Social housing Sterrenveld in Wezembeek BE

**PROJECT SUMMARY**
Sustainable renovation of a social housing tower to fulfill contemporary comfort standards

**SPECIAL FEATURES**
- Glazed in balconies
- Holistic sustainable approach

**ARCHITECT**
Quirynen Jacobs Architecten

**OWNER**
GM voor Volkshuisvesting

IEA – SHC Task 37
Advanced Housing Renovation with Solar & Conservation
BACKGROUND
This apartment block, part of the Ban Eik garden city project, was the winning design of an architectural competition in 1959. Most of the 417 residences are single family houses alongside two identical tall apartment blocks, Zonneveld and Sterrenveld, and two smaller blocks. A good mix of uses and a district heating system for the whole neighbourhood made this an exemplary project in the sixties.

New construction or renovation?
After 30 years the apartment blocks were completely worn out and out of date. They were built from cheap construction materials were poorly maintained. The blocks were a problem "hotspot". When the regional social housing company “GM voor Volkshuisvesting” took over the Ban Eik, the decision was made to refurbish the whole neighbourhood. Sterrenveld and Zonneveld were slated for demolition. However, a new urban planning law forbade new construction higher than 3 levels. Considering this, the planners decided that the building structure was sound, so they opted for a thorough renovation. First Zonneveld was renovated towards the actual construction standard. In a final phase, the renovation of Sterrenveld was planned.

Reflection about the programme
Stimulated by the Flemish Government through a call for pilot projects, the renovation took a holistic view of sustainability. Energy loss was minimized with insulation, heat recovery and thermal bridge alleviation. Complementing this were solar collectors and pv panels. The social network of the neighbourhood was to be revitalized through wise use of architectural and urban planning tools.

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The apartment layouts were completely redesigned. The old apartment block had one central hallway per floor without any window or ventilation. It divided the block in half, with apartments facing north or south. The new design stretched all apartments from north to south, and regrouped the inner circulation in three vertical staircases and lifts, opening to the outside. This measure required the removal of most of the internal walls that gave the structure its rigidity. Adding balconies to the building as a new structural element, resolved this. The balconies are sheltered by a glass façade, creating "winter gardens". In summer, the glazing can be opened, converting them to normal balconies.

**Extra sustainable measures**

Each apartment is handicapped accessible. Two apartments per floor are adapted to the principles of lifelong living. The old boiler room building has been converted to office space for an NGO and for the social housing company, as well as a multipurpose room for the residents. All low rise blocks have an extensive green roof.
SUMMARY OF THE RENOVATION

- Reuse of the concrete structure
- 12 cm mineral wool insulation of the building
- Use of lightweight inner walls for flexibility
- New, ground floor, single-family residences in wooden frame construction.
- West facade was brought forward two meters, making room for large protected balconies, anchored to the existing construction (no new foundation works). The glazed in balconies reduce thermal bridges and create "winter gardens".
- Old central hallway replaced by three, decentral vertical circulation shafts, with daylighting.
- New windows with high performance double glazing (U=1.1 W/m²K)
**CONSTRUCTION**

**Roof construction**  \( U\text{-value: } 0.28 \text{ W/(m}^2\text{K)} \)
*(top down)*
- Roofing: 10 mm
- Mineral wool insulation: 120 mm
- Screed on PE foil: 40 mm
- Concrete slab: 150 mm
- Plaster: 10 mm
- Total: 330 mm

**Wall construction**  \( U\text{-value: } 0.41 \text{ W/(m}^2\text{K)} \)
*(interior to exterior)*
- Plaster: 10 mm
- Concrete: 180 mm
- Mineral wool insulation on PE foil: 80 mm
- Exterior stucco: 20 mm
- Total: 290 mm

**Ceiling above exterior**  \( U\text{-value: } 0.26 \text{ W/(m}^2\text{K)} \)
*(top down)*
- Grès tiles: 20 mm
- Concrete: 70 mm
- Cork: 10 mm
- Polyurethane insulation on PE foil: 30 mm
- Reinforced concrete: 150 mm
- Mineral wool insulation: 80 mm
- Exterior stucco: 20 mm
- Total: 380 mm

Mineral wool insulation being installed on the existing concrete walls of the north façade.
ENSURING A HIGH BUILT QUALITY

To ensure a well insulated and thermal bridge free construction, attention had to be paid to quality. The guiding principles of the project were:
• Defining goals in the technical specifications for thermal bridge free construction, air tightness, and high insulation levels.
• Carefully detailing of construction details
• Selecting contractors based on willingness and capabilities to respect sustainable principles. This had to be proven by a statement, a vision and reference projects.
• All details of importance were discussed with the contractor through execution drawings and technical files.
• Systematic on site assessment of the construction works by the building team.

A THERMAL BRIDGE FREE CONSTRUCTION

The new structure for the "winter gardens" consists of concrete slabs and steel columns. The structure gives the building its rigidity. To reduce the thermal bridging, the connection between building and "winter gardens" was reduced to a minimum. An almost continuous layer of hard insulation board runs between both concrete slabs. Chemically fixed anchors make the connection between both structures.

On the north facade, the public circulation is completely open air, and the existing floor slabs go from inside to outside. To eliminate the thermal bridging that would result, the floor slabs are completely wrapped in an insulation layer.
Monitoring also allowed insights as to the influence of occupants on energy performance. In Sterrenveld, the tenants were satisfied with fairly low room temperatures. This can be explained by the larger families living in these larger apartments.

As a result, the already over dimensioned heating system could not efficiently produce the small amounts of required heat and so it kept switching on and off. While the predicted efficiency had to be around 100%, the measured efficiency was only 84% after optimisation.

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RENEWABLE ENERGY USE
• 30m² vacuum tube solar collectors, orientation south-west. Total measured production during the first 18 months: 9.9 MWh.
• 15m² polycrystalline PV panels, with a peak capacity of 19 kW. Total measured production over 17 months: 2.5 MWh.

ENERGY PERFORMANCE
Space + water heating (primary energy)*
Before: 150 kWh/m²a
After: 75 kWh/m²a
Reduction: 50%
*Flemish implementation of EPBD

INFORMATION SOURCES
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This research was done within the framework of the LEHR project (www.lehr.be), grouping three research teams (PHP/PMP, Architecture et Climat – UCL, BBRI), on account of the Belgian Federal Science Policy, executing the “Programme to stimulate knowledge transfer in areas of strategic importance”.

Summary of U-values W/(m²·K)

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<thead>
<tr>
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<th>Before</th>
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<tbody>
<tr>
<td>Roof</td>
<td>0,77</td>
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<tr>
<td>Walls</td>
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<td>Windows’</td>
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BUILDING SERVICES
• Two condensing gas boilers, one for domestic hot water (200kW) and one for low temperature heating (407kW).
• Domestic hot water production is split between pre-heating (solar thermal) and post-heating, with 3 storage tanks of 1000l each for pre-heating, and 2 storage tanks of 300l each for post-heating.
• Mechanical ventilation system with heat recovery. Due to lack of head room, the ventilation ductwork runs through six vertical shafts, connected to four heat recovery ventilation (HRV) units.
• Three types of HRV units: 1 rotary heat exchanger (R=75%), 2 cross current systems (R= 65%), 1 heat pipe. (R= 55%)

Domestic Hot Water production with separate storage tanks for pre-heating (A) and post-heating (B)

6 technical shafts distribute all heating, water, electricity and ventilation.

Photovoltaic solar panels and vacuum tube solar heating system on the roof of Sterrenveld.