Social housing „Sterrenveld“, Wezembeek, Belgium

PROJECT SUMMARY
Sustainable renovation of a social housing project towards current comfort standards

SPECIAL FEATURES
Winter gardens
Holistic sustainable approach

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SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

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

An aerial view of the garden city Ban Eik. In the middle you see the two apartment buildings, Sterrenveld to the left and Zonneveld to the right.

The old apartment block being stripped.

BACKGROUND

The apartment block is part of a garden city project named Ban Eik, based upon an architectural contest of 1959. Most of the 417 residences were single family houses, alongside two identical bigger apartment blocks, Zonneveld and Sterrenveld, and two smaller ones. A good mixing of functions, and a district heating system supplying the whole neighbourhood made this an example project in the sixties.

New construction or renovation?

After 30 years the apartment blocks were completely worn down and out of date, due to cheap construction materials and failing maintenance. This made the blocks 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. As for Sterrenveld and Zonneveld, the first option was to demolish these blocks completely. This turned out not to be an option, since a new urban planning law forbade new construction higher than 3 levels. When the planners saw that the structure of the building was still in optimal shape and had a good and flexible grid, 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.

Stimulated by the Flemish Government through a call for pilot projects, the design expressed a holistic view on a sustainable renovation, tackling energy loss through insulation and heat recovery, minimizing thermal bridges, installing solar thermal and PV, and revitalising the social network of the neighbourhood with architectural and urban planning tools.

Reflection about the programme

First of all, the storage rooms on ground level were relocated on the first floor, making way for new residences. This improves social control on the surroundings, and links the building to its low rise neighbours.

The old co heating boiler room, now a community centre and small office block.

The new residences on ground floor, and the storage rooms on the first floor: above on the west façade and below on the east façade.

Secondly, the floor plans of the apartments were completely redesigned. The old apartment block had a central internal hallway per floor without any window or ventilation. This hallway divided the block in two parts, creating 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 lift cases, open to the outside.

This measure required the removal of most of the internal walls that gave the structure its rigidity. Adding terraces to the building as a new structural element, resolved this. A glass surface shields these large terraces, creating actual winter gardens. In summer, the glazing can be opened, so that the terraces function as normal balconies.

Extra sustainable measures

Each apartment will be accessible to disabled people. Two apartments per floor will be adapted to the principles of lifelong living.

The old boiler room building is now reused as office space for an NGO and for the social housing company, as well as a multipurpose room for the residents, in order to improve the mix of functions.

All low rise constructions have an extensive green roof.

The new winter gardens. It's possible to open the glazing and so to have a normal balcony.

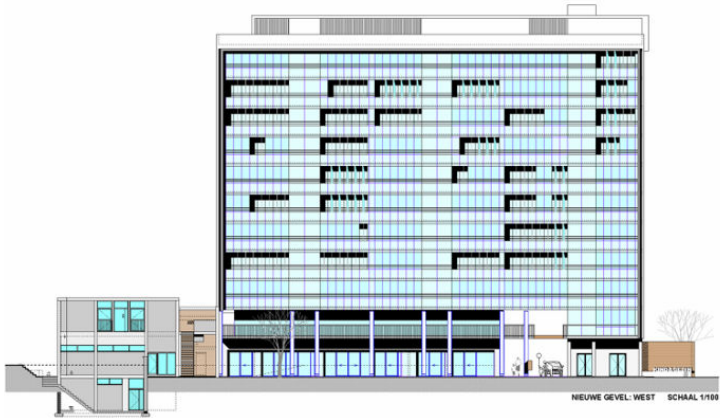
Green roof on top of the new residences. In the background you see the single family housing of the garden city.

The Sterrenveld block before the renovation. In the background you can see the already renovated Zonneveld block.

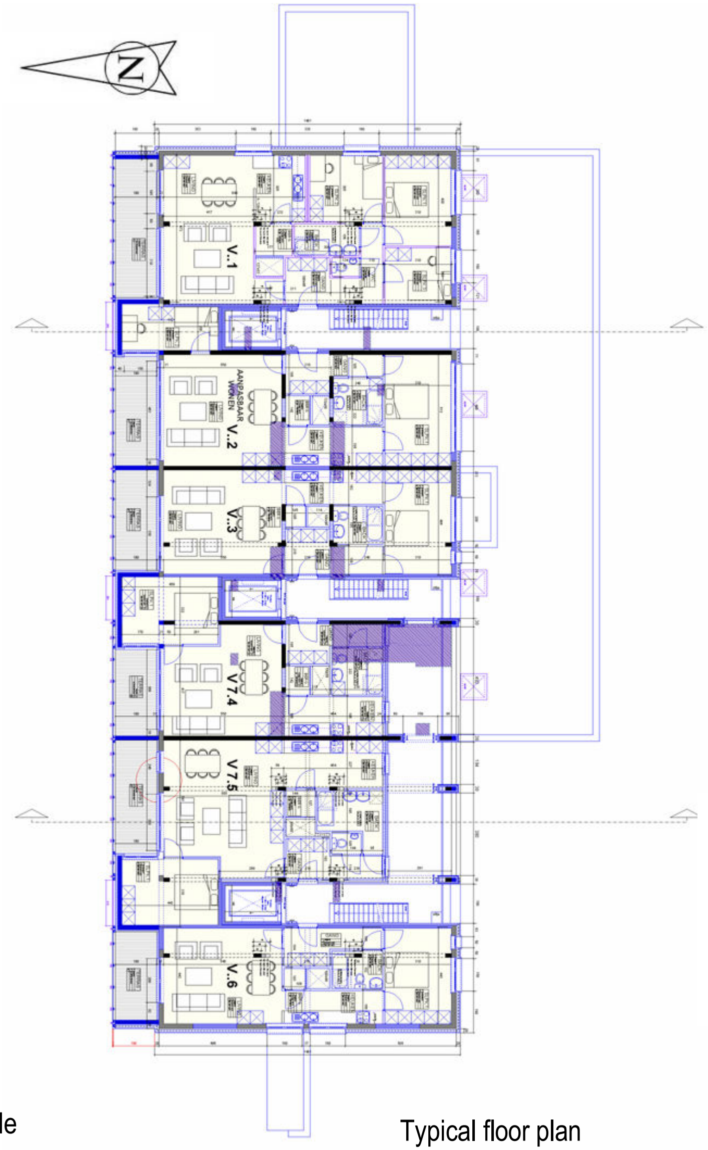
The Sterrenveld block after renovation, view on the west façade.

SUMMARY OF THE RENOVATION

- Reuse of the concrete structure
- Insulation of the building envelope with 12 cm mineral wool
- Use of lightweight inner walls, to improve flexibility
- New single family residences on ground floor, erected in wood frame construction.
- West façade is brought forward two meters, making room for large protected terraces, attached to the existing construction (no new foundation works). This reduces thermal bridging from the terrace slabs and creates a winter garden.
- Old central hallway is replaced by 3 decentral vertical circulation shafts, with plenty of influx of natural light.
- New windows with high performance double glazing (U=1,1 W/m²K)



Façade



Typical floor plan

Mineral wool insulation being installed on the existing concrete walls of the north façade.

CONSTRUCTION

Roof construction *U-value: 0,28 W/(m²·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-value: 0,41 W/(m²·K)*

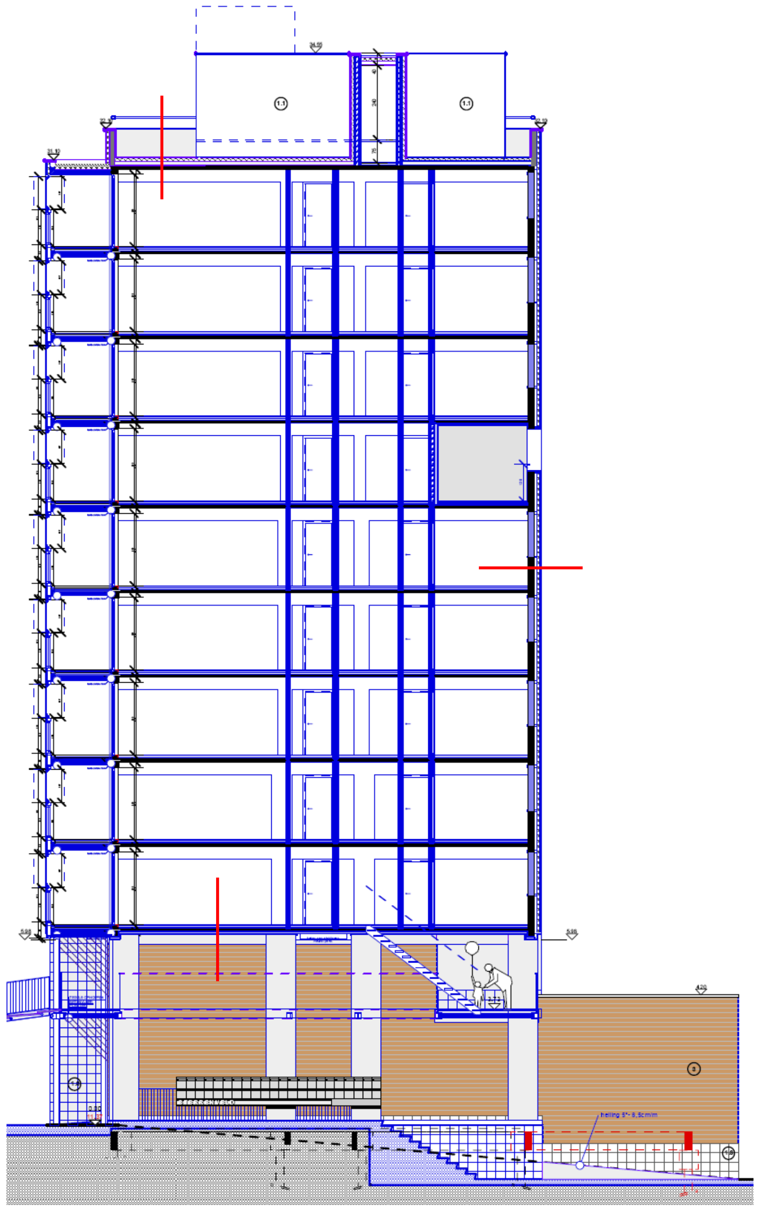
(interior to exterior)

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-value: 0,26 W/(m²·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



Thermally insulated connection between winter gardens and concrete structure.

The winter gardens on the south.

ENSURING A HIGH BUILT QUALITY

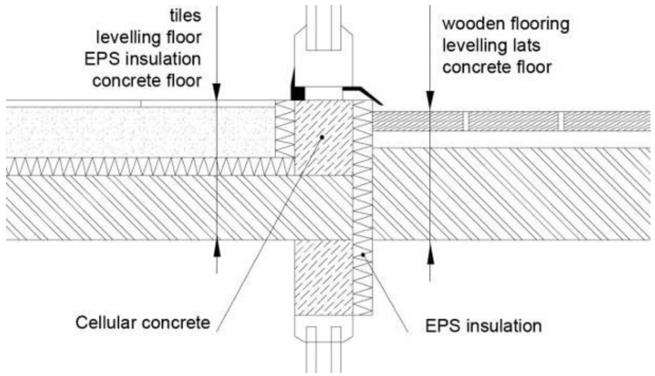
To ensure a well insulated and thermal bridge free construction, attention had to be paid to quality. The main instruments used in the project were:

- Defining goals in the technical specifications for thermal bridge free construction, air tightness, insulation values, …
- Execution plans and construction details
- Selecting contractors was based on willingness and capabilities to work along 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 of 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 has been 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 façade, the public circulation is completely open air, and the existing floor slabs go from inside to outside. To eliminate the thermal bridging effects that would result, the floor slabs are completely wrapped in an insulation layer.



Connection between floor and winter garden.

The Sterrenveld building in front, the Zonneveld building In the back (right) after the renovation.

The 2 300l buffer tanks in front, and the 3 1000l buffer tanks in the back.

MONITORING

The entire technical system is monitored and controlled, in both Zonneveld and Sterrenveld. The comparison between the buildings, one standard and one low energy retrofit, leads to some interesting conclusions.

First of all, it underlines the importance of monitoring and fine tuning, at least for the first years after renovation. The solar thermal installation in particular needed adaptation.

Secondly, the impact of the insulation measures was clearly visible in the measurements.

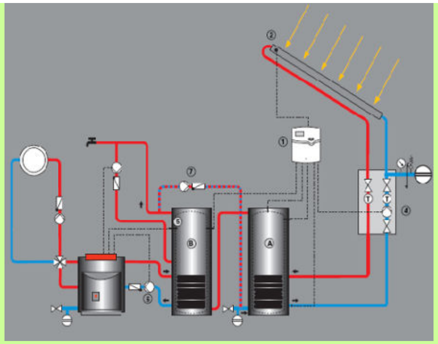
	15.10.07 – 15.10.08		15.10.08 – 29.10.08	
	Zonneveld 70 app	Sterreveld 60 app	Zonneveld 70 app	Sterreveld 60 app
Hot H_2O (l)	1.066.320	1.104.120	40.100	44.390
kWh/l Hot H_2O	0,090517	0,090099	0,093267	0,087249
% Sunboiler savings		0,46		6,45
Hot H_2O (kWh)	96.520	99.480	3.740	3.873
Heating (kWh)	248.193	255.203	9.241	6.961
Loss (kWh)	215.747	142.401	8.277	4.963
Total (kWh)	560.460	497.084	21.258	15.797
% Loss	38,5	28,6	38,9	31,4

The impact of the people on the installation was also clearly measured. In Sterrenveld, the required comfort temperature by the tenants was fairly low.

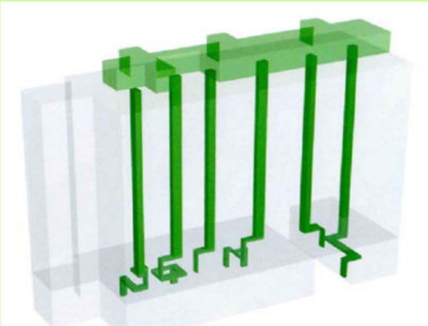
This can be explained by the larger families living in these larger apartments.

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

The central monitoring system for the buildings Zonneveld and Sterrenveld.



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.

Summary of U-values W/(m²·K)

	Before	After
Roof	0,77	0,28
Walls	2,78	0,41
Basement ceiling	6,66	0,26
Windows*	5,1	1,19

BUILDING SERVICES

- Two condensing gas boilers, one for domestic warm 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 free head space, 6 vertical technical shafts integrate the ventilation ductwork, connected to 4 heat recovery ventilation (HRV) units.
- 3 types of HRV units: 1 rotary heat exchanger (R=75%), 2 cross current systems (R= 65%), 1 heat pipe. (R= 55%)

RENEWABLE ENERGY USE

- 30m² vacuum tube solar panels, orientation south-west. Total measured production in 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

VMSW, www.vmsw.be

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