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MANTOVA

THE TOWN HALL BUILDING IN SAN BENEDETTO PO (MN)

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HISTORICAL NOTES

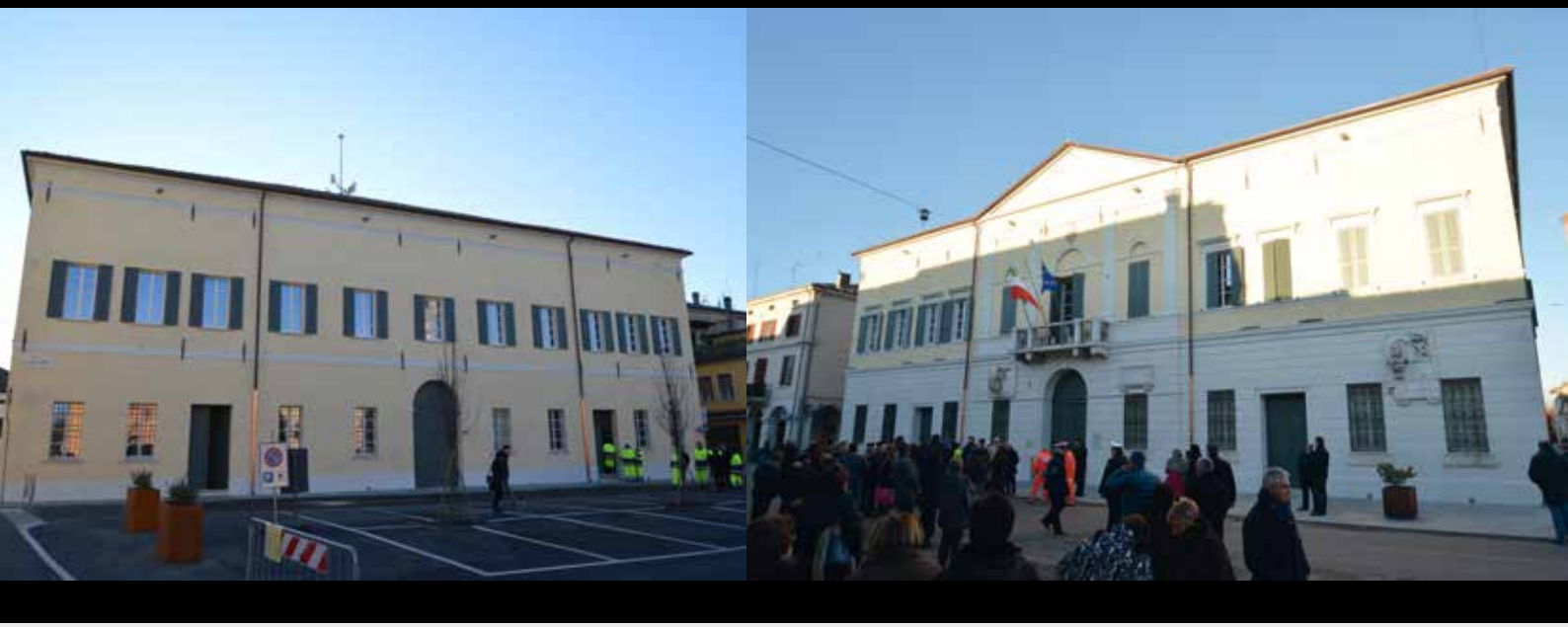
1852-54. The large building of the Town Hall was built during the second half of the 19th century based on a design by engineer Camillo Cavo. The former complex was supposed to house the "Imperial Regia Gendarmeria" (the Imperial Police station), the municipality offices, the local prison, the school and the dwellings for the police commander, the school teachers and the keepers.

1930. The huge original project remained unfinished and only the portion meant for the town hall was eventually built. Records dating from 1930 are witness to the use of the building and report some maintenance intervention on the rooftop.

1979/1990. During this period, extensive alterations were made to the internal layout of the rooms and functions, along with a number of maintenance and restoration works, including reparations of the rooftop, the consolidation and renewal of the floor slabs, and a sizable intervention of roof waterproofing.

THE BUILDING

The Town Hall of San Benedetto Po is a typical nineteenth-century structure based on solid brick masonry, which has been the object of several modifications over time. These alterations turned the building into a complex and seismically vulnerable structure: during the history of the building, some local rigid reinforcements, brick and concrete floors were added, and the internal functional layout was changed. An earthquake in 2012 caused huge damage to the structure, which imposed urgent restoration works in the entire complex.



THE INTERVENTIONS

The works not only implied damage reparations, but also the seismic rehabilitation and protection of the original structure of the building. Special care was devoted to the extant structures and to the whole masonry, based on a scientific survey of the structures. The interventions are disseminated throughout the complex, which is now an example of different approaches. The existing structures were consolidated, new strengthening elements were added wherever necessary, chains were added and restraints reinforced, and wooden reinforcing diaphragms were created below the roof without removing the top cover.

ENDOSCOPIC ANALYSIS OF MASONRY

The complexity of a building may be intrinsic in an apparently regular masonry and the works may be hindered by the need to preserve decorations or fresco-painted walls. The understanding of the quality of masonry is a key factor for planning seismic consolidation. To this end, endoscopic analysis offers an extremely reliable tool to identify weak areas that would be otherwise invisible (gaps, defective bedding, irregular brick pattern, core walling, etc.).

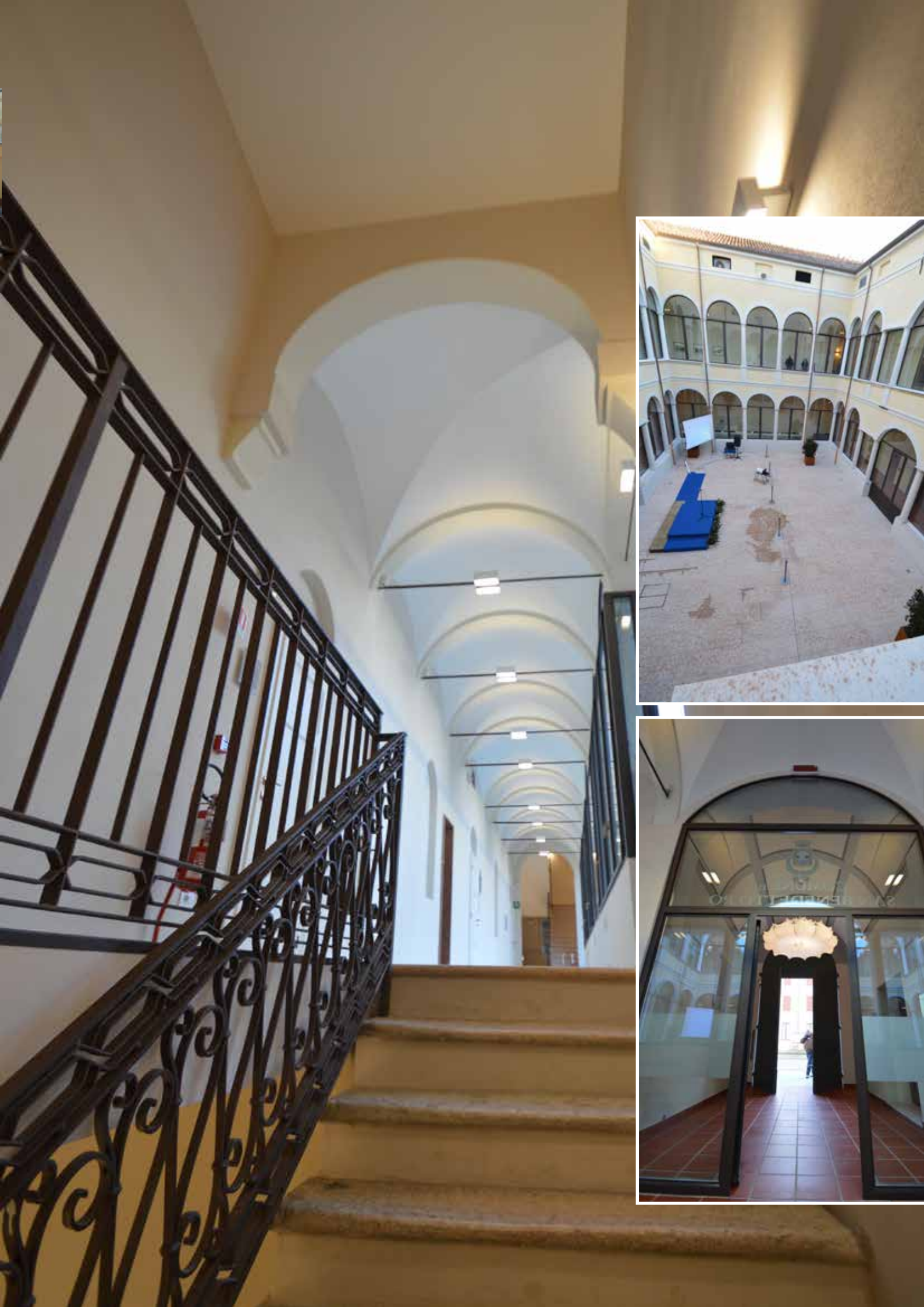
STRUCTURAL CONSOLIDATION WORKS

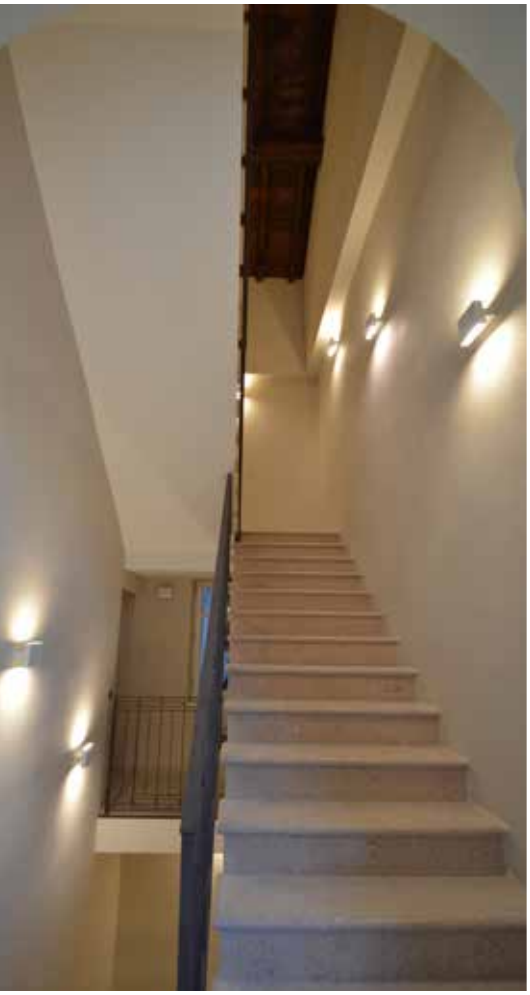
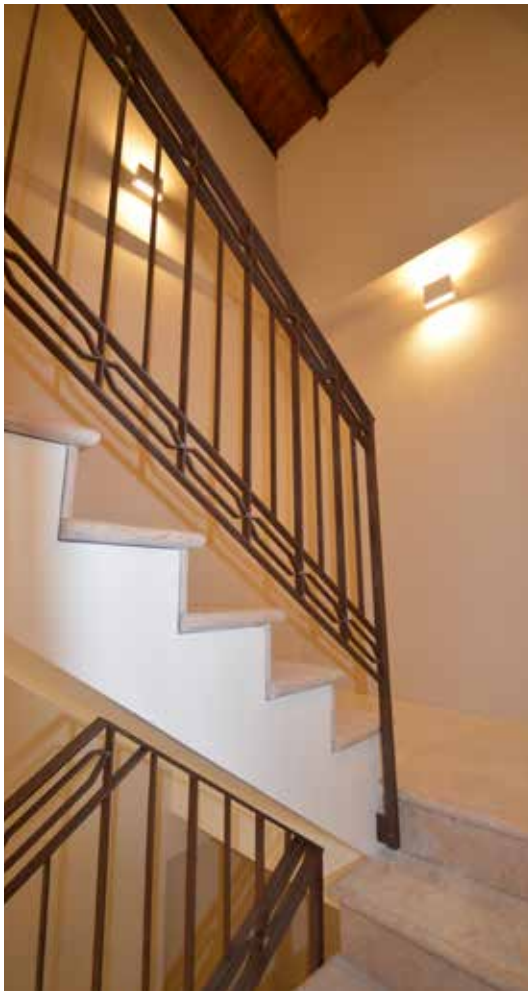
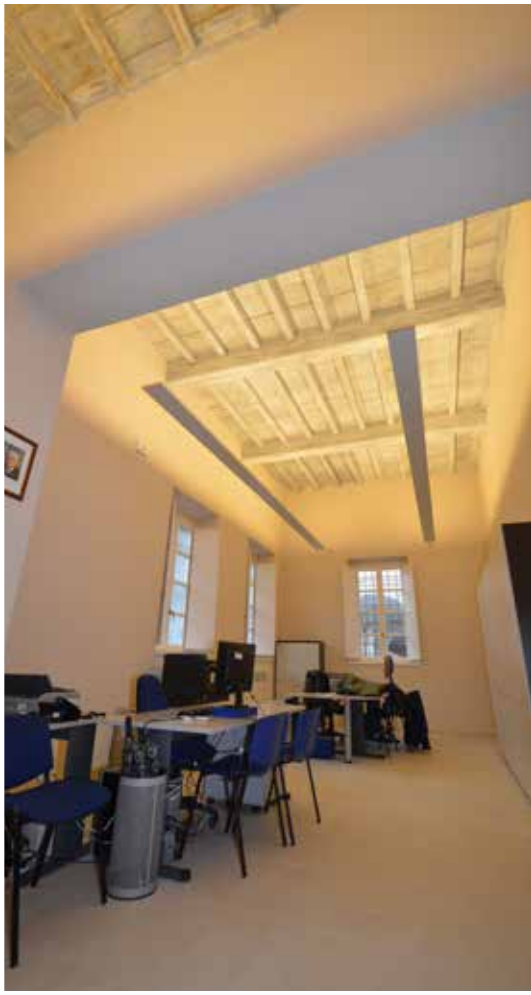
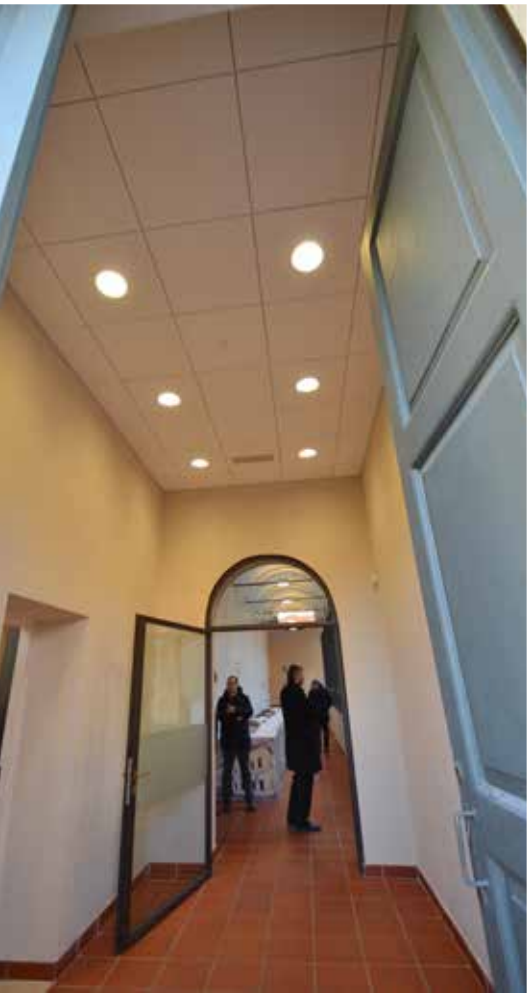
A historical structure does not usually offer good box action, which makes it more vulnerable to damage owed to the separation between different structural elements. A modeling of the building makes a basis to make hypotheses and reckon the reaction to seismic stress mathematically.
The execution of a 3-D mathematical model of finite elements is implemented with a number of possible solutions capable of preserving most of the original structure and, if

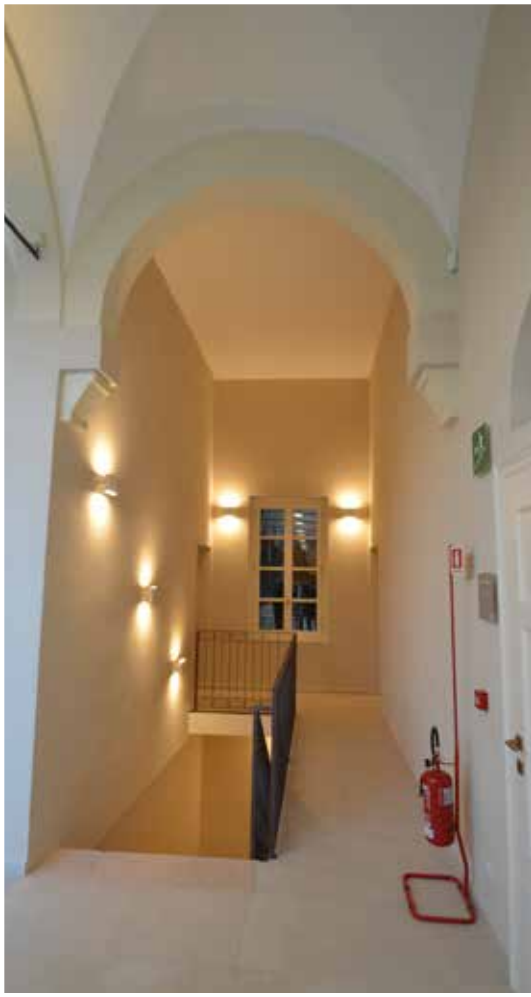
required, adding some elements. The works executed in the Town Hall included the following solutions, among others:
- introduction of horizontal metal chains across the building, at the vault extrados (areas were emptied to make room for the works);
- construction of reinforced plaster wall. Clearly, the latter solution will not be viable in valuable historical buildings, but here the 3-D study of box action was intersected with the practical need to accomodate the offices in spaces of poor historical value. The benefits of the solution lie in user-friendly and cost-effective works, which were carried out in the new added elements only.

VAULT AND FLOOR CONSOLIDATION – DIFFERENT WORKS HELP MAXIMIZE EFFICIENCY

The different elements of the building made the object of peculiar structural interventions aimed at conservation and seismic consolidation. To this end, the maximum compatibility of materials and the minimum impact on the valuable historic environment were the main criteria adopted for the selection of the most viable solutions.
The tensile strength of the rooftop bearing structure was upgraded thanks to the introduction of wooden braces, which enhance the box action of the structure.
The vaulted elements were consolidated by applying two-directional carbon fibre meshes glued with a pozzonala binder. The floors above them were built with a suspended double wooden panel type X-lam, which makes a stiff and self-bearing structure.





FINISHES

The most precious elements of the building (cast plaster ornaments of ceilings and wooden floors) were made the object of rigorous restoration works.
In the rooms deprived of decorations and original elements, thin plasterboard walls were built with a view to combining the need for structural consolidation with the energy and functional requirements arising from their destination of usage (offices open to the public). These false walls allowed to hide the installations, and therefore avoid tracing the extant walls or building visible ducts, but also to provide efficient thermal insulation with the help of mineral wool panels.
The existing frames of doors and windows (either old or damaged by the earthquake) were replaced with new frames guaranteeing greater energy efficiency. The new outer frames are made of wood, while the frames in the cloister are insulated iron profiles.

INSTALLATIONS AND IMPROVEMENT OF ENERGY EFFICIENCY (CLASS A/B)

The vertical ducts of all installations run outside the walls and inside the false plasterboard walls, so as to avoid any tracing or weakening of bearing elements.
The conditioning and air exchange happens through fan coils. The production of refrigerated water is ensured by a refrigerating unit located in the attic, fed by a well. The production of hot water for the central heating occurs via a substation connected to the municipal heating network.
Furthermore, the Town Hall is provided with installations for fire-detection, break-in alarm, video entryphone, structured cabling and video control.
Reduction of energy consumption up to 82% referring ot the previous asset and seismic mitigation with an improvement up to 70%.

EXECUTION OF A WELL

A well provided with an underground electrical pump was excavated in the inner courtyard, to feed the refrigerated unit. Advice by a geologist was seeked to determine the location of the well, its depth, its flow rate and the difference in temperature between the inlet water and outlet water. The integration of the well with the new installation machines helped maximize the efficiency and yield of the whole structure.