

“A Factory for the Future”: Inveruno New School



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Abstract School is a rather complex issue that involves a range of different disciplines—the technical disciplines of architectural, system and structural design, along with the disciplines of training that define the educational project, as well as the disciplines of sociology and urban studies. Given such complexity, the relationship among public institutions such as City, Province and Regional administrations and the seats of scientific research such as University Departments where the above-mentioned specific expertise is developed, becomes fundamental for an innovative school project.

Keywords School · Architecture · Inter-disciplinary · Sustainability · Nzeb · Anti-seismic · Public authority collaboration · BIM

1 Introduction

Here, school is intended as a relational space open to the territory and designed to host public activities accessible to the entire urban community. The new school of Inveruno is, in this sense, the new civic center of the city, a representative building and a place of cultural integration. The school is designed to offer flexible and permeable spaces (sliding walls, movable furniture, glazed rooms, covered and open-air collective areas, etc.) where innovative education becomes the key principle to provide students with adequate skills. Therefore, the school offers in equal measure individual spaces for education and study, spaces for exploration where students may experiment and as a group practice the skills they have acquired (cross-disciplinary workshops), and group spaces where they may present and discuss the results of their work with the school and city community. Just as important are the open space between the buildings and the central square designed to host open-air events that involve the entire school community.

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2 Urban Context

Inveruno, a town with 8600 residents, is part of the metropolitan city of Milan in the Lombardy region.

Its urban structure mainly resulted from the prevailing agricultural activity that experienced a renewed impulse after the opening of the Canale Villoresi in the second half of the nineteenth century.

The modification of the territory after the construction of the canal resulted in a new system of smaller canals and in the innovation of the agricultural activity and brought remarkable transformations in the history of the town. During the modern age, Inveruno owed its urban expansion to the creation of industrial activities such as the Muggiani textile mill, the Officine Elettriche Colombini and more recently the Belloli oil-mill.

The development of industrial activities resulted in a gradual decline of agriculture with remarkable consequences on the urban structure of Inveruno. Later on, the decommissioning of most industrial facilities has left several sites now requiring adequate redesign and redevelopment as they play a strategic role in the urban structure.

The urban fabric of Inveruno comprises a first and oldest core connected to the establishment of the rural hamlet and featuring linear buildings that follow the morphology of the territory. Their layout defines closed blocks with interior courtyards. This oldest core is complemented by sections of residential fabric comprising low houses within which the landmarks of the town community, starting with piazza San Martino bordered by the parish complex, emerged. A third evolution followed this second development, which appears more relevant in terms of quantities rather than for settlement reasons. This is a disjointed and patchy fabric made of one- or two-family houses built during the phase of industrial development. This expansion resulted in an uncontrolled sprawl within which, however, the old structure defined by orthogonal hydrographic canals that shape a road network that still organizes the actual expansion of the town's urban boundaries is still recognizable.

Within this heterogeneous context, the industrial site of the decommissioned Belloli oil-mill, now undergoing a design rehabilitation, is located in the northeastern part of the town and the urban void that defines it plays the role of a cornerstone between two kinds of road tracing of the urban expansion. Therefore, the rehabilitation of this decommissioned site, in terms of its location and contextual features, is strategically important for the urban transformation of Inveruno.

3 The Site

The decommissioned Belloli site is a large urban void bordered by via Brera, via Fratelli Bandiera, via IV Novembre, and the provincial road 129. Built in 1919, the Belloli industrial facility increased its activity in the post-WW2 period and closed

down in 1979. The large void of the decommissioned factory within the town was surrounded along the perimeter by industrial facilities demolished in 2009 for safety reasons and still features a towering reinforced concrete silo used to store seeds. Built in the 1960s, the silo is a reinforced concrete structure supported by “V”-shaped pillars that emerges as an actual landmark in the town and over the years has almost become a historic monument in the life of its residents. The site is currently in a state of disrepair and heavy deterioration. Its rehabilitation is necessary because it occupies a central spot along a green axis established by the park across from the Town Villa overlooked by the town library that extends along *viale Piemonte*, connects the areas of the Inveruno Sports Union and further on, the green areas of the Luigino Garavaglia Town Stadium. This green axis is particularly important for the Town of Inveruno as it connects the areas that traditionally accommodate the old San Martino Fair, the main agricultural fair of the region for over four centuries.

4 Architectural Design

The principle underlying the design of the new school complex results from the belief that the current buildings fail to meet some fundamental requirements as a good quality educational facility. The two primary schools have small classrooms and lack collective spaces and workshops, without mentioning the fact that their cafeterias are in the basement. The secondary school building is hardly functional in terms of the standards of a modern secondary school: the building is not properly insulated and therefore underperforming on an energy level and the implementation of safety measures from the static point of view would require a significant investment.

The project results from the belief that the school represents a place of primary importance and recognition for the town community within the urban structure. For this reason, the project addresses multiple levels in the rehabilitation of the decommissioned Belloli oil-mill site. The core of the project is an open public space created for the gathering of the entire community. The two schools with their sports facilities and a small auditorium that closes the perspective from *via IV Novembre* overlook this new green square. The school complex is conceived as a small campus where open space is prevailing and the layout of the individual buildings acquires a particular importance. Indeed, in order to respect the vocation of this large urban void, the buildings are recessed from the boundary of the roads so that they create widenings and resting spaces for the town.

Both buildings, a primary school and a middle school, feature an open courtyard overlooking a central square with a slight rotation that follows the layout of the context in order to create articulated and differentiated volumes around the central square as well as to distinguish their sites and accesses.

The middle school complex lies to the north-west from via IV Novembre and comprises the classrooms and the sports buildings, while the open-air sports facilities and the cafeteria directly connected to the school's building lie in the back from the square.

At the southeast, there is the primary school complex comprising, from the entrance, the indoor sports facilities followed by the actual school building in a recessed position from the road. Like the first building, this complex has its green open spaces and the cafeteria at the back. The buildings are autonomous and independent volumes also in terms of their potential of use by the citizenship. The school offers sections others than the educational facilities that can be used in different ways as well.

5 The Single Buildings and Their Interior Spaces

The middle school building includes four classes with attached workshops and special classrooms, while the primary school includes three classes and an additional Montessori Method program for one class of the school of Furato, a hamlet of Inveruno.

The middle school has a courtyard layout with a system of load-bearing columns that define its inner and outer perimeter. This solution allows treating the elevations in a differentiated manner by opting for either glazed walls or opaque infills according to the needs. This construction system also offers additional advantages in terms of transparency and visual openness as it optimizes the potential of natural lighting. The school is accessible through the green courtyard overlooking the square. At the ground floor, a large lobby connects the interior courtyard and the garden in the back, a large collective space designed to host temporary exhibitions of the students' works. All the classrooms at the ground and first floors along with the associated workshops overlook the large central courtyard according to a layout that benefits from the best sun exposure. The generous distributive system becomes an informal space (a fundamental element in the guidelines of innovative educational facilities) where alternative education- or study-related activities may be organized. The staircase cores and services are located at the sides of the courtyard so that they are immediately visible and accessible. One of such cores provides access to the locker rooms of the gym through an underground passage.

The class-B gym is designed to host junior league provincial and regional sports games. The facility relies on load-bearing walls and features two entirely glazed and shielded elevations overlooking the courtyard. The gym's main elevation directly overlooks the new green square so that the building may be accessible independently from the school. Spectators and users may reach the gym directly from a lobby in order to get either to the stands on the field's sides or to the locker rooms and ancillary services at the underground level. From the northern elevation, instead, it is possible to access directly the outdoor sports courts in the school's large garden.

One last small building accommodates the cafeteria directly connected with the school building from one of the distribution cores through a covered and heated passage. The cafeteria is entirely glazed and openable towards the exterior.

The primary school has the same features as the middle school except for the necessary distinctions related to the latter facility. Classrooms and workshops are similar in terms of size to those of the middle school, except for the selection of specific furniture that guarantees high flexibility in the subdivision of spaces. The gym is smaller than the one of the middle school and designed to accommodate motor activities for children. It is likewise independent and directly accessible from the green square even for after-school programs such as sports activities that require smaller courts—martial arts, yoga or dance classes.

The cafeteria is larger in this case and divided into smaller “rooms” in order to avoid overcrowding strongly discouraged by the scientific community of educators.

A civic hall completes the square in the terminal part as a facility designed to operate independently from the school and host activities for both students and the entire town community.

6 Technical Design Choices

The technical choices reflect the compliance to the following main criteria: reduction of energy consumption, reduction of the building’s environmental impact, reduction of construction times, construction and use flexibility, simplified maintenance and management.

7 Building Life Cycle

The project relies on the use of construction technologies based on the dry assembly of single components. Vertical prefabricated concrete structures are mounted on a concrete basement for the construction of the load-bearing frame and are completed by floors and interior laminated wood walls designed to guarantee a fast and efficient construction on the one hand, and dimensional precision and flexibility of spaces on the other hand. Prefabrication allows for a high quality level due to the possibility of selective dismantling and replacement of parts in case of maintenance. The absence of the seasoning times required by concrete and the installation of completed components allow for a shorter construction phase. A particular care was devoted to the distributive flexibility of classrooms, which have no structural elements dividing them and therefore may be repurposed in case of changed use requirements simply by dismantling and moving the wood dividing walls. The two courtyard layouts allow for an optimal distribution network of systems, the connection ridges of which are in the readily serviceable false ceiling and in the raised floors in order to guarantee flexibility of use and an easy maintenance.

8 Materials, Safety and Comfort

The wooden elements of the floors allow for a perfect reaction in case of earthquake as they perform as a monolithic plate unbounded to the concrete frames. The now consolidated use of both elastomeric and sliding seismic isolators guarantees a high resistance to earthquakes. Aside from technological aspects, we tried to provide the building with features that would guarantee maximum efficiency to emergency escape routes in case of danger.

The insulation materials we chose are of natural origin and recyclable; they provide a high stability of performance across time and maximum fire resistance. The wooden floors are completed by cork suspended ceilings, which are highly efficient in reducing noise reflection.

In order to ensure the natural ventilation of spaces, the pivoted windows are equipped with vertical opening leaves. Low-emissivity glass and rolling blinds complete the equipment of windows in order to guarantee high levels of comfort.

The geometry of the façade, which is recessed from the floors, allows for a satisfying control of solar radiation, while the stringcourse beams perform as brise-soleils in order to protect the elevations.

The walls are enclosed in ventilated walls equipped with interior insulation and a particular care was devoted to the elimination of cold bridges.

Green roofs concur to the control of solar radiation. If sown with low-water requirement plants such as succulents, they will guarantee a further thermal insulation to the surface.

The rooms are equipped with underfloor radiant heating panels; each room is equipped with temperature control calibrated on crowding and solar radiation. A ventilation system channels filtered, hot and humidified air into the rooms through airflow vents and high induction diffusers with air intake vents and grills in toilets and corridors.

9 Environmental and Energy Sustainability

The widespread reliance on prefabrication, the careful design of the shell and the use of natural materials, efficient glazing and solar shields complement energy-efficient air conditioning systems.

The production of domestic hot water is centralized and fueled by heat pumps. Winter/summer air conditioning exclusively relies on renewable power sources.

The geothermal system fueled by reversible heat pumps is the only source of thermo-refrigeration. The system we propose relies on a station with two heat pumps, one of which functioning in a polyvalent reversible mode. Both concur to cover the winter energy supply, while the polyvalent heat pump covers the summer energy supply of the building, as well as the yearly production of domestic hot water (DHW) with a total recovery of heat during the summer period.

A system of photovoltaic panels would be installed on the roof of the gym.

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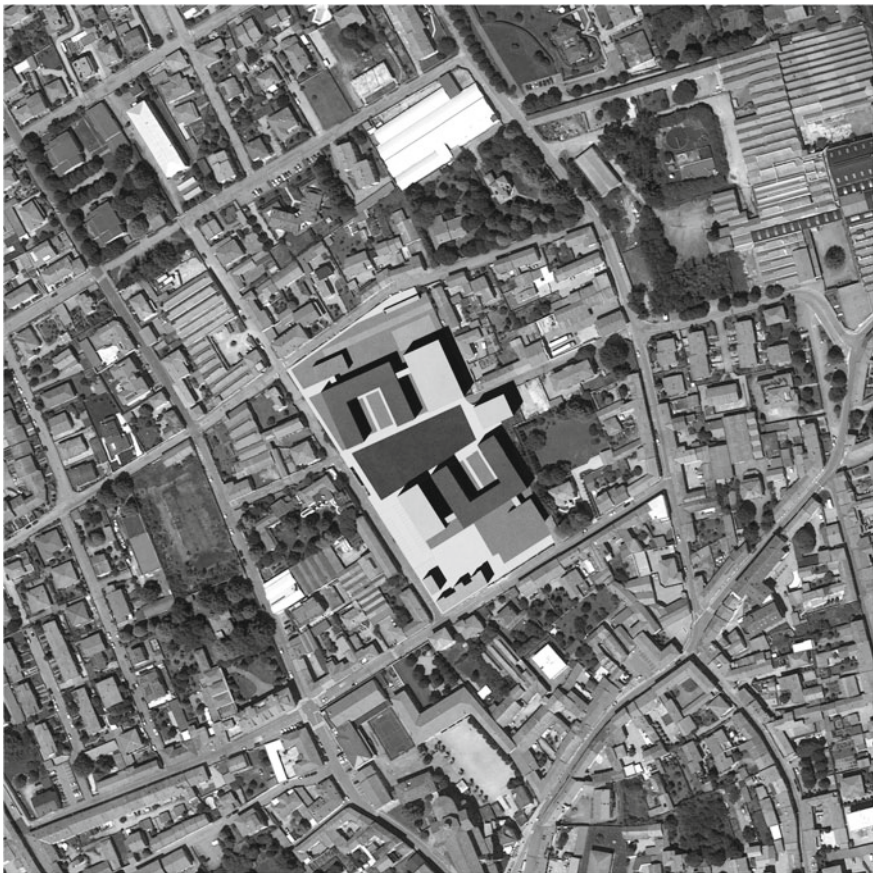


Fig. 1 Aerial photography photomontage

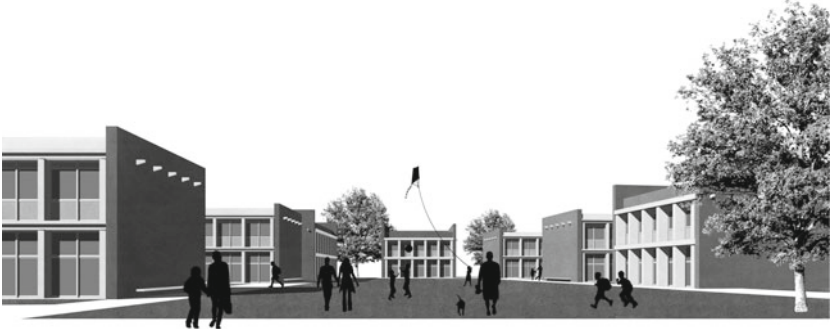


Fig. 2 View of the main courtyard garden

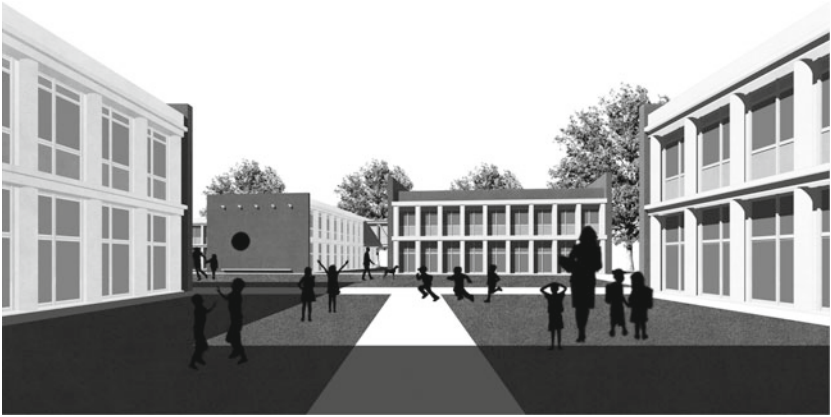


Fig. 3 View from the high school courtyard

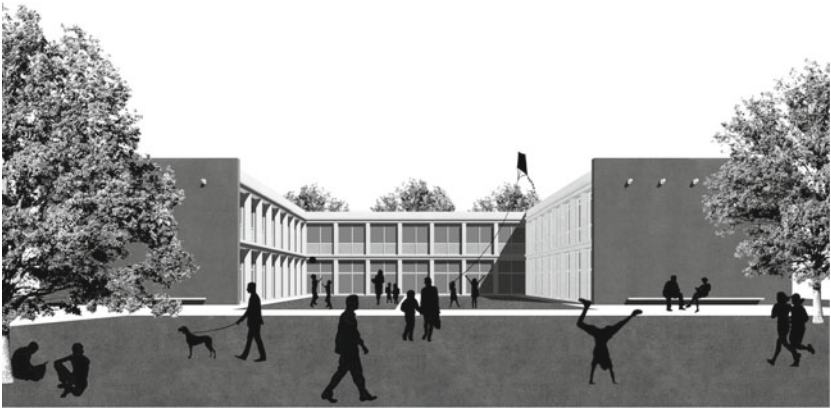


Fig. 4 View from the high school courtyard garden



Fig. 5 General plan

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