

1. OVERVIEW

PROJECT SUMMARY

- Year of construction: **1964**
- Year of renovation: **2010 (Jul – Dec)**
- Building typology: **“High-rise apartment”**

-Space heating demand: **21kWh/m².a**

SPECIAL FEATURES

- Renovation towards “Very low energy” apartment
- Box-in-box construction

ARCHITECT

Horia Bali

2140 Borgerhout, Apartment



One Stop Shop Demonstration Project

Brochure Passiefhuis-Platform vzw
Gitschotellei 138, B-2600 Berchem
T: +32 (0)3 235 02 81
www.passiefhuisplatform.be



2. CONTEXT AND BACKGROUND

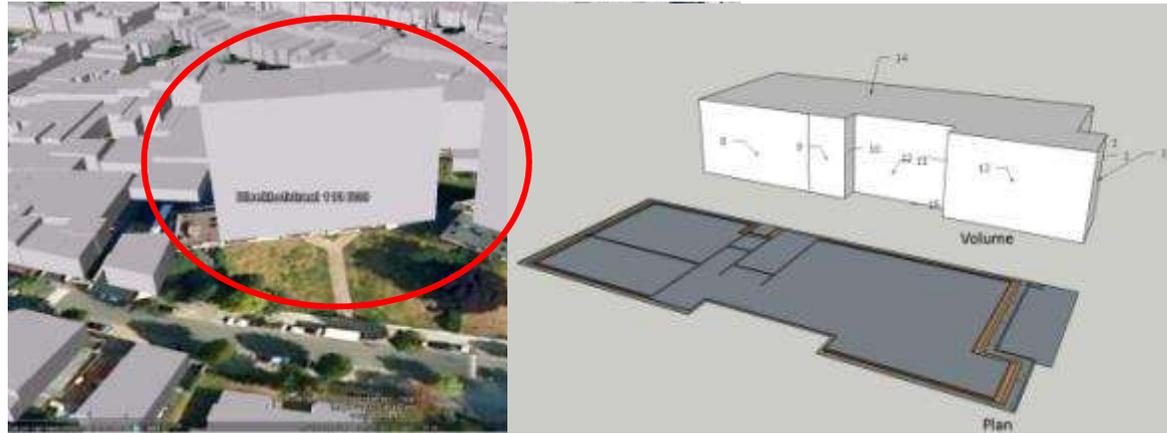
BACKGROUND

- Ownership status: **private**
- Net surface area: **75,70 m²**
- Occupation: **single family**

SUMMARY OF THE RENOVATION

- Renovation towards “Very low energy” apartment
- Box-in-box construction, internal insulation into a timber construction
- Change of doors and windows to a higher performance
- Improvement of airtightness and reduction of thermal bridges
- Ventilation system type D with heat recovery

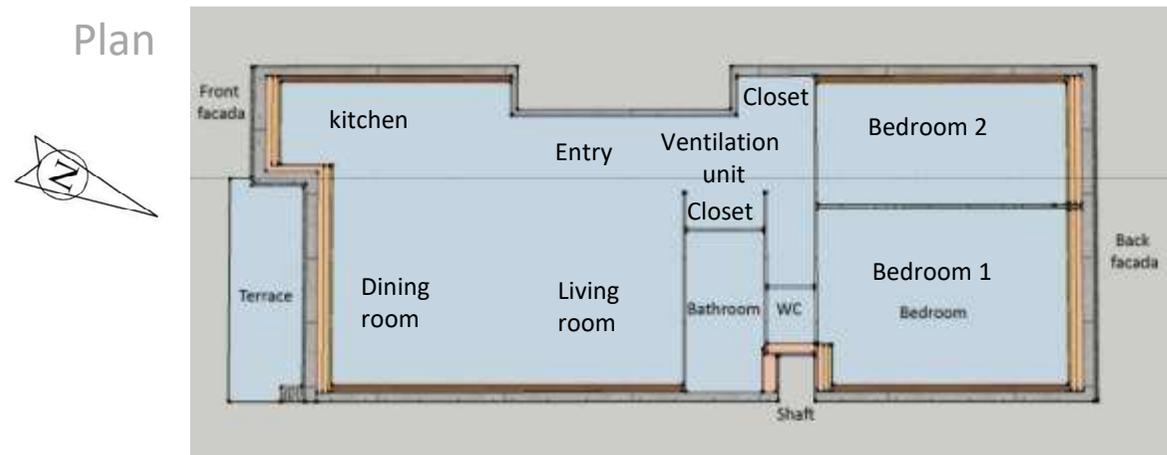
Pictures



Project location

Volume of apartment

Plan



2. ENERGY PERFORMANCES

Energy performance – before and after, space/water

USE	kWh/m ² year	kWh/year
Energy demand before renovation (heating and DHW)	145	12325
Energy demand after renovation (heating and DHW)	21	1638

Renewable energy use

Because this is an apartment in a high rise apartment building, it was not possible to install any renewable energy sources.

Thermal and electric consumption and costs (before and after)

Because the renovation was done immediately after the purchase there is no data of the before situation.

After the renovation the only thermal consumption is an electrical heating device of 2500W.



Special attention for cold bridge free placement of the passive doors.



Airtight vapor barrier between toilet and technical shaft.



4. DECISION MAKING PROCESSES

OBJECTIVES AND DETAILS

Why was the apartment selected?

When the owner was looking for a house, she had several conditions in mind. With the high real estate prices in mind, she wanted to find a dwelling that would fit these conditions:

- Affordable purchase
- Good structure
- Able to renovate in a short period
- A fully enclosed apartment to avoid thermal losses
- A perfect orientation
- Close to the city, public transport
- ...

She found this apartment on the 9th floor of a high rise apartment building in Borgerhout. This high floor had an extra advantage: there is no direct contact with the street life and you have a nice view over the city. This results in a fairly quiet living. A renovation was necessary, with worn out electricity, plumbing and windows with single glazing.

The goal of the renovation was to reach the passive house level and to have an affordable housing in an urban context. To keep the costs of the renovation low, the owner decided to work with inexperienced craftsmen, who were willing to learn.

During renovation



Installation of
insulation

Installation of
windows



5. THERMAL ENVELOPE

Exterior wall – front and back facade Construction

U-value: 0,108 W/m².K

Materials. (exterior to interior) / (existing – new):

Facing bricks	6 cm
Light concrete	22 cm
Phenolic foam insulation	12 cm
Hemp insulation between timber	10 cm
Hemp insulation in pipes cavity	5 cm
Gypsum fibre board	1,3 cm
U = 0,11 W/m²K	56,3 cm

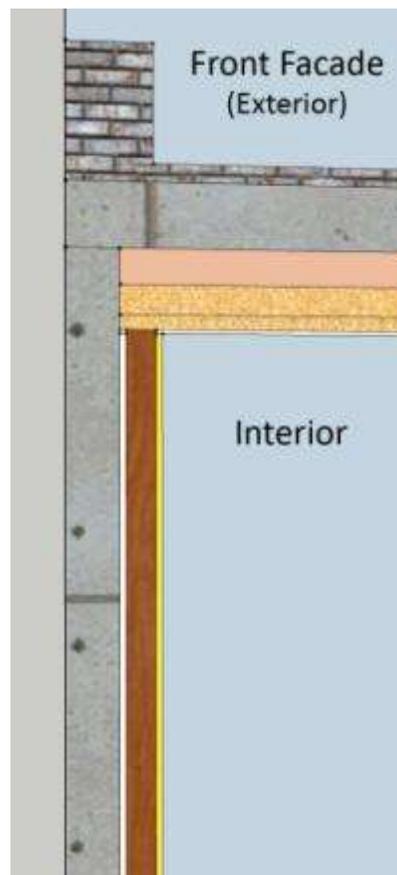
Wall– Technical shaft to Bedroom 1

U-value: 0,11 W/m².K

Materials. (exterior to interior) / (existing – new):

Light concrete	5 cm
Phenolic foam insulation	12 cm
Hemp insulation between timber	10 cm
Hemp insulation in pipes cavity	5 cm
Gypsum fibre board	1,3 cm
U = 0,11 W/m²K	33,3 cm

Detail



Connection between insulation exterior and interior wall

Wall– Technical shaft to WC

U-value: 0,13 W/m².K

Materials. (exterior to interior) / (existing – new):

Light concrete	5 cm
Phenolic foam insulation	16 cm
Gypsum fibre board	1,3 cm
U = 0,13 W/m²K	22,3 cm

Wall– Technical shaft to bathroom

U-value: 0,09 W/m².K

Materials. (exterior to interior) / (existing – new):

Light concrete	5 cm
Phenolic foam insulation	24 cm
Gypsum fibre board	1,3 cm
U = 0,09 W/m²K	30,3 cm

Wall– Interior wall (acoustic insulation)

U-value: -

Materials. (exterior to interior) / (existing – new):

Light concrete	10 cm
Wood fibre board	10 cm
loam	3 cm
	23 cm



Exterior wall – back and side walls

Construction

U-value: 0,11 W/m².K

Materials. (exterior to interior) / (existing new):

Finishing bricks		6 cm
Heavy concrete		22 cm
Phenolic foam insulation		12 cm
Hemp insulation between timber		10 cm
Hemp insulation in pipes cavity		5 cm
Gypsum fibre board		1,3 cm
U = 0,11 W/m²K		56,3 cm

Exterior wall – Between kitchen and terrace

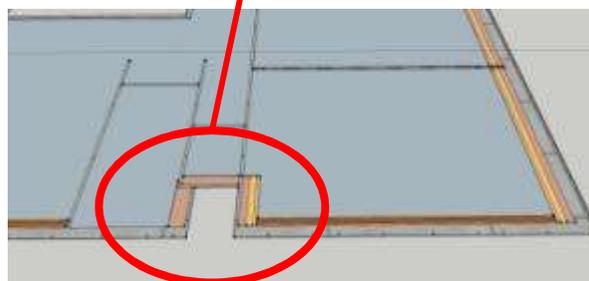
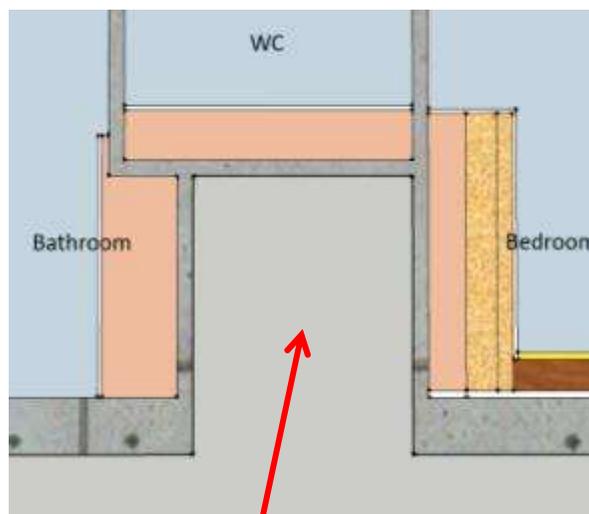
Construction

U-value: 0,08 W/m².K

Materials. (exterior to interior) / (existing new):

Finishing bricks		6 cm
Light concrete		22 cm
Phenolic foam insulation		12 cm
Gypsum fibre board		1,3 cm
U = 0,16 W/m²K		41,3 cm

Pictures/figures



Insulation from shaft to WC, bathroom and bedroom 1

Thermal bridge avoidance:

Windows

Thermally insulated window frame with triple glazing.

Average whole window U-value: 0,80 W/m²K

- **Window in the north side**
0,81 W/m²K
- **Windows in the south side**
0,78 W/m²K

Airtightness



The airtightness of the project was reached mainly due to placement of vapour barrier foils and the interior plaster. A blower door test indicated an n_{50} -value of 0,8 ach⁻¹.



6. BUILDING SERVICES

HEATING SYSTEM

The existing radiators were all taken away and the tubes were sealed. The current owner has installed taps on the sealed tubes so other owners can reinstall radiators on the central gas boiler if ever wanted or needed. Without any extra heating, the temperature in the apartment never drops below 17°C. If necessary, an electrical heating device of 2000W can be used when the outer temperature drops below zero and the days are cloudy.

In the bathroom there are two pipes \varnothing 8 cm with hot water which run through the whole building. This water is heated by a central gas boiler.

VENTILATION

A balanced ventilation system with heat recovery was installed (type D, R=78%).

HOT WATER PRODUCTION

Domestic Hot Water is produced by a central gas boiler which provides hot water for the entire building.

Winter strategies

- *The apartment is completely surrounded, so thermal losses are only to find on the front and back facade,*
- *The solar gains are maximized in winter by the orientation of the windows. Only on cloudy winter days an extra heating is necessary.*
- *Ventilation system type D with heat recovery is the main heater of the house.*



Extra heating device of 2000W for the cold, cloudy days.

Summer strategies

- *The perfect orientation of the building makes it possible to create a good natural ventilation to cool the dwelling.*



Ventilation system "D" with heat recovery (R=78%)



Ventilation ducts



7. ENVIRONMENTAL PERFORMANCES

WATER

To reduce the water consumption several measures were taken:

- Replacements of the toilets by ones with double flush button
- Placement of water saving showerhead and water taps,

Also the owner decided to use a hot fill dishwasher and washing machine,

MATERIALS

The choice was given to good insulating materials (low lambda value) who are also environmental friendly. Therefore the choice was given to phenolic foam and hemp insulation.

For the acoustic insulation of the internal walls they used Wood fibre board with loam.

8. User experiences

A year after the renovation the owner is still very satisfied. It's very pleasant to live and due to the passive house joinery and air tightness, the street noise stays out. The fact of working with inexperienced craftsmen has resulted in some errors. There were some problems with the air tightness and with the plumbing.

The indoor climate is good, with temperatures never going above 28°C (when the outside temperature is 36°C) in summer or below 17°C (when the outside temperature is -15°C and the sun is completely clouded) on winter days. The orientation is also very good for night cooling. The only problem is the dry air: with only 20% humidity in winter this is very low. The owner is now experimenting with house plants and evaporators. The fact that it was almost impossible to reduce the thermal bridges was a heavy disappointment. In reality however, their impact seems to be less than calculated.

Due to the internal insulation the net surface area of the apartment was reduced to 75m². For the current owner this was not an issue, but it has to be taken into account when looking at the cost per m².

9. Cost information

The purchase of the apartment was somewhere around 90,000 euro. This was also the total cost of the renovation itself. These were spread as followed:

- Construction (demolition, sanitary, tiles, interior doors, inside windows) 59,0%
- Passive joinery 18,8%
- Ventilation 11,1%
- Insulation + airtightness 11,1%



Windows between bedroom and toilet and between living room and bathroom provide daylight on places where the sun does not come. This creates a pleasant feeling and reduces the use of electric light.



By placing the new windows and terrace door behind the insulation thermal bridges are avoided.

