Frugal rehabilitation of a primary school

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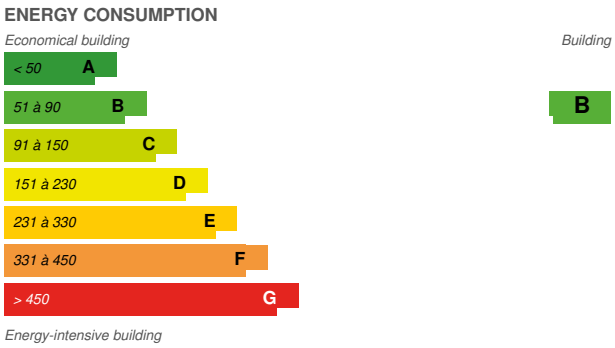
Primary energy need :

69 kWhep/m^2.an

(Calculation method : RT existant)



Building Type : School, college, university
Construction Year : 1756
Delivery year : 2017
Address 1 - street : 21 rue des Franciscans 68100 MULHOUSE , France
Climate zone : [Cfb] Marine Mild Winter, warm summer, no dry season.

Net Floor Area : 1 925 m^2
Construction/refurbishment cost : 2 900 000 €
Number of Pupil : 350 Pupil
Cost/m2 : 1506.49 €/m^2

Proposed by :

General information

This case study presents the renovation of the Cour de Lorraine primary schools in the city of Mulhouse from 2015 to 2017. The renovation was accompanied by the construction of a new building, consisting of a canteen, sanitary facilities, an after-school reception area and a sports hall.

The aim of this renovation was to consolidate the structure of the building, to improve the management of fire and seismic risks, to improve the quality of the indoor air, to reduce energy consumption and to enhance and conserve the heritage, all at a controlled cost.

Changes in use

The building has already undergone many changes in use over time. Indeed, it was first a cloth factory, before being converted into offices, housing and workshops when a spinning mill was built in the yard. The building was converted into a school in 1871, when Alsace-Moselle became German: schooling was compulsory in Germany, whereas it was not yet in France.

During the renovation in 2015, the project leaders took advantage of the work to rethink the interior of the building. The building was redesigned to increase the school's capacity from 13 to 18 classes. The school canteen was moved to the new building, the boiler room and staff accommodation were removed and the ground floor of the existing building was transformed into classrooms.

Constraints and issues related to the old building

The building was suffering from a major problem of humidity. There were two main reasons for this:

- Firstly, its foundations were not deep, even though there are canals nearby. The water was therefore rising into the walls through the floor.
- On the other hand, previous renovations had been carried out with unsuitable insulating materials, such as cement plaster, which prevented water from evaporating from the walls.
- In addition, there was insufficient ventilation, which contributed to water stagnation. The structure of the whole building was therefore weakened by the excess moisture, resulting in numerous cracks.

This situation was a source of major energy losses.

Treating the moisture

- A 1.40 m strip of sandstone paving stones was laid between the school and the asphalt of the courtyard, to allow the moisture in the soil to evaporate
- Replacement of cement renderings on the exterior with lime renderings

Strengthening the structure

- Consolidating the foundations by injecting mortar under pressure
- Installing metal reinforcements to raise and anchor the inscribed stairs

Insulating effectively

- Insulation of walls and high floors with mineral wool and installation of hygrovapor brakes
- Insulating the floor with polyurethane
- Replacement of all intermediate floors with joist floors, with acoustic and fire regulations
- Replacement of carpentry in poor condition and restoration of others

Initially the walls were to be insulated with bio-based materials, but this was not possible for cost reasons (the project dates from 2015/2017, the cost of these materials has since fallen). The risk of condensation induced by the use of mineral wool had to be ruled out using the Glaser method

Installing efficient energy systems

- Installation of two gas condensing boilers in the new building, which also supply the school with heating and DHW
- Installation of underfloor heating on the ground floor
- Installation of a BMS to regulate the heating in the classrooms and to monitor the building's consumption in detail
- Installation of two double flow air handling units in the attic

The work required the opinion of the Architecte des Bâtiments de France and the Conservatoire Régional des Monuments Historiques, as some parts of the building are listed in the Inventaire des Monuments Historiques (one of the facades, two staircases and the roof). The heritage aspect of the building notably constrained the choice of insulation: insulation from the inside was preferred so as not to harm the school's facades.

Sustainable development approach of the project owner

The very type of the site testifies to the project owner's sustainable development approach. In fact, rehabilitating the existing one made it possible to avoid building an entirely new school. This saves energy, materials and floor space. Renovation also makes it possible to reduce carbon emissions and the energy consumption of the existing one, which is just as important as building high-performance new buildings.

The city of Mulhouse, by renovating this building, has chosen to enhance and preserve the city's heritage. This makes it possible to offer schoolchildren and more generally the inhabitants a pleasant living environment, which recalls the history of the territory.

Architectural description

The architecture of the building contains remarkable heritage elements. The facade of the school on the street side, dating from the 18th century, includes sculpted decorations in blond sandstone as well as a triangular pediment pierced with an oculus. It has been listed in the Inventory of Historical Monuments since 1981, just like the roof and two staircases also from the 18th century. The second floor of the school has a rococo lounge. The survey also revealed the presence of original construction techniques, such as solid wood and plaster partitions dating from the 17th century.

The walls, 50 to 60 cm thick, are made of yellow sandstone and limestone, paved and coated with lime. They offer good thermal inertia to the building. The base stones, chaining and framing of the bays are in pink sandstone from the Vosges.

If you had to do it again?

Use bio-based materials whose price has fallen since the time of the work.

See more details about this project

https://www.rehabilitation-bati-ancien.fr/retours-experience/rehabilitation-raisonnee-et-raisonnable-dune-ecole-primaire

Photo credit

Bankruptcy

Stakeholders

Contractor

Name : Ville de Mulhouse (mandataire : CITIVIA SPL)
Contact : 03 89 43 87 67
http://www.citivia.fr/fr/citivia

Construction Manager

Name : Formats Urbains, Architectes Associés
Contact : 39 rue de Victor Schoelcher 68200 Mulhouse / +33 (0)3 89 33 27 90
http://www.formats-urbains.fr/

Energy

Energy consumption

Primary energy need : 69,00 kWhep/m^2.an

Calculation method : RT existant

Breakdown for energy consumption : Heating: 43% Lighting: 29% DHW: 1% Auxiliaries (ventilation, pumps): 27% Cooling: 0%

Initial consumption : 214,00 kWhep/m^2.an

Renewables & systems

Systems

Heating system :
- Condensing gas boiler
- Low temperature floor heating

Hot water system :
- Condensing gas boiler

Cooling system :
- No cooling system

Ventilation system :
- Double flow heat exchanger

Renewable systems :
- No renewable energy systems

Other information on HVAC :
Ventilation: in winter, the fresh air is filtered for fine particles, then heated by a rotary exchanger and hot water coils connected to the gas boiler, in order to be blown at a temperature of 21 ° C.

Smart Building

BMS :
Use of Centralized Technical Management.
Work on digital mockup throughout the project.

Environment

Urban environment

This school is located in the city center of Mulhouse, which was surrounded by canals at the time. It was built on the "Cour de Lorraine" known by this name since 1726, from the name of its owner.

Costs

Construction and exploitation costs

Total cost of the building : 2 900 000 €

Contest

Reasons for participating in the competition(s)

Garantir les performances de l'existant est tout aussi important que de construire du neuf performant. C'est pourquoi il est essentiel de s'attaquer à la rénovation du bati existant. Notamment le bâti ancien, construit avant 1948, qui représente 1/3 de l'existant.

Cette étude de cas montre qu'il est tout à fait possible d'atteindre de bonnes performances énergétiques en rénovation, même dans des bâtiments rongés par l'humidité avec une structure fragilisée, le tout pour un coût maitrisé. Elle montre que l'on peut combiner bâti ancien et systèmes énergétiques modernes et innovants. Enfin, elle montre que ce type de bâtiment, grâce à une rénovation efficace, peut offrir une certaine qualité de l'air et un bon confort interne à ses occupants. C'est donc un exemple pour la réhabilitation du bâti ancien, souvent soumis à des enjeux similaires.

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