RENOVATION REPORT

The renovation reports are grounded in the findings of the pilot projects conducted as part of the ISOL'ution project. They synthesise practical lessons learned and identify key considerations for the reuse of insulation materials in various building typologies and material types.

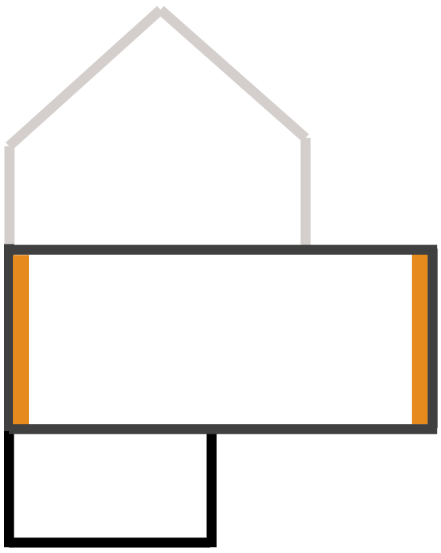
SITE 3

INTERNAL INSULATION OF FAÇADE

EXISTING SITUATION

Three apartments on top of each other in building were renovated and insulated, then taken over by an AIS as part of the RENO+ project.

Location of intervention	*building with three flats*
Affected floors	*3*
Housing units	*3*
Année de construction / rénovation lourde	*1940*
Type of construction	*brick façade with wooden floor*
Component to be insulated	*facade*
Surface area of the envelope	*350*
Points to consider	*Ensure good continuity of insulation and airtightness throughout the façade.*

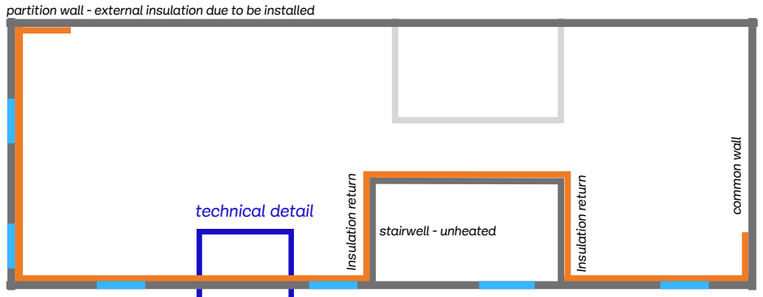


Section schématique de la typologie

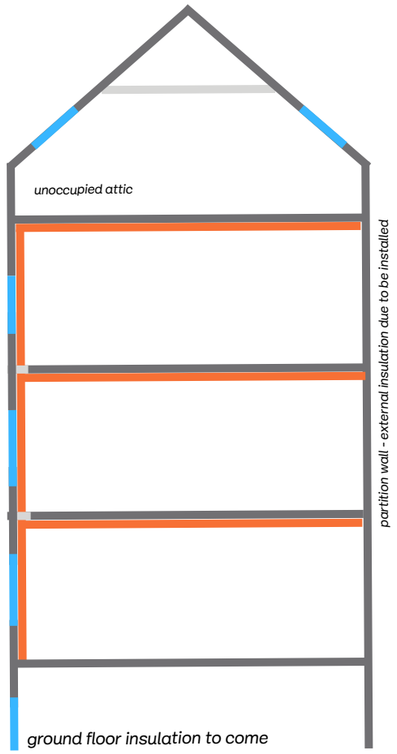
TECHNICAL DECISION

Elements to be insulated	*facade*
Side of insulation	*inside*
Surface to be insulated	*165 m2*
Anchoring method	*metal partition wall*
Type of insulation used	*Rock wool*
Execution by	*Casa Blanco*

● *window* ● *reused insulation* ● *structure*



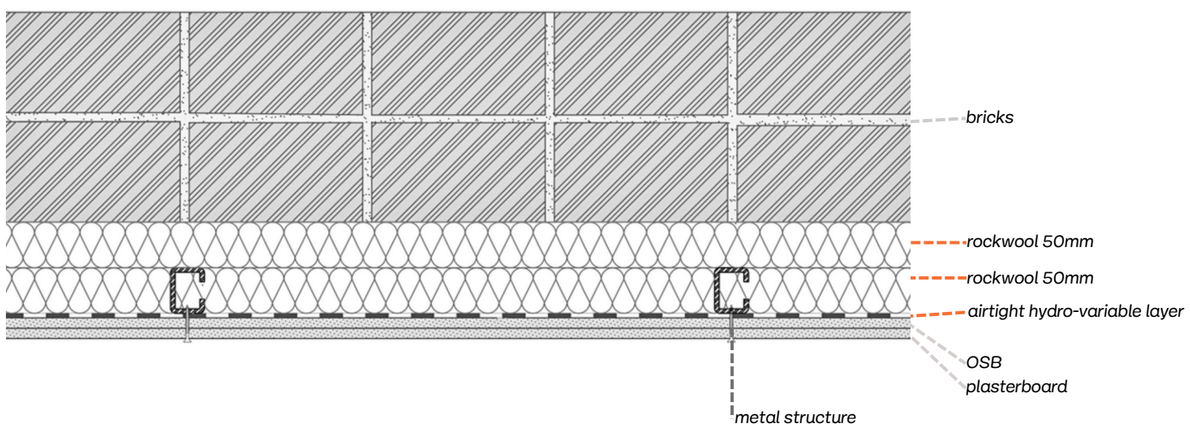
simplified plan



simplified section

Technical detail explanation

A double layer of rock wool, each 5 cm thick, was chosen to ensure continuous insulation across all levels, facilitated by the complete renovation with the opening and insulation of the floors. A metal frame, fixed to floor and ceiling, holds the insulation panels in place, while wooden wedges ensure the structure is securely fixed and stable on the walls. Opening up the floors allowed for the airtight encapsulation of the wooden beams integrated into the façade, thus protecting these elements from moisture damage. The vapour barrier completes this system, controlling moisture exchange and contributing to the health of the occupants and the interior insulation.



technical detail

wall insulation

wall insulation

REUSED INSULATION MATERIALS USED

Rock wool was chosen for insulating this façade because it is easy to install in a partition wall. As the budget allocated for insulation on the project was limited and the surface area to be insulated was large, rockwool was the obvious choice. This material is available in large quantities on the reuse market at a reasonable price. Most of this material is recovered from the demolition of office partition walls.

lot 1

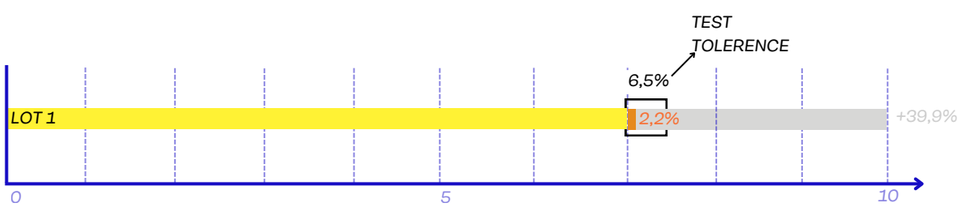
Test results of the thermal conductivity

The table below consists of two parts. First, it lists the materials used and their technical characteristics. Secondly, their thermal resistance is compared using different lambda (thermal conductivity) values and different thicknesses. The thickness of the insulation panels is calculated based on the thermal resistance of an equivalent new insulator (orange), the average measured value (yellow) and the default value (grey). If the technical information on an insulation material is unknown or unavailable, a default thermal conductivity value from Annex A of Belgian standard NBN B 62-002 is used to calculate the thermal resistance. The thickness is calculated based on an R-value of 4m2.kW (this is the minimum thermal conductivity that applies in the Brussels RENOLUTION subsidy-scheme for roof insulation). The black box indicates the tolerance of the test-device to take into account for the results.

Materials	*type*	*lot*	*quantity*	*thickness*	*avarage lambda test*	*new lambda*	*default value*	*supplier*
rockwool	*mineral*	*1*	*315 m2*	*5 cm*	*0,035754*	*0,035*	*0,050*	*BatiTerre*
					**1*	**2*	**3*	

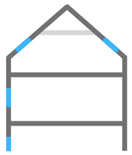
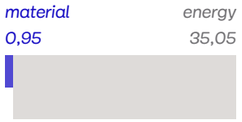
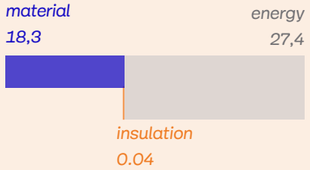
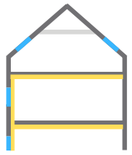
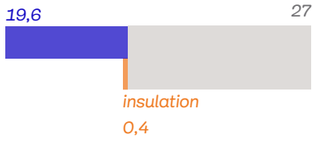
Insulation thickness in cm to achieve a thermal resistance of R: 2,5 m2.K/W

mineral wool



RENOVATION SCENARIOS

This table compares several scenarios: the original situation, a renovation with reused insulation materials, and a renovation with new materials. It examines various aspects: the wall composition, thermal conductivity of the insulation, price, overall environmental score, the share that insulation represents in the climate impact, the impact on climate change, and the thermal performance of the element. The TOTEM tool was used for these analyses. This table enables an informed decision to be made on whether or not to use reused materials for the insulation of a building element.

Roof	Element composition	Area to be insulated (m²)	**Thermal resistance of insulation R (m²·K/W)** *Indicates the ability of the insulation to slow down the flow of heat through the material. Calculated by dividing the thickness by the thermal conductivity (lambda). The higher the R value, the better the insulation.*	**Cost comparison** *This section is broken down into several sub-elements: the insulation material (I), all materials (M), labour (L) and additional costs. The price is first expressed per square meter, then as the total cost for the entire project. This allows for a clear comparison between the different options.*	**Environmental impact per life cycle stage (mPt/FU)** *The graph below illustrates the environmental score per life cycle stage element, based calculation with the TOTEM-tool. The total environmental score is broken down into the different phases of the life cycle, showing the respective contributions of production, construction, use and end-of-life. This representation makes it possible to identify in which life cycle stages the main impacts occur and to clearly compare the differences between the options of reuse and new material.*	**Impact per component (mPt/FU)** *This graph shows the relative share of materials and energy in the total environmental impact of an element, calculated using the TOTEM tool (in millipoints per m²). The energy impact is based on transmission losses, while the material impact covers the entire life cycle of the components. It also shows the extent to which insulation contributes to the material impact, thereby guiding choices towards the most sustainable solutions for renovation.*	**Impact on climate change (kg CO_2eq./FE)** *This graph shows the impact of elements on climate change (expressed in kg CO_2 eq. per functional unit) compared to an indicative reference scale. This scale was established based on the environmental impacts of all similar elements available in the TOTEM library.*	**Thermal performance (W/m²·K)** *This figure expresses the amount of heat that passes through a wall element per square metre for a difference of 1 Kelvin between its two sides. The lower the value, the better the thermal insulation of the element.*
initial state 	*Double brick façade* *Wooden floor-beams*	*0m2*				material 0,95 energy 35,05  **36**	*723.0 kgCO2 eq/m2*	*1.34 W/m2.K*
reused insulation 	*INSIDE* *+ 5cm rock wool insulation* *+ 5cm in metal partition wall* *+ vapour barrier*	*165 m2*	*lambda: 0,035754* *R: 2,9*	*PRICE: 102€/m2: 16 830€* *I: 6€/m2: 990€* *M: 37€/m2: 6 105€* *L: 65€/m: 10 725€*	waste 2,6 production 15,7 energy 27,4 	material 18,3 energy 27,4 insulation 0.04  **45.7**	*635.0 kgCO2 eq/m2*	*1.07 W/m2.K*
new insulation 	*INSIDE* *+ 5cm rock wool insulation* *+ 5cm in metal partition wall* *+ vapour barrier*	*165 m2*	*lambda: 0,035* *R: 2,9*	*PRICE: 109€/m2 17 985€* *I: 13€/m2: 2 145€* *M: 44 €/m2: 7 260€* *L: 65€/m: 10 725€*	waste 2,6 production 17 energy 27 	material 19,6 energy 27 insulation 0,4  **46.6**	*650.8 kgCO2 eq/m2*	*1.05 W/m2.K*

FEEDBACK

Design

side insulation

interior

As the façade presented historical elements it was insulated from the inside. This solution requires particular attention to airtightness in order to avoid the risk of condensation in the wall. The thickness of the insulation was deliberately limited so that the wall would not become too cold in winter and could continue to regulate humidity.

fixation

inserted

A first layer of insulation was installed against the masonry, followed by a second layer inserted into a metal structure fixed kept in place using wooden wedges. This system ensures rigidity and continuity, but the TOTEM analysis revealed a high environmental impact from the metal structure, suggesting the value of a less impactful alternative, such as a wooden structure.

humidity

average

When insulating a brick façade from the inside, it is essential to check whether the exterior finish is permeable to water vapour. Otherwise, there is a risk that moisture passing through the wall will not be able to escape to the outside. In this case, good ventilation and the installation of a continuous vapour barrier on the inside were therefore essential, while paying particular attention to the airtight packaging of the floor beams.

choice materials matériaux

minérale

The choice of materials used in this case was mainly based on their ease of installation, high availability, low cost, and high thermal resistance (in order to minimise loss of interior space).

availabillity

very available

Rock wool is widely available on the reused materials market. However, a large quantity of materials was needed in this case, given the vast surface area to be insulated. The thinness of the mattresses does not cause any problems, as it allows for continuous insulation in two layers.

price

inexpensive

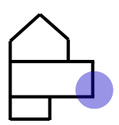
In this case, the materials did not have to be sourced long in advance: this choice did not require any more planning than a project using new insulation materials.

phase shift

low

Rock wool offers less protection against heat during the summer. However, when insulating a façade from the inside, phase shift plays a less important role.

thermal bridge



resolved

This type of design presents several sensitive points in terms of thermal bridges, particularly where the floors and walls are in contact with the facade. However, the need to reinforce the floors facilitated the installation of continuous internal insulation around the beams. Returns of at least 1 meter were provided for on the common walls.

Installation

state material

average

The condition of the recovered insulation can vary greatly. In this case, some of the insulation mats had significant rips. However, due to the flexible nature of the insulation, the deformations did not pose any major problems during installation. The mats were not packed in an airtight way, which resulted in a noticeable amount of dust in the material.

dimensions

uniform

The recovered rock wool mattresses were uniform in size, which greatly facilitated their installation in the metal structure.

processing materials

average

Reused rock wool mattresses are very easy to handle. However, there is a risk that the mattresses may tear when cut, which requires a little more care.

installation

simple

The two-layer installation in a metal structure was very easy to carry out, thanks in particular to the flexibility of the mattresses and the uniformity of their dimensions.

nuisance

large

Handling reused mattresses produces more dust, which makes the work more laborious. This dust can irritate the respiratory tract and eyes; it is therefore recommended to wear protective clothing, a mask and goggles during implementation.

logistics

low

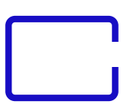
All the material came from a single location. This meant that the logistics were fairly limited.

irregularities building

average

The inside of the façade had significant irregularities, making it difficult to ensure proper contact between the insulation and the masonry (to prevent the formation of air pockets that could lead to mould growth). In this case, several layers of insulation had to be stacked on top of each other to ensure insulation across the entire thickness, which made it difficult to achieve a flat finish.

continuity insulation

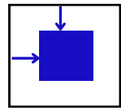


continuous

The continuity of the insulation between the different floors was ensured thanks to preparatory work, in particular the reinforcement of the floor. This made it possible to incorporate the new beams into the insulation and create a continuous layer (this operation would have been much more complex without first opening up the floors).

Thermal Conductivity

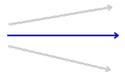
sample preparation



easy

The mineral wool insulation mats are very easy to cut to obtain a sample of the correct size, thanks to their low density and flexibility.

evolution



stable

Rock wool insulation (even torn in certain places) retains its lambda value very well.

default value

average

The default value applied in the absence of information on the brand or model is detrimental to mineral insulation. On this project, this required an increase of approximately 40% in the thickness of the insulation. This constraint resulted in a slight loss of space (due to the additional thickness required to compensate for the uncertainty associated with the actual performance of the insulation).

insulation deformation

average

The insulation has lost some of its thickness, and its corners were sometimes deformed or damaged.

market fluctuations

little

There is little variation in thermal conductivity and characteristics between the different types of rock wool. However, rock wool comes in several densities, which must be taken into account in designs.

Based on all the feedback received, the current implementation can be considered positive overall.

- *The interior **design**, dictated by the historic nature of the façade, adequate ventilation and careful installation of the vapour barrier remain essential to ensure the durability of the insulation. Furthermore, the metal structure used to support the second layer of insulation has a significant environmental impact, suggesting that more sustainable alternatives should be sought.*
- *The **installation**, facilitated by the flexibility and uniformity of the materials used and the reinforcement of the floors, allowed for continuous insulation between floors. However, the mats were sometimes damaged and dusty, which complicated installation. Furthermore, reused rock wool was available in large quantities and at an affordable price, with simplified logistics thanks to a single source close to the construction site.*
- *The **thermal conductivity** of rock wool remained stable despite slight irregularities and a few tears.*

CONCLUSION

Despite the challenges associated with the condition and handling of reused materials, this implementation ensured continuous and effective insulation. Thermal bridges were largely resolved, and the thermal conductivity of the recovered rock wool proved to be stable.

The environmental impact of the metal structure remains a weak point, but the local availability of insulation and involvement in logistics contributed to an overall coherent approach.

ISOL'UTION

UTILISONS DU RÉEMPLOI

ISOL'ution is a collaboration between the ATM department of the ULB, La Rue asbl, Casa Blanco and Batiterre. The project aims to test the reuse of insulation materials in energetic renovation projects in Brussels. Insulation materials are recovered, sorted, tested (mainly on their thermal conductivity) and reinstalled in homes.

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RENOLUTION .brussels

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