to good restoration guidelines; therefore, consolidation, regulatory compliance, environmental comfort, energy saving, plant installations, acoustic quality, should not be dealt as a separate variables, but as members of a one system closely integrated.

The restoration project must be developed by pursuing the prudential criteria of the discipline: minimal intervention, distinctness and expressive authenticity, reversibility, without inserting improper and impacting installations, but at the same time combining historical sensitivity with technical skills enabling targeted solutions for each individual case [2].

The design process, shared by different designers, must provide a depth knowledge of goods through the extension of the classic investigation of the restoration to new themes in order to identify the values, limits of intervention and transformation. In particular the inclusion of new technological systems requires more investigation aimed at determining the parts of the building, less connoted form historical and architectural point of view, that are more adapted for new plant components. Different methodological approach can be used to define action strategies, all based on multidisciplinary analysis. A general deductive-experimental approach based on different cases studies can be used: from a critical reading of spaces and of its characteristic elements (decorative elements, non-replaceable floors, pipes, chimneys etc.), a "reversibility matrix" is defined [3] in order to identify the degrees of freedom and the different levels of compatibility with the introduction of additional measures for the improvement comfort and the energy performance.

The design of all plant systems aimed at controlling the indoor environmental quality (thermal, acoustics, lighting) requires in general, and in particular in this specific case, a peculiar caution and accuracy, due to the complexity of the functions and intended uses, avoiding forcing on the nature of the historical artifact, but at the same time ensuring all the necessary performances.

In particular the system design approach for the restoration and reutilization of a historical and monumental building requires special caution and accuracy, due to the complexity of the functions and of the uses required, avoiding forcing the nature of architecture but, at the same time, combining the architectural language with that of modern plants, through the implementation of an integrated project.

2. The case study

The case study is the church of St. Francis in San Giovanni in Persiceto, placed inside a convent complex and founded in the thirteenth century by the Franciscan order; over the centuries it has undergone transformations such as the fifteenth-century expansion, damage during wartimes and decay due to improper use after Napoleonic disposals. Although the planimetric structure is still that of 15th century with a single nave, the building was radically changed in 18th century, according to the project of the famous architect Alfonso Torreggiani, where the walls were raised to emphasize the height in relation to the planimetric length and a new system of vaulted roofing was creates. The new building developed in the Baroque style, according to a widespread typology in the Bologna