Apartments and offices in Brussels, Belgium

PROJECT SUMMARY
Vertical extension : replacement of the sloping roof by three levels of apartments.

SPECIAL FEATURES
Use of ecological materials and renewables
Densification of urban area

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INTERNATIONAL ENERGY AGENCY

IEA – SHC Task 37
Advanced Housing Renovation with Solar & Conservation

The new graded roof construction follows the silhouette of the old roof.

The façade towards the street was left untouched

QUITE AN APPRECIATED NEIGHBORHOOD

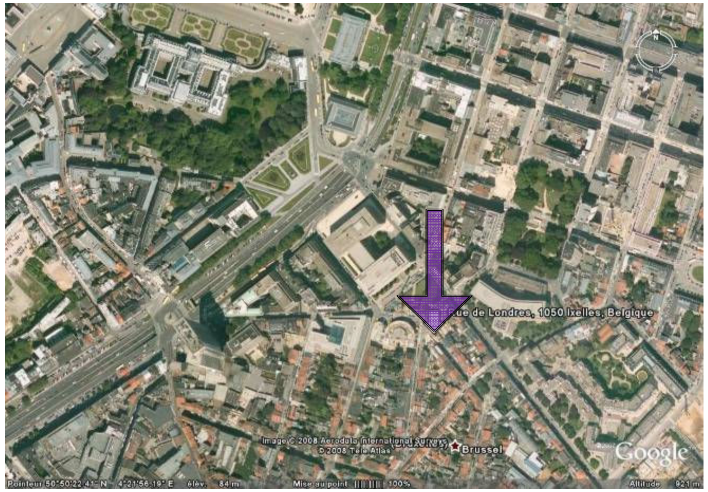
This renovation is situated rue de Londres, close to Brussels' inner ring road, and benefits from accessibility and proximity of services. This availability is made possible thanks to the density of the urban site that concentrates housing, shops, offices, services, common transportation, administration, entertainment.

The will to extend the housing capacity corresponds to a high demand in this appreciated neighborhood of Ixelles, close to the city centre. Despite the resulting pressure for more housing, a mix of functions was kept in order to maintain a soft mobility, a symbiosis with and a local organization of the neighborhood.

A WELL INTEGRATED CONTEMPORARY INTERVENTION

The façade represents the typical Brussels architecture from the end of the 19th century, showing a well-balanced and punctuated composition, framed by carriage entrances enhanced with balconies and underlined by its framework in blue stone.

The structure of the existing roof was worn out and the roof tiles damaged, making replacement of the roof mandatory. In stead of replacing the roof, a light wooden structure was built in order to create four apartments : two duplexes and two triplexes.



Aerial view of the neighbourhood of the building, in the centre of Brussels

The choice of a terraced volume matches the volume of the existing pitched roofs and offers a space for a terrace and small vegetable garden on each floor.

The lower existing floors house offices and a workshop, and are used by a non-profit organization encouraging inner city bicycle use.

The original stables in the courtyard were also renovated and are used by a carpenter.

From the street, the modifications are hardly visible.

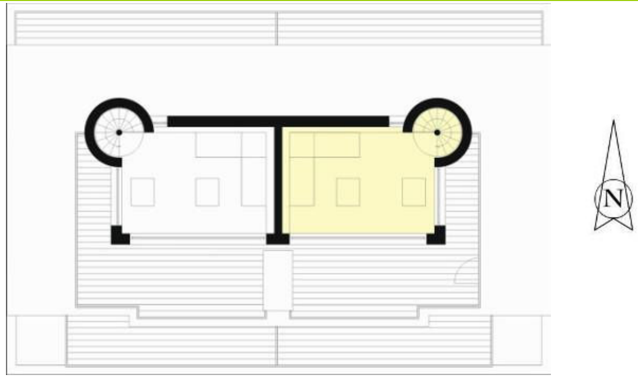
Terraces of the triplexes, southern part

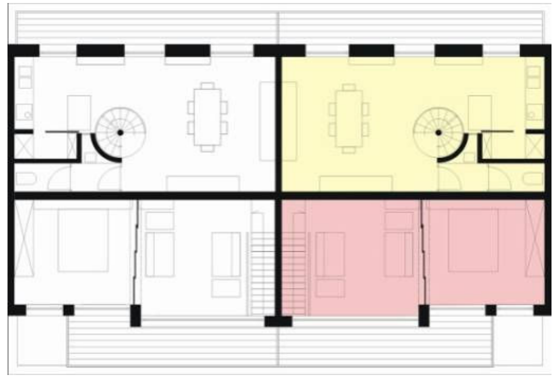
The access to the floors is made through the existing staircase and lift. A central corridor linking both, leads into the apartments. This layout of the premises divides the space into two parts : one to the north, overlooking the street and another one to the south, overlooking the inner block and its yard. To give the northern apartments a view on the south, a third level was constructed, above the duplexes. The southern façade is designed to let the sunlight enter in a controlled way. Large fixed sun visors in pergola-style contribute to creating a charming outside space, where the wooden horizontal surfaces (floor and "ceiling") dialogue together. The wood, as a contrast, softens the strong presence of the metallic elements that underline the verticality.

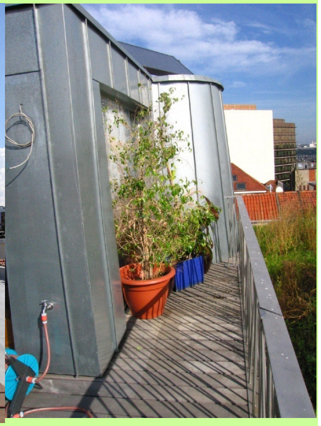
BUILDING CHOICES

Since extra floors meant extra weight, the choice of a wooden structure seemed the most appropriate for its lightness, its flexibility, and moreover because the stability of the existing building was fragile, with almost non-existing foundations.

The vertical extension was covered in zinc, attached to a pinewood lathwork. The choise of a wood construction as a side effect resulted in a quasi thermal bridge free construction.







View on the terraces and the staircase, during construction and after finishing

View on the terraces of the triplexes an duplexes, North side. Part of the wall already has a zinc finishing.

CONSTRUCTION

Roof construction *U-value: 0,112 W/(m²·K)*

(top down)

EPDM light grey	
Cork insulation panel	200 mm
Cellulose insulation + rafter	200 mm
Variable internal air barrier	- mm
Battens	35 mm
Plasterboard	12 mm
Total	447 mm

Wall construction *U-value: 0,244 W/(m²·K)*

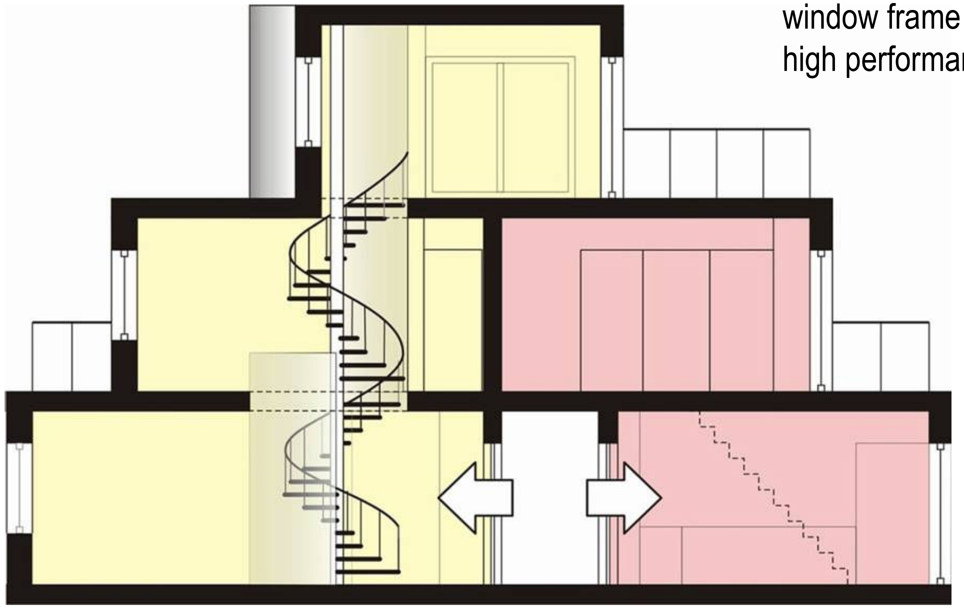
(interior to exterior)

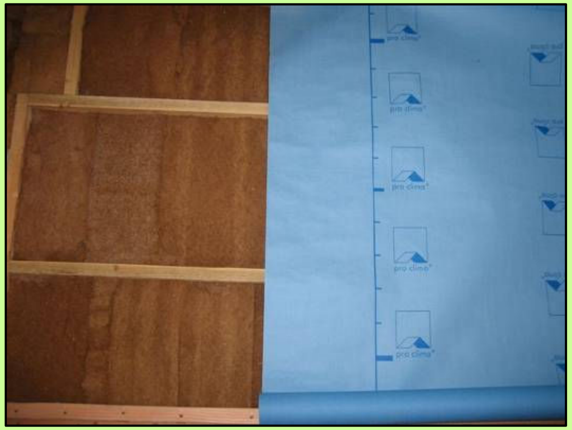
Plasterboard	12 mm
Battens	35 mm
Variable internal air barrier	- mm
Wood fiber insulation panel/ Cellulose + wood construction	180 mm
Wooden lathwork	22 mm
Zinc	2mm
Total	251 mm

Windows*:*

window frame *:* eucalyptus FSC

high performance double glazing





Insulation in wood fiber and the vapor barrier.

Natural insulation in cork

MATERIALS , WASTE

The sustainable logic behind the choice to retrofit the building, in stead of its deconstruction and reconstruction lies primarily in limiting the demolition waste as well as use of new materials, and for each step the energy and the pollution that goes with it. In this state of mind, the floors of the existing building were only slightly renovated. Moreover some dismantled materials were recycled in the newly built floors. In this construction you will find untreated structural wood, larch floors, clay coverings, eucalyptus window frames, wood fiber and cellulose, cork, EPDM.

Detail of the EPDM liner over the cork insulation

WATER MANAGEMENT

The question of water treatment was answered in this project in many different ways. The existing water tank was reused, a common washing room was created for all the tenants, and it's washing machine works on solar hot water. Vegetable gardens were created on the terraced roofs, accessible from the apartments, and a green roof will cover the lower building of the annex. The courtyard which houses some parking spots, has a permeable covering and is surrounded by flowerbeds.

Common washing room with automatic payment system

Reactivated water tank with pump.

Solar Thermal system: DHW and heating

17 m² of solar thermal panels were installed on the roof. The installation was purposely over dimensioned, so it would not only cover most of the domestic hot water demand, but also participate in the heating of the apartments.

A storage tank of 400 liters is heated first and provides the DHW. In summer, this only takes one hour. Next, a tank of 700 liter stores the heat to be used in the very low temperature surface heating system. The resulting DHW system has an autonomy of 90% on a yearly basis.

Rational Energy Use

The apartments that are for rent are equipped with a "chart for good energetic behavior" explaining the correct everyday behavior concerning the ventilation and the use of water and energy.

HEATING SYSTEM

The surface heating system circulates 'hot' water in the walls and the floors. Because of the big surface and good thermal insulation, the system can function at very low temperature. Steered by an external probe, the surface temperature varies between 25° and 35° C.

Because the Belgian climate doesn't deliver enough sun in the winter, a complimentary heating energy source in the form of a geothermal heat pump (water/water) was selected. This system made it possible to omit all fossil fuel consumption. At the moment the pump still works on electricity from the net, but the owners are participating in the production of green electricity.

Four holes were drilled to a depth of 70 meters, and refrigerant loops were installed inside. During winter, a heat pump transfers the heat form the refrigerant to the low temperature surface heating loop. During summer, the reverse strategy is possible, transferring heat back to the soil. The heat pump is programmed to be used almost exclusively during the night, using low cost electricity and storing the heat in the buffer tanks.

Silicate block wall and surface heating ductwork.

POLICY OF THERMAL INERTIA

Using wood as a construction material is interesting from the point of view of thermal insulation, but it lacks inertia: the construction warms up and cools down very quickly. Therefore, it is necessary to give the construction a suitable mass to reduce the oscillations in temperature. In summer, heat is accumulated during the day and released during the night. During winter the thermal mass works the other way round, accumulating the heat produced by the heat pump and releasing it during the day.
For this reason, the central load bearing wall on the lower floor is built out of silicate blocks. These blocks combine a favourable ecological balance with a high thermal mass.

AWARDS VAN DE BELGISCHE ARCHITECTUUR 2007 ENERGIE AWARDS
AWARDS DE L'ARCHITECTURE BELGE AWARDS DE L'ENERGIE

In 2007, the architect received the Belgian Architecture Energy award with this project in the category "collective housing".

COST STATEMENT

The investment for an installation like this one, is considerable. The costs of digging the holes amounted to approximately 10,000 € and the price of installation of the heating system was approximately two times higher than for a traditional system. But, taking into account the premiums for heat insulation (7€/m2), the solar premium (5 up to 6000 €), the little maintenance of the system and the building, a low total electricity consumption and no fossil fuel consumption, the pay back time is estimated at about fifteen years. A possible increased value in the future for low energy houses in not included here.

In comparison with a classic construction using ecological materials increased the cost by 25%.

Some special remarks on prices:

- The clay plaster costs the same as a standard plaster but has a better thermal inertia.
- The silicate blocks do not cost much more than standard hollow bricks, but their thermal inertia is better and they are glued, contrary to traditional brick laying, reducing the working hours and thus the costs.

Applying the clay plaster

South oriented façades of the apartments

Small gardens on the new graded roof

SUMMARY OF U-VALUES W/(m²·K)

	Before*	After
Attic floor	0.77	0.11
Walls	2.78	0.24
Windows	5.1	1.31

* Since there was no before situation, these are the values of the buildings below

BUILDING SERVICES

Ventilation system type A
Heat pump for heating: water/water system
4 bore holes of 70m
Heat distributed by wall heating.
Central washing machines with pre-heated water from the solar collectors

RENEWABLE ENERGY USE

Solar heating collector, flat plate collector: 17m²
Storage volume: 400l for pre-heating + 700l for heating distribution
Rain water tank: 15.000l

ENERGY PERFORMANCE

Space + water heating (primary energy)*
Before: - kWh/m²
After: 41 kWh/m²
Reduction: -%
*Walloon implementation of EPBD

INFORMATION SOURCES

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