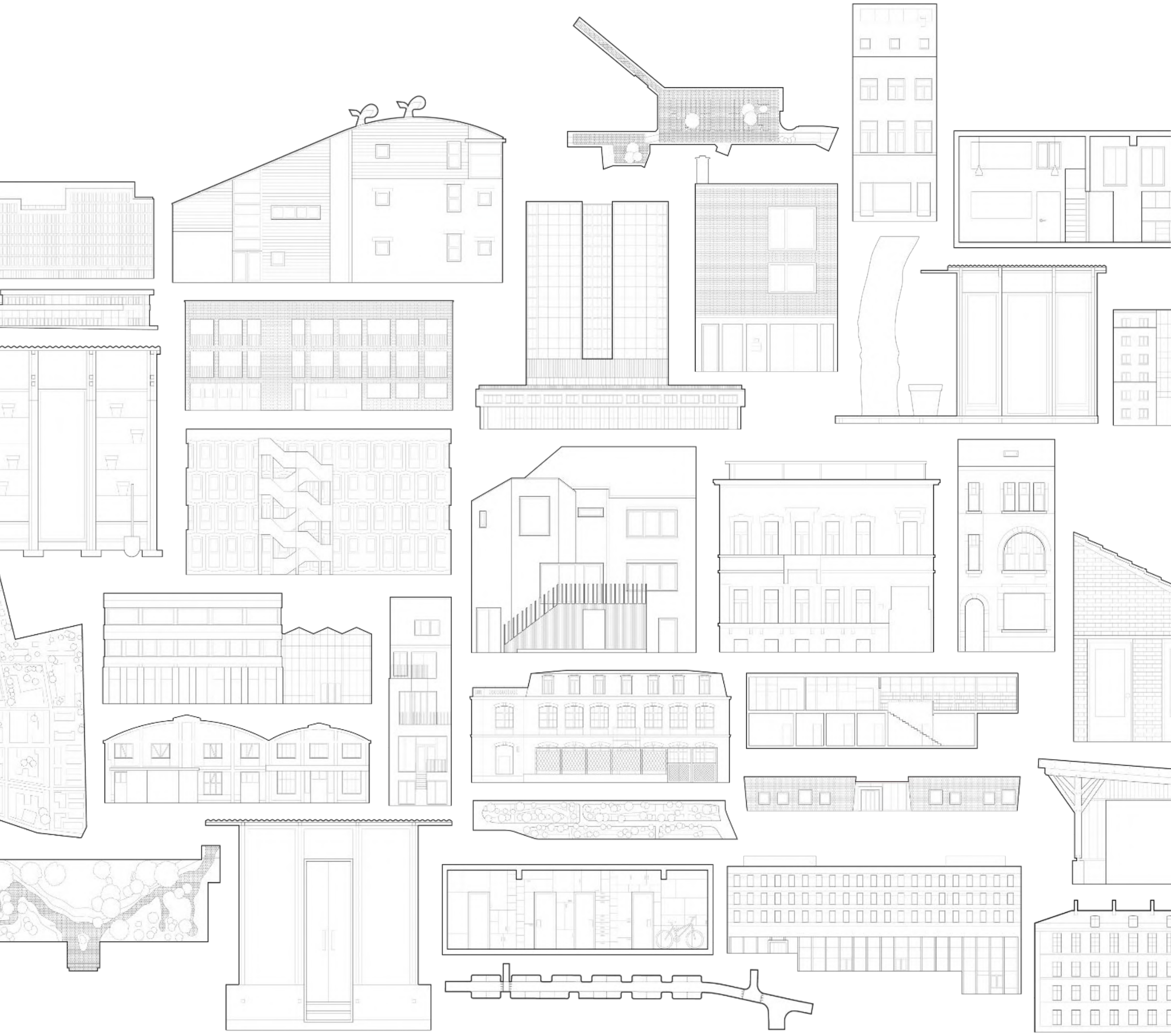
Interreg
North-West Europe
FCRBE
European Regional Development Fund



32 DETAILED PROJECT SHEETS

PROJECTS INFO, REUSED RATES AND REUSED ELEMENTS

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Authors and contributors :
Célia Chaussebel (Rotor)
Mathilde Doutreleau (CSTB)
Gaspard Geerts (Rotor)
Michaël Ghyoot (Rotor)
Emilie Gobbo (Bruxelles Environnement)
Elodie Macé (CSTB)
Elham Maghsoudi Nia (TU Delft)
Victor Meesters (Rotor)
Martine Mouchet (Bruxelles Environnement)
Mona Nasseredine (CSTB)
Marie-Annick Rabefiraisana (Rotor)
Charline Richard (Bruxelles Environnement)
Ad Straub (Tu Delft)

With the support of :
Bruno Domange (LIST)
Duan Hua (LIST)
Merel Limbeek (Utrecht)
Sara Rademaker (Utrecht)
Hugo Topalov (Bellastock)

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Context

This document has been produced as part of the Interreg NWE 739 FCRBE project (Facilitating the Circulation of Reclaimed Building Elements), implemented between October 2018 and December 2023.

The FCRBE project aims to increase by 50% the amount of reclaimed building elements being circulated in North West Europe by 2032. This report has been prepared in the context of the project capitalisation (2022-23). It corresponds to the deliverable WP T4.2.3.

The authors and the funding bodies of the FCRBE project cannot be held liable for the use that can be done with the content of this document.
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This document presents the 32 projects selected as part of the analysis in the form of individual project sheets. Each sheet details the results achieved in the project with regards to their specificities and provides a detailed overview of the quantity and the nature of the reused elements.

It is one of the four documents produced within the FCRBE project and addressing this topic of reuse and reclamation rates. These four documents are as follows:

1. *Set, monitor and report on reclamation and reuse rates in construction projects. A common approach.* This document sets out the necessary definitions and presents the main methodological aspects for dealing with the issue of reuse and reclamation rates.

2. *Ex-post analysis of 32 construction and renovation works. Results and discussions.* This document sets out how we calculated and analysed the reuse rates achieved in a sample of 32 recently completed projects.

3. *32 detailed project sheets. Projects info, reused rates and reused elements.* This is the present document. It is a complement to the analysis of the 32 projects that gives as much details as possible on the reused elements used in each project.

4. *Live tests*. *Report on 4 operations using reuse targets.* This last document reports on live tests which have enabled the methodological principles established in the study to be put to the test in projects currently underway.

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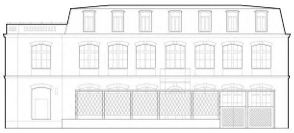


Maison des Canaux

Reuse everywhere and down to the smallest detail in this reference place for the circular, social and solidarity economy in Paris.

Program: *Social/cultural renovation*
Project type: *Transformation of an existing building*
Surface area: *1.010 m^2*
Contracting authority: *Ville de Paris*
Architect: *Grand Huit*
Contractors: *A Travers Fil - Les Résilientes - APIJ Bat - Travail et Vie - La tête dans les nuages - Duarte construction - SME, Bosio - Europamiante - Générale Métal - Elips- Juniors/les bâtisseurs - Bégo-Réemploi - atelier R-ARE - Stu-Dio - Réavie - LauClem*
Reuse assistance: *Bellastock*
Engineering assistance: *Switch (HVAC) - Tisco (Structure) - Tribu Energie*
Contract: *Public*
Public support: *Région ile de France - France Relance - City of Paris participatory budget*
Project duration: *2018-2022*

PARIS

Image source: Mathieu Delmestre

The "Canals" building was built in 1882 for the administration of the canals services in the 19th arrondissement of Paris. In 2010, following the departure of the administration, the desire to transform this place into a "house of solidarity and innovative economies" emerged.

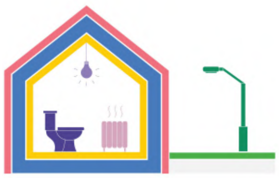
In this sense, the City of Paris decided to make the space available to actors in these sectors. As these premises required major refurbishment, it was agreed that the operation would be exemplary in terms of circular economy, professional integration and education, to be aligned with the image of the project and its occupants. This translates into very ambitious targets in terms of materials, energy and water sobriety, modularity of spaces, use of low-tech, reinterpretation of vernacular techniques, etc. In particular, the project aimed at reusing as many reuse elements as possible.

Image source: Mathieu Delmestre

Grand Huit, the architects, coordinates a multidisciplinary team composed of enterprises specialised in social integration, artisans, engineering assistants and designers whose mission was to make this living site a demonstrator of reuse, and an inclusive space.

The result is a building in which each element catches the eye, intrigues and makes you wonder how it was made and with what materials. The project gives pride of place to the skills of artisans, as in the beautiful reused dry stone wall of the terrace, for instance.

The high reuse rate in the Structure layer (43%) can be explained by the fact that the main structural intervention in this renovation project was the construction of an external terrace, which made use of reclaimed steel beams. For the rest of the building, it is the original structure that has been retained (hence, not included in the inflows measured here). That outdoor surface elements are so predominant (100%) can be explained by the consequent weight of the stone that has been abundantly reused and laid without mortar. The project also achieves a very high reuse rate in the Space Plan layer (51%), which was the main layer targeted by this renovation.



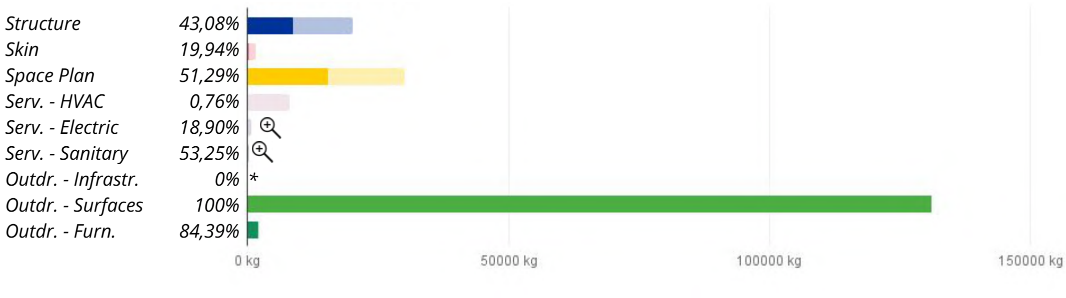
Legend:

Reused mat. | *Other mat.*

** = not calculated because the layer does not contain reused element*
= not visible at this scale

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Reuse rate per layer (in mass)



Building elements reused in the project (per layer)

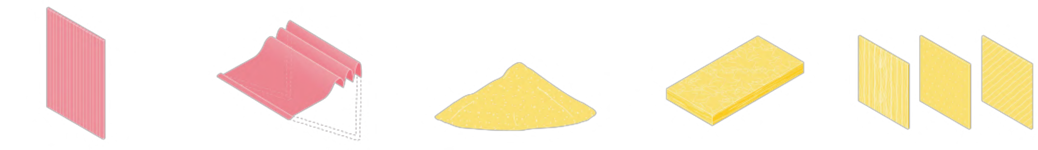
Structural steel 7.187 kg - 17.448 kgCO_2eq

Solid bricks 1.487 kg - 121 kgCO_2eq

Stone tiles and slabs 3.206 kg - 224 kgCO_2eq

Exterior windows 219 kg - 336,4 kgCO_2eq

Window security bars 30 kg - 27,5 kgCO_2eq



Polycarbonate panels 20,5 kg -236 kgCO_2eq

Shading fabric 30,6 kg - 4.980,9 kgCO_2eq

Sand screed 4.800 kg - 85,7 kgCO_2eq

Glass wool insulation 3.462 kg - 346,2 kgCO_2eq

Wood finishes 1.363 kg - 26,2 kgCO_2eq

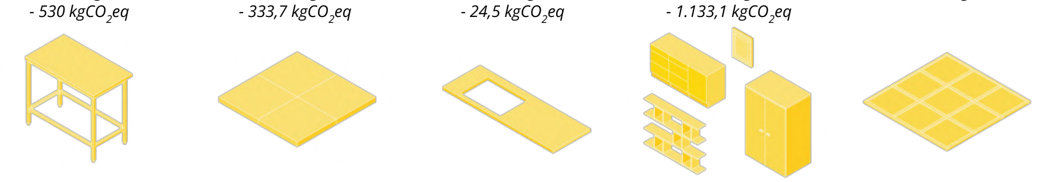
Fabric wall coverving 270 kg - 530 kgCO_2eq

Ceramic tiles 461 kg - 333,7 kgCO_2eq

Concrete tiles 286 kg - 24,5 kgCO_2eq

Interior doors 254 kg - 1.133,1 kgCO_2eq

Wood flooring 173 kg



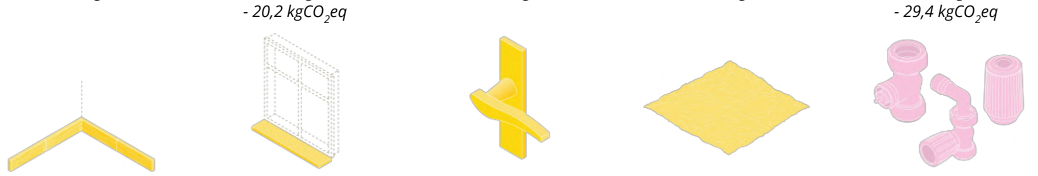
Work benches 106 kg

Cement tiles 81 kg - 20,2 kgCO_2eq

Solid-surface countertop 66 kg

Casework 58 kg

Suspended ceiling 56 kg - 29,4 kgCO_2eq



Wood plinths 51 kg - 2,3 kgCO_2eq

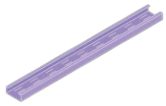
Wood based sills 24 kg - 9,9 kgCO_2eq

Door handles 8 kg

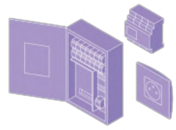
Paper ceiling 6,8 kg

Radiator accessories 7 kg

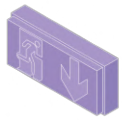
Ventilation grill
0,2 kg
- 9,1 kgCO_2eq



Cable trays
93 kg
- 272,6 kgCO_2eq



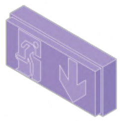
Electrical components
29,4 kg
- 243,6 kgCO_2eq



Emergency exit lights
6,8 kg
- 101,5 kgCO_2eq

LED tube lights
3,2 kg
- 611,6 kgCO_2eq

Spot lights, lamps, sconces
2 kg
- 209,4 kgCO_2eq

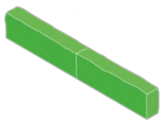


Alarms and detectors
1,3 kg
- 3,1 kgCO_2eq

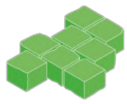
Ceramic sinks
90 kg
- 103,3 kgCO_2eq

Toilet bowls
30 kg
- 167,9 kgCO_2eq

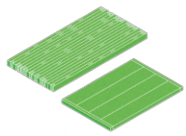
Faucets
12 kg
- 102,7 kgCO_2eq



Stone kerbs
101.050 kg
- 389,9 kgCO_2eq

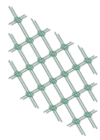


Stone pavers
28.000 kg
- 129,3 kgCO_2eq



Wood decking
1.895 kg

Wood treillis
1.705 kg



Rope treillis
250 kg

Grande Halle de Colombelles

Giving a new life to industrial heritage with maximal preservation and minimal material flows.

Program: *Social/Cultural renovation*
Project type: *transformation of an existing building*
Surface area: *3.650 m^2*
Contracting authority: *SEM Normandie Aménagement*
Architect: *Encore Heureux - Construire*
Contractors: *Gagneraud - Cenomane*
Reuse assistance: *Albert et compagnie*
Engineering assistance: *Ligne BE - T&E Ingénierie*
Contract: *Public*
Public support: *local authorities (the urban community of Caen la mer, the Normandy region, the town of Colombelles), Etablissement Public Foncier de Normandie, Ademe, ERDF.*
Project duration: *2017-2019*

Image source: Cyrus Cornut

The blast furnaces of the *Société Métallurgique de Normandie* were built on the Colombelles plateau to the north-east of the Caen urban area in 1917. They ceased their activity in 1993, marking the year of the last casting on site. The electrical workshop, one of the last vestiges of this industrial site, together with the impressive cooler, was restored and completed in 2019. This large concrete hall has been transformed into a workspace and cultural area.

The project preserves as much of the existing building as possible: the skin has been kept in place with punctual fixes where needed. Three wooden levels have been built in the small indoor nave. A café-restaurant and workshops are located on the ground floor, and co-working spaces and rehearsal spaces find their place on the upper floors. These workspaces are extended onto wooden balconies overlooking the great nave, which has been left almost entirely untouched. The great nave is a meeting place for cultural and professional events.

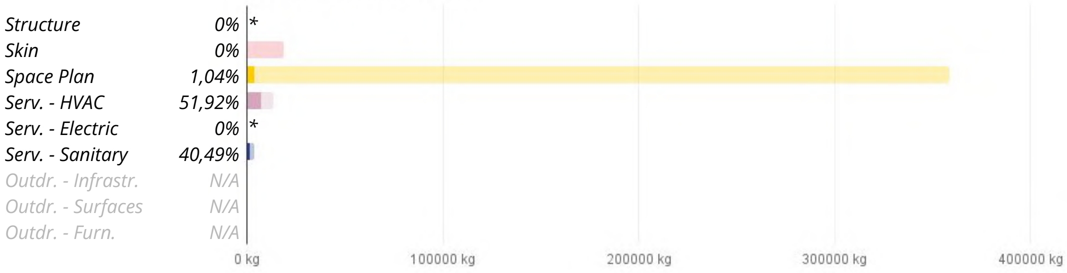
Image source : Cyrus Cornut

The contracting authority wanted to significantly reduce the carbon impact of the project. With a process involving all the stakeholders—from the project owner to the contractors—the project emphasises the reuse of materials, bio-sourced materials, energy efficiency, retaining efforts, biomass heating system, etc.

By creating a specific lot for reuse in the tender, the project succeeded in reusing interesting elements. Many of the project's components, such as radiators, sanitary fittings, tiles, windows and fire doors, were salvaged from demolition sites in the region.

The high reuse rate in the HVAC layer (52%) was achieved thanks to the reuse of more than 50 steel and cast-iron radiators, the latter being particularly heavy. In the Sanitary layer, it was mainly ceramic sinks and toilet bowls that contributed to the reuse rate.

Reuse rate per layer (in mass)



Legend:

Reused mat. *Other mat.*

** = not calculated because the layer does not contain reused element*
N/A = the project does not include this layer

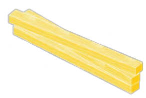
Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Building elements reused in the project (per layer)

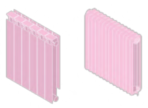
Mineral wool ins.
2.811 kg
- 1.407 kgCO_2eq

Fire doors
574 kg
- 226,6 kgCO_2eq

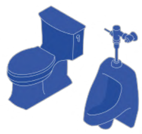
Interior doors
304 kg
- 2.039 kgCO_2eq



Wood structure
55 kg
- 57,9 kgCO_2eq



Cast iron and sheet metal radiators
6.952 kg
- 3.593 kgCO_2eq



Toilet bowls/urinals
1.074 kg
- 1.762 kgCO_2eq

Ceramic sinks
423 kg
- 722,9 kgCO_2eq

Grab bars
2 kg

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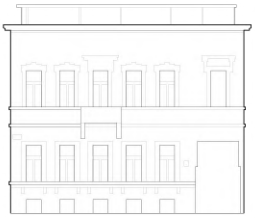


Zinneke

The renovation site as a laboratory for experiments on reuse.

Program: *Office and workshops*
Project type: *Transformation of an existing building*
Surface area: *4.000 m²*
Contracting authority: *Zinneke asbl*
Architect: *Ouest*
Contractor: *De Coninck*
Reuse assistance: *Rotor*
Engineering assistance: *Matriciel*
Contract: *Public*
Public support : *ERDF*
Project duration: *2016-2020*

Image source: Delphine Mathy

Zinneke is a Brussels socio-artistic non-profit organisation whose activities range from the organisation of a twice-yearly parade to running woodwork and metalwork workshops. In 2015, Zinneke obtained public funds to renovate their facilities to accommodate their various activities.

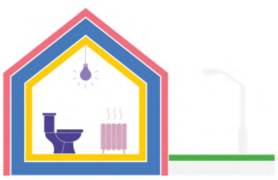
Completed in 2020, the project involves the renovation of a complex of different buildings, including three 19th century classical Brussels houses, a long industrial hall and a former printing facility. The renovation seeked to draw on what the existing buildings already offered. Architectural interventions were minimal and mostly aimed at improving or revealing latent qualities.

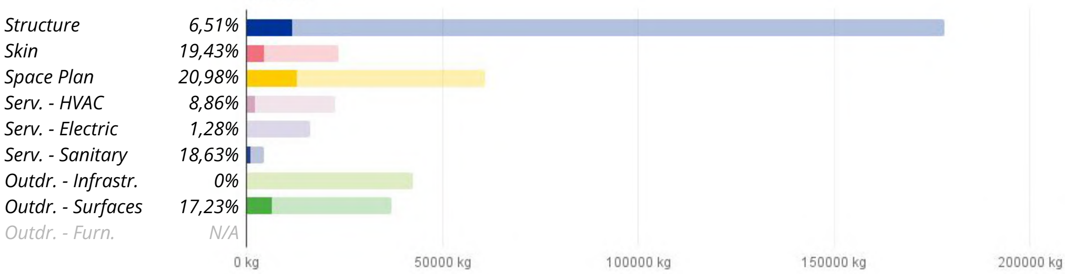
This pilot project aimed at combining four distinct objectives : 1) preserve as much of the original building as possible, 2) reclaim and reuse as much of the elements that could not be retained as possible, 3) design a future-proof building that can be adapted over the years to multiple uses, and 4) embed training programmes into the undertaking of the building works.

Image source: Delphine Mathy

For what concerns the reuse objective, one of the challenges was to tweak tendering procedures to maximise reuse opportunities while still complying with the regulation on public tenders. Different pathways have been tested throughout the project, such as organising the supply of reclaimed building elements by the contracting authority themselves or requiring the contractors to supply reclaimed materials from the professional market. Overall, a key success factor was teamwork and the co-design process through which the contracting authority and their assistants, the architects and the engineers (Matriciel) closely collaborated.
The reuse rate graph illustrates the ambition to incorporate as many reuse elements as possible, at every level of the project, even in highly technical elements such as an entire ventilation unit!

Reuse rate per layer (in mass)





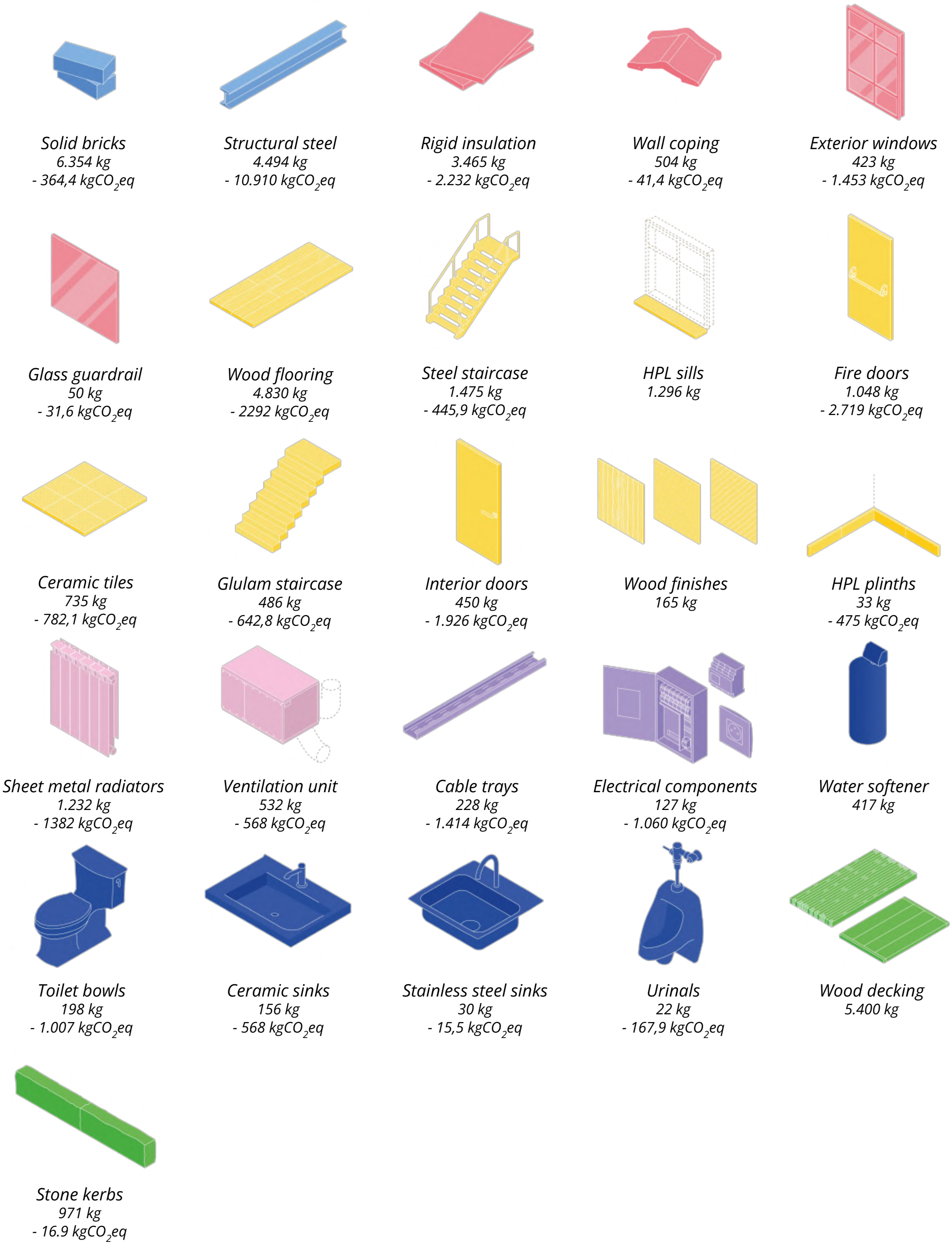
Legend:

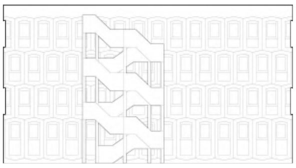
Reused mat. *Other mat.*

N/A = the project does not include this layer.

Building elements reused in the project (per layer)

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).





Takeda school

Converting an office building into a school without touching the envelope and modifying only the interior layouts? Mission accomplished!

Program: *School*
Project type: *Transformation of an existing building*
Surface area: *4.000 m²*
Contracting authority: *School organising authority*
Architect: *Agwa*
Contractor: *Thiran*
Engineering assistance: *JZH*
Contract: *Public*
Project duration: *2018 - 2019*

Image source : Arvi Anderson

This is a two-phase project. The first phase involved converting an office building into a school. In the second phase, a new construction was added to extend the surface areas. The present analysis only looks at the first phase of the project, as information on the second phase was not available.

During the first phase, the emphasis was on reusing the elements present in the offices and constructing temporary elements designed in such a way as to make their future reuse possible. However, these temporary elements became permanent during the second phase.

The office building had a simple, modular system of partitions. During the works, the partitions were dismantled and reassembled to create the classrooms. To make up for the missing elements, partitions made of plywood panels were added. They help to give the building a new identity. Suspended ceilings have been retained since they contribute to classroom acoustics.

Image source : S. Malaud

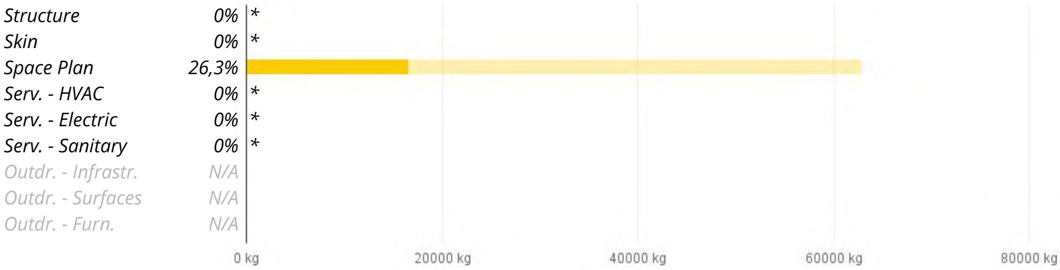
The architects transformed diverse constraints into opportunities to highlight the building's new identity: a remarkable emergency staircase, made up of wood and galvanised steel, and a large canopy marking the entrance to the school.

All the materials reused in this project originate from the site itself. They never left the building: they were simply rearranged to meet the needs of the new function. In this case, same-site reuse was an excellent way to drastically reduce transport.

One of the strengths of this project lies in its basic premise: right from the design stage, architects opted for a radical sobriety in their use of material resources - without compromising architectural quality. Retaining most of the original building and reusing partition walls (among other elements) were key strategies to achieve this.

This achievement is reflected in the results of the analysis of the reuse rate. They show that most of the efforts are into the Space plan layer, with a reuse rate of 26 %. Overall, this layer uses less than 60 tonnes of materials, a pretty low figure for a building of this scale (4.000 m^2). This, of course, is the result of retaining most of the original building. Unfortunately, we did not proceed to the calculation of the preservation rate but there is no doubt that this result would be equally impressive.

Reuse rate per layer (in mass)



Legend:

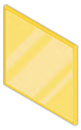
Reused mat. *Other mat.*

** = not calculated because the layer does not contain reused element*
N/A = the project does not include this layer

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

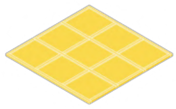
Building elements reused in the project (per layer)

Plywood panels
12.062 kg
- 17.655 kgCO_2eq



Interior windows
1.380 kg
- 2.846 kgCO_2eq

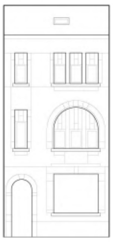
Mineral wool insulation
1.074 kg
- 1.862 kgCO_2eq



Suspended ceilings
1.015 kg
- 735,6 kgCO_2eq

Metal studs
863 kg

Interior doors
161 kg
- 3.138 kgCO_2eq



Warland

A renovation of a private house with finesse, reusing materials and with an eye to future reuse thanks to reversible laying.

Program: *Individual housing*
Project type: *Transformation of an existing building*
Surface area: *160 m²*
Contracting authority:
Private owner
Architect: *DE CLERCQ + DECLERCQ*
Contractor: *Global Art Concept*
Reuse assistance: *Rotor*
Contract: *Private*
Public support: *Be.Circular*
Year of completion: *2016*

Image source : Bernard Boccara

For the renovation of this single-family house in Jette (Brussels), the clients wanted to give pride of place to circular approaches. Their starting point? Retaining most of the original building!

It is sometimes said that building techniques from the past are not suited anymore to meet contemporary standards—hence their demolition and replacement by new solutions. In this project, however, the clients and their contractors demonstrated that this assertion needs to be seriously nuanced. With witty constructive solutions, a good eye for details and skilled crafts·wo·men, it is possible to achieve high standards while preserving most of what is already there.

How they improved the acoustic insulation of the floors is a good illustration. After having carefully dismantled the solid wood floors and parquet, the original beams were reinforced and the floor has been filled with cellulose.

Image source : Be Circular

This system made it possible to level of the floor without modifying its thickness (and by consequence preserving the interior doors, and so forth).

Reclaimed floor and parquets were laid on a cork and rubber membrane without glue, to facilitate any future dismantling. Similarly, the original windows have been carefully dismantled to be restored and improved with a more energy-efficient glazing.

Energy-wise, the project achieves a good balance between strategic interventions to improve the thermal performances and a sobriety in material use.

Wherever additional materials were needed, the clients and their contractors opted for reclaimed and salvaged elements. The wall cladding of the bathroom is made of locally salvaged marble. Most of the sanitary equipment is reused. Reclaimed cast-iron radiators have been installed. The kitchen is entirely made of salvaged elements.

When looking at the reuse rates in the different layers, one can see these ambitions being translated into figures. Without surprise, the main layers concerned by reuse are Structure (with a 8 % reuse rate), Space plan (with a 17 % reuse rate), HVAC (with a 30 % reuse rate) and Sanitary (with a 85 % reuse rate).

Overall, the inflows for these layers represents 38,5 tonnes of materials. The relatively high reuse rates and the relatively low absolute quantity are a direct consequence of the multiple efforts to preserve the original building.

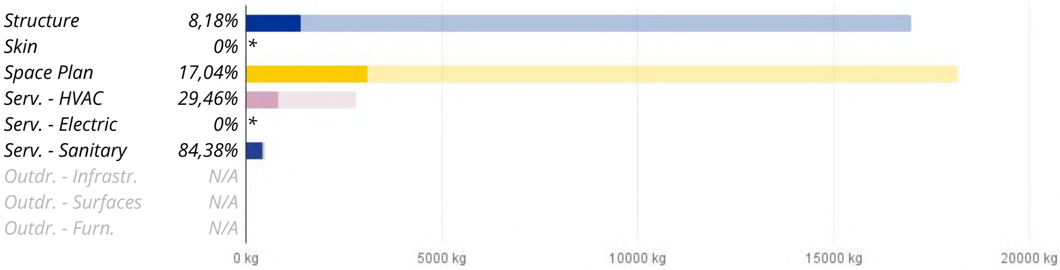
Legend:

Reused mat. | Other mat.

** = not calculated because the layer does not contain reused element*
N/A = the project does not include this layer

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

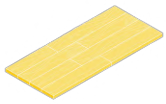
Reuse rate per layer (in mass)



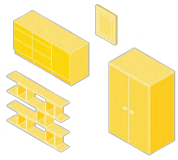
Building elements reused in the project (per layer)

Solid bricks
1.388 kg
- 112,1 kgCO_2eq

Stone finishes
1.829 kg
- 244,7 kgCO_2eq

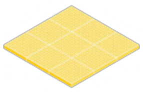


Wood flooring
547 kg
- 131,9 kgCO_2eq

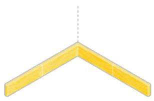


Casework
410 kg

Interior doors
290 kg
- 938,9 kgCO_2eq



Ceramic tiles
150 kg
- 30 kgCO_2eq



Wood plinths
20 kg

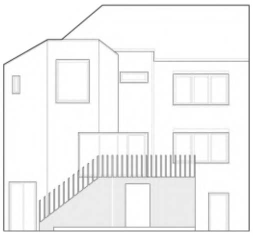
Cast iron radiators
825 kg
- 380 kgCO_2eq

Toilet bowls
255 kg
- 535,1 kgCO_2eq

Cast iron bathtub
100 kg
- 117,9 kgCO_2eq

Water softener
50 kg

Clos Dupont



A comprehensive circular approach for the extension of a Brussels house.

Program: *Individual housing*
Project type: *Transformation of an existing construction*
Surface area: *200 m²*
Contracting authority: *Private owner*
Architect: *Vla architecture*
Contractor: *Eco Construct Group*
Reuse assistance: *Eco-Homes*
Contract: *Private*
Public support: *Be.Circular*
Year of completion: *2017*

Image source : Bernard Boccara

The project concerns the extension on three levels of a single-family house in Evere (Brussels). The extension replaces an old one-floor volume that had become obsolete.

In this project, circularity is tackled from a comprehensive perspective: not only does the project aim at reducing its impact on the environment through reusing building materials but it also anticipates how the new extension can be adapted through time and its components reused in the future. For instance, the connections between the new and the old structures are designed to be easily dismantled.

Bricks from the original extension have been reclaimed and reused for the construction of the new volume. The quantity available, however, did not match with the needs therefore the client sourced additional bricks from a local reclamation dealer.

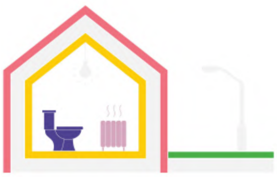
Image source : Bernard Boccara

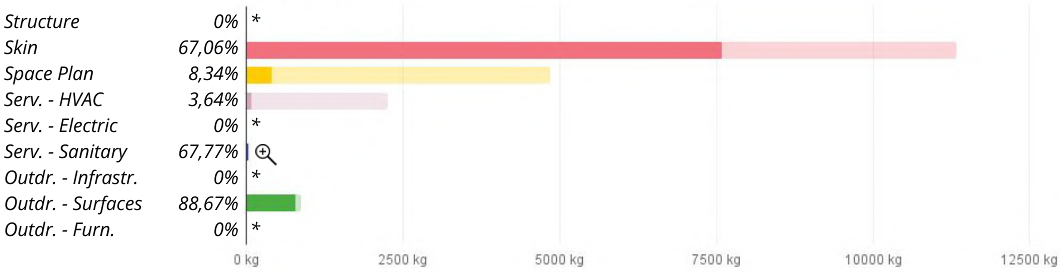
The client went for a combination of two types of Klampsteen—a relatively common brick type in Belgium, dating from the 1960s and 1970s. They chose two variants, with different colours and dimensions. The architect designed a special bond to deal with the vertical joints. They also used slightly thicker horizontal joints to make up for the height difference. These mortar joints are racked, contributing to give to the façade a look and feel that wouldn't have been achieved with new materials.

Other elements have been salvaged from the original extension and reused in the new one: windows, a steel staircase and Belgian blue limestone window sills. Additional elements have been supplied by local reclamation dealers.

As with all renovation projects that retain most of the existing building, it is important to bear in mind that the reuse rates only correspond to the incoming flow—i.e. the materials necessary to execute the works. They do not take into account the elements that have been retained in their original location.

Reuse rate per layer (in mass)





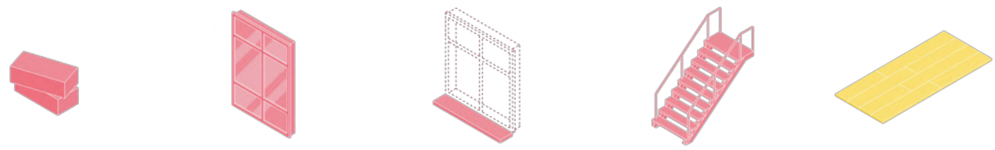
Legend:

Reused mat. | Other mat.

** = not calculated because the layer does not contain reused element*
🔍 = not visible at this scale

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Building elements reused in the project (per layer)



Solid bricks
6.950 kg
- 1.027 kgCO_2eq

Exterior windows
447 kg
- 519,1 kgCO_2eq

Stone sills
120 kg
- 18,7 kgCO_2eq

Steel staircase
81 kg
- 495,5 kgCO_2eq

Laminate flooring
356 kg
- 227,2 kgCO_2eq

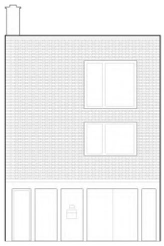
Interior doors
50 kg
- 226 kgCO_2eq

Sheet metal radiators
82 kg
- 138,2 kgCO_2eq

Toilet bowls
15 kg
- 83,9 kgCO_2eq

Ceramic sinks
15 kg
- 51,6 kgCO_2eq

Concrete pavers and slabs
773 kg
- 16,2 kgCO_2eq



Program: *Individual housing*
Project type: *New construction*
Surface area: *255 m²*
Contracting authority: *Private owner*
Architect: *Karbon' architecture et urbanisme*
Contractor: *Gauthier Nagant, 3ALJ Construct*
Engineering assistance: *BESP Stoffel & Partners, Sofiane Boudahri*
Contract: *Private*
Project duration: *2018-2020*

Maison Vignette

A new construction using a mix of bio-based, minimally processed and reused materials.

Image source : Giulia Frigerio

The house Vignette was built on an empty plot in Auderghem (Brussels). It is structured around a central patio and with the idea of connecting the living room with the back garden.

Together, the clients and their architect wanted to lower the environmental impact of their project. The structure is in timber, sourced from local and sustainably managed forests. The insulation uses straw bales. The cladding of the back façade also uses local wood. The interior walls are made of hemp and lime concrete blocks, and are plastered with natural gypsum, lime and sand.

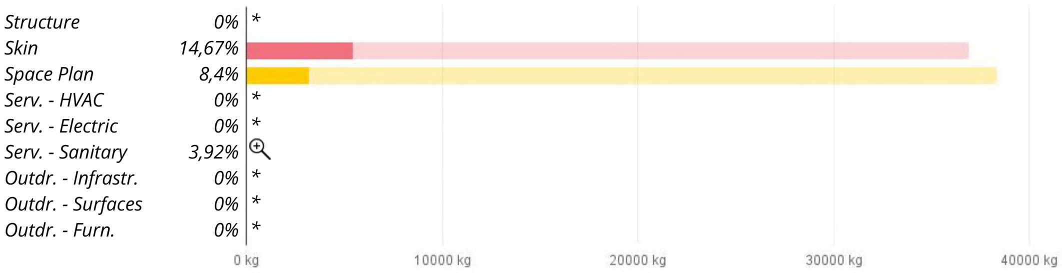
Beside these minimally processed and largely bio-based building materials, the architects also opted for reuse. The most striking example is the unusual claustra of the front façade, made of large *Boomse Steen* bricks—a longer and wider variant of a common Belgian brick type. These were supplied by a local reclamation dealer who delivered 3.000 bricks on site.

Image source : Karbon'architecture

Leftovers from the façade have been reused to build a staircase in the garden. The project also reuses tiles, Belgian blue limestone floor slabs and sanitary fittings.

In this project, the layers concerned by reuse are Skin (with a reuse rate of 15 %), Space plan (with a reuse rate of 8 %) and Sanitary (with a reuse rate of 4%). For these 3 layers, the overall inflow weighs 75 tonnes—a figure slightly higher than what can be found in the same layers in renovations of a similar same scale. This is, of course, because new construction entails much larger flows of materials than renovation. This project shows, however, that their impact on the environment can be kept minimal thanks to strategic choices.

Reuse rate per layer (in mass)



Legend:

Reused mat. *Other mat.*

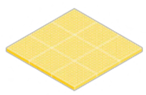
** = not calculated because the layer does not contain reused element*
🔍 = not visible at this scale

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Building elements reused in the project (per layer)

Solid bricks
5.412 kg
- 552,1 kgCO_2eq

Stone finishes
2.927 kg
- 256,3 kgCO_2eq



Ceramic tiles
280 kg
- 175,8 kgCO_2eq

Ceramic sinks
30 kg
- 154,9 kgCO_2eq

Interreg North-West Europe FCRBE

European Regional Development Fund

Program: *Individual housing*
Project type: *Transformation of an existing building*
Surface area: *255 m²*
Contracting authority: *Private owner*
Architect: *BXLMRS - Lionel Bousquet*
Contractor: *Bois&Structure*
Reuse assistance: *Enesta*
Engineering assistance: *Enesta*
Contract: *Private*
Public support: *Be Circular 2017*
Year of completion: *2017*

Dethy

An exemplary renovation carried out by an architect-client that combines energy efficiency, bio-based materials and circular economy principles.

Image source : Stéphanie Roland

This project concerns the renovation and the extension of a typical Brussels house. The architect, who is also the client, wanted to deliver an exemplary circular and sustainable project: energy performant (reaching the passive standard), using bio-based materials, reusing building materials and implementing adaptive design strategies.

The implementation lived up to these expectations.

Energy-wise, the building reaches the very-low energy standard. It mostly uses natural wood-fibres for the thermal insulation, with an additional batch of rigid polystyrene panels originating from a Brussels construction company's overstock.

Some elements were reused on site. It is notably the case of a batch of reclaimed bricks but also of sheet metal radiators. During the works, timber joists could be salvaged but were of no use in the project and have therefore been donated to a local association.

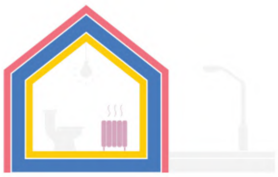
The bricks of the façade are production missfits that the manufacturer could not sell because of colour or surface defects.

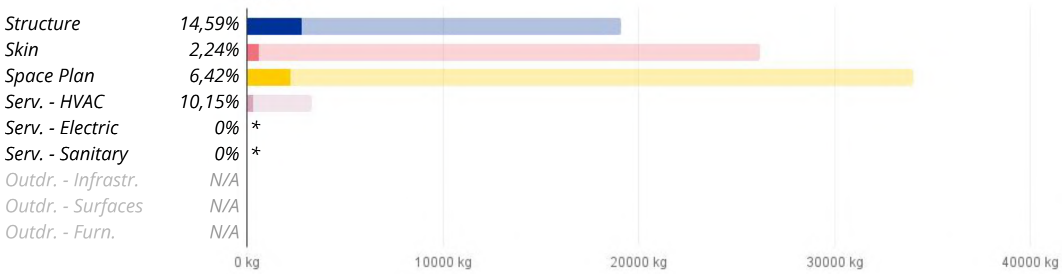
The entire structure of the extension is made of wood, prefabricated in a workshop and assembled on site. The project provides for the possibility of changing its uses. Openings between two floors have been shut but could be easily reopened in the future if necessary, for instance.

These various challenges come together to form the ingredients of a beautiful and comprehensive renovation project, modest in its form and appearance but rich in the complexity of its materiality and design.

In this project, the layers concerned by reuse are Structure (15 %), Skin (2 %), Space plan (6 %) and HVAC (10 %). Together, they represent a total inflow of 84,5 tonnes. Compared to similar projects, this figure is relatively high. This results from the materials necessary to achieve a high level of energy performance.

Reuse rate per layer (in mass)





Legend:

Reused mat. *Other mat.*

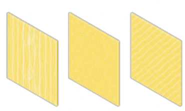
** = not calculated because the layer does not contain reused element*
N/A = the project does not include this layer

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Building elements reused in the project (per layer)

Solid bricks
2.784 kg
- 101,9 kgCO_2eq

Rigid insulation
585 kg
- 276,8 kgCO_2eq

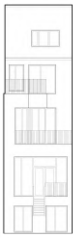


Wood finishes
2.183 kg

Sheet metal radiators
336 kg
- 619,4 kgCO_2eq

Rue de l'Est

The project pays particular attention to preserving and reusing building elements, enhancing heritage features and improving the acoustics of the building.



Program: *Individual housing*
Project type: *Transformation of an existing building*
Surface area: *290 m²*
Contracting authority: *Private investor*
Architect: *VLA architecture*
Contractor: *Deco Sege Rom sprl*
Reuse assistance: *Eco-Homes*
Engineering assistance: *MC-carré, Earth 'n' Bee*
Contract: *Private*
Public support: *BeCircular 2018*
Year of completion: *2018*

Image source : Bernard Boccara

This project concerns the respectful transformation of a 1900s Brussels house into three flats. Its name comes from its location: *15 Rue de l'Est.*

The building's front façade was in pretty good condition and had a high heritage value. Therefore, most of the interventions were geared towards the back façade (which has been entirely rebuilt) and the interior design.

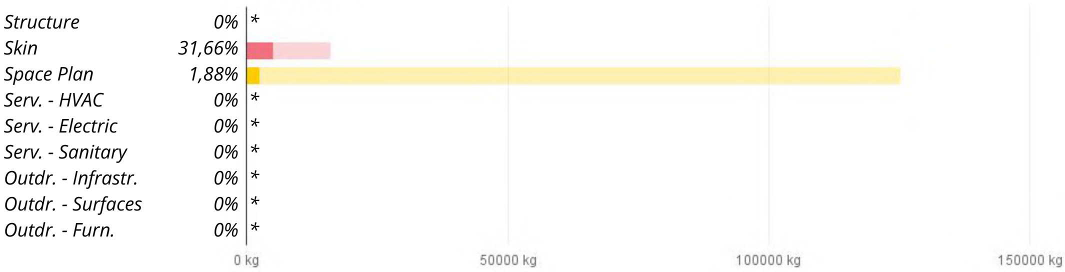
A reclamation audit was carried out in order to have a precise view on what could be retained or reused.

During the demolition phase, the owners realised that a large quantity of materials would be discarded as waste despite their excellent condition and their high quality (floor tiles, wood flooring, marble and Belgian blue limestone...). They decided to retain them on site. Their reuse, however, proved to be more complicated because it entailed additional costs.

The project benefited from a Be.Circular award—a regional public scheme aiming at accompanying ambitious circular projects, notably through financial support. It made it possible to investigate how to reuse these elements, on site or somewhere else. It also allowed the project to dive deeper into circular principles, such as organising exchange of materials between concomitant sites and sourcing natural and local building materials.

In this project, the layers concerned by reuse are Skin (32 %) and Space plan (2 %). The total inflows of these layers represent 141 tonnes of material.

Reuse rate per layer (in mass)



Legend:

Reused mat. *Other mat.*

** = not calculated because the layer does not contain reused element*

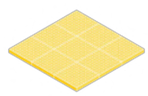
Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Building elements reused in the project (per layer)

Solid bricks
4.958 kg
- 766,8 kgCO_2eq

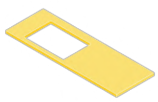
Stone cladding
65 kg
- 16,9 kgCO_2eq

Exterior doors
32 kg
- 113,3 kgCO_2eq

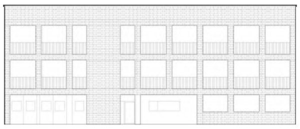


Ceramic tiles
1.024 kg
- 651,23 kgCO_2eq

Interior doors
950 kg
- 3.075 kgCO_2eq



Stone finishes
380 kg
- 34,3 kgCO_2eq



Co-housing De Schilders

A facade made of reused bricks that seems to have always been there to envelop an unusual housing project.

Program: *Housing*
Project type: *New construction*
Surface area: *1.200 m²*
Contracting authority:
Private investors
Architect: *Havana*
Engineering assistance: *Lime*
Contract: *Private*
Project duration: *2013-2016*

Image source : Filip Dujardin

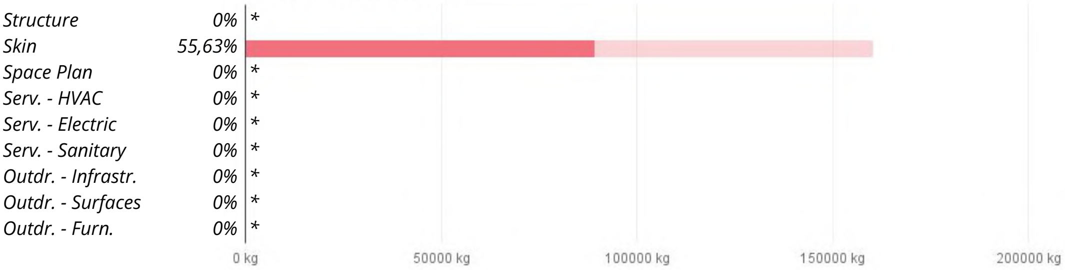
De Schilders is an innovative collective housing located in Sint-Amandsberg (Belgium). Delivered in 2016, it is the result of the desire of eight families to live together in a compact, single building. The building mixes individual spaces with shared areas, such as a garden, a community kitchen and a laundry room.

The designers paid a lot of attention to blur the lines between individual and communal areas. The design makes use of different strategies to give the impression that the building is not just a pile of flats, but one big house. The entrance doors to the flats are simple wood interior doors, for instance.

The reuse efforts are concentrated on a single large batch of material: the facing bricks, which are reclaimed 'Nieuwpoortse moef' bricks supplied by a local dealer. With this design decision alone, the project achieves a 56 % reuse rate for the Skin layer (in mass). This brick confers to the building a raw but elegant character. It testifies on the passage of time, as if these walls had been there for centuries.

Image source : Filip Dujardin

Reuse rate per layer (in mass)



Legend:

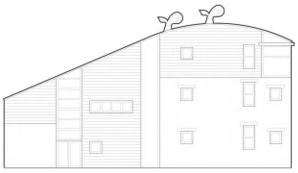
Reused mat. | *Other mat.*

** = not calculated because the layer does not contain reused element*

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Building elements reused in the project (per layer)

Solid bricks
89.238 kg
- 10.189 kgCO_2eq



BedZed

Still considered a successful and ambitious project today, BedZed has stood the test of time, proving the long-term viability of reusing materials.

Program: *Housing*
Project type: *New construction*
Surface area: *2.500 m²*
Contracting authority: *Peabody Trust*
Architect: *Bill Dunster*
Contractor: *Gardiner & Theobald*
Reuse assistance: *Bio Regional*
Engineering assistance: *Ellis & Moore - Ove Arup*
Contract: *Private*
Project duration: *2000-2002*

Image source: Tom Chance

Beddington Zero Energy Development (BedZED) is a mixed-use housing and workspace project that integrates many facets of sustainable design and construction. Located in Hackbridge, South London, BedZED has gone down in history as the UK's first large-scale, mixed-use sustainable community. It has been an inspiration for low-carbon and eco-friendly housing developments around the world.

The design team adopted a range of strategies to lower the environmental impact of the buildings. The overall plan makes sure to use the land sparsely. Energy use is reduced through passive design strategies such as bioclimatic orientation, triple-glazing, thermal mass and high levels of insulation. Whenever possible, BedZED made use of biobased, recycled and reclaimed building materials. An estimated 52% of BedZED's construction materials (in mass) were sourced within a radius of 56 km around the site.
In terms of circular strategy, the most striking result is probably the reuse of 98 tonnes of structural steel profiles (corresponding to 95 % of all the steel needed).

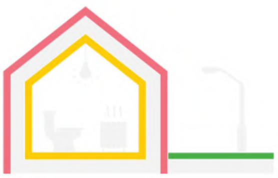
Image source: Bioregional

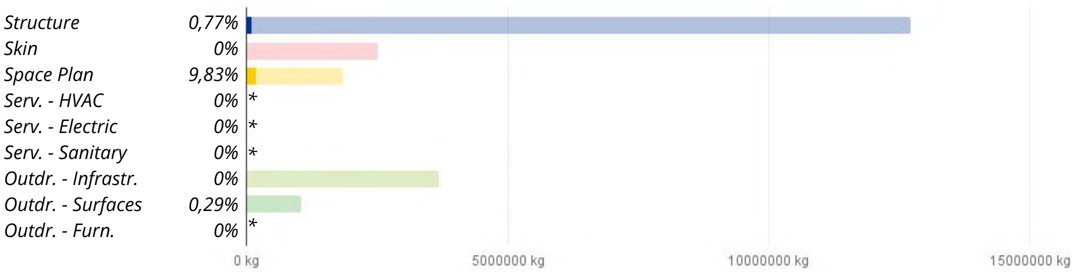
These are mainly used in the workspace areas.

At the time of its construction, the result represented a major feat—and still today, very few buildings have outstripped it. It required designing the project to adapt to the available profiles, developing protocols to check the quality of the steel, convincing the many people involved in the project about the feasibility of such an operation, finding a company that could salvage and reuse the profiles, etc. In the end, BedZed proved that it is possible to reuse steel for structural purposes and that this strategy is incredibly efficient in drastically reducing the environmental impact.

The very low reuse rate (less than 1%) for the Structure layer seems surprisingly low considering the relatively high quantity of reused steel. It comes from the fact that most of the structure is built from load-bearing masonry and concrete slabs. Compared to these ponderous materials, steel is much lighter. This result also illustrates a major difference between the renovation and new projects in our sample. In most renovation projects, the inflows of materials for the Structure layer concern small additions to a main structure that is already there; whereas with a new construction, the structure needs to be built from scratch and entails much bigger flows of materials. In this case, the reuse rates inevitably drop down.

Reuse rate per layer (in mass)





Legend:

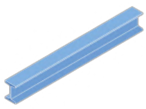
Reused mat. *Other mat.*

** = not calculated because the layer does not contain reused element*

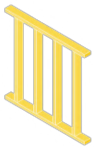
The data used to produce this analysis all come from the publication: Bioregional, *BedZed: Toolkit Part 1 - A guide to construction materials for carbon neutral developments*, 2002.

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

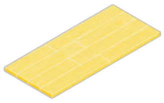
Building elements reused in the project (per layer)



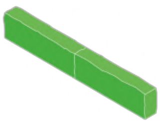
Structural steel
98.000 kg
- 237.920 kgCO_2eq



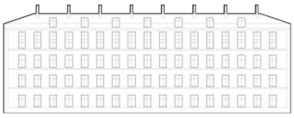
Wood studs
175.000 kg
- 184.392 kgCO_2eq



Wood flooring
7.400 kg



Stone kerbs
3.000 kg
- 58,2 kgCO_2eq



Housing Reuilly - Lot Ae

This renovation of a listed building demonstrates how low-tech conservation and reuse can be incorporated into a large-scale project.

Program: *Housing*
Project type: *Transformation of an existing building*
Surface area: *6.330 m^2*
Contracting authority:
Paris Habitat
Architect: *Camille Salomon*
Reuse assistance: *Rotor*
Engineering assistance: *id+*
Contract: *Public*
Year of completion: *2019*

Image source: David Boureau

The redevelopment of the Caserne de Reuilly is a large urban project in the 12th arrondissement of Paris. It concerns the conversion of a former military site into housing, student residences, a nursery, commercial facilities and a public garden. The overall project was contracted through six distinct lots. The lot Ae, completed in 2019, targeted the deep renovation of a listed building into social housing (the renovation includes the construction of new volumes).

Paris Habitat, the contracting authority, intended to foster reuse at Reuilly. It was naturally the case in the Lot Ae, where this challenge was combined with that of preserving as much of the existing building as possible.

The project management team was assisted in this approach by Rotor. Together, they carried out many actions to meet the objectives, such as conducting an inventory of all the components that could be salvaged for reuse from the existing buildings, the curation of a small exhibition

Image source: Rotor

showcasing the most promising batches of reusable materials (including the results of the research on the possible surface treatments and conditioning). Among these candidates to reuse, one could find closet doors in massive wood, natural stone from interior walls and cast iron radiators. All of these were reused for the new development.

Lot Ae represents only part of this major renovation and new-build project. Over the entire operation, 11 materials batches and 640 tonnes of building materials were reclaimed and reused throughout the different operations. This project shows that maintaining what already exists and same site reuse are complementary strategies for renovating the existing built environment.

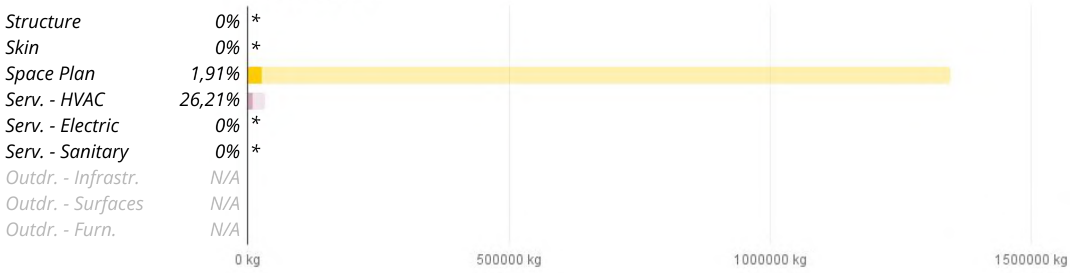
Legend:

Reused mat. | Other mat.

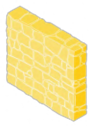
* = not calculated because the layer does not contain reused element
N/A = the project does not include this layer

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

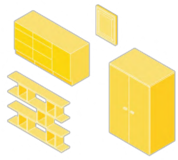
Reuse rate per layer (in mass)



Building elements reused in the project (per layer)



Stone infill
24.000 kg
- 330,3 kgCO_2eq



Casework
1.686 kg

Cast iron radiators
8.500 kg
- 5.873 kgCO_2eq

Jeugdkliniek

Reusing the elements from an office building to build a youth's clinic - a successful example of site-to-site reuse.

Program: *Clinic*
Project type: *New Construction*
Surface area: *3.334* m^2
Contracting authority: *Emergis*
Architect: *Rothuizen Architecten*
Adviseurs Team: Taco Tuinhof, Dick Schuit, Evert Jan Akershoek, Petula de Smit, Daco van Houte, Igor Vreezen, Sjoerd de Nooijer
Contractor: *BouwMeesterPro*
Reuse assistance: *New Horizon Urban Mining*
Contract: *Public (UAV-GC)*
Public support: *Provincie Zeeland*
Project duration: *2018 - 2019*

Image source: Rothuizen architecten

Jeugdekliniek is a newly constructed child and youth clinic located in Kloetinge (Netherlands). Designed by the Rothuizen Architecten team, and completed in 2019, this project applied a well-structured approach to circular construction.

At the start of the inception phase, it so happened that an office building (called the *Rijkswaterstaat* or RWS) in a nearby town was empty and scheduled for demolition. The architects, in agreement with the clients, therefore decided to reuse the elements made available from this building for the design of the clinic.

To execute the reuse plan, the company New Horizon Urban Mining was contracted as reuse assistant. They carefully dismantled all the reusable materials from the RWS building. As a result, a wide range of materials found their way into the new construction, including the main beams in wood, columns, window frames, wood shingles, partition walls and doors.

Image source: Rothuizen architecten

Additionally, certain elements were sourced from another building on site, called Ithaka, such as electrical components, timber beams and windows. Interestingly, the wood-framed walls and wood shingles are here reused for the second time. Their previous installation was already the reuse of mooring posts salvaged from the Breskens harbour.

The project received financial support from the province of Zeeland for the dismantling of the RWS office. It was financed by Rabobank.

Site-to-site reuse is quite unusual as it requires a good synchronisation between the schedules of two different sites (demolition on one hand and construction/renovation on the other). Such a coincidence does not happen often. But when it does, it usually leads to very effective reuse operations.

The Jeugkliniek achieves a high reuse rate in the Structure layer (9 %), mostly thanks to reusing timber and steel structures, and in the Skin layer (7 %), notably thanks to reusing wood shingles and wood-framed walls.

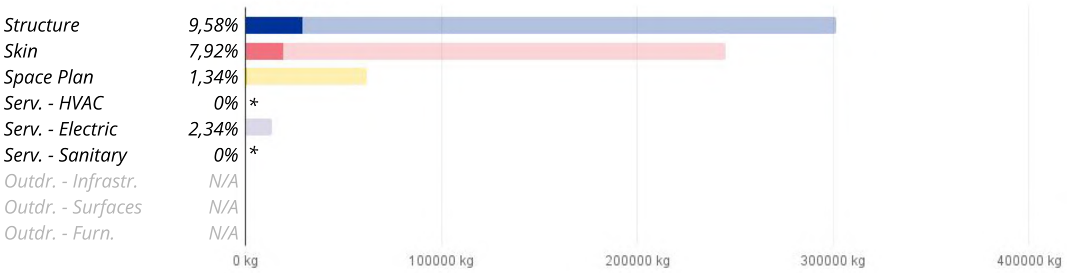
Legend:

Reused mat. | Other mat.

* = not calculated because the layer does not contain reused element
N/A = the project does not include this layer

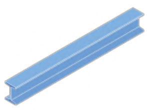
Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Reuse rate per layer (in mass)



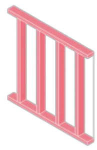
Building elements reused in the project (per layer)

Structural timber
28.809 kg
- 30.355 $kgCO_2eq$

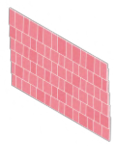


Structural steel
105 kg
- 254,9 $kgCO_2eq$

Exterior windows
12.675 kg
- 5.745 $kgCO_2eq$

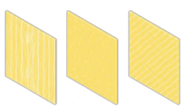


Wood-framed wall
3.900 kg



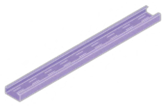
Wood shingles
2.826 kg
- 754,4 $kgCO_2eq$

Glass partition wall
500 kg
- 1.779 $kgCO_2eq$

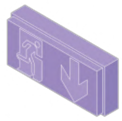


Wood finishes
229 kg
- 347,3 $kgCO_2eq$

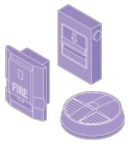
Interior doors
102 kg
- 226,6 $kgCO_2eq$



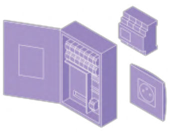
Cable trays
214 kg
- 93,7 $kgCO_2eq$



Emergency exit lights
57,6 kg
487,5 $kgCO_2eq$

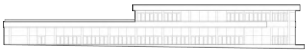


Alarms and detectors
18,5 kg
- 7,5 $kgCO_2eq$



Electrical components
17,3 kg
- 144,7 $kgCO_2eq$

Spot lights, lamps, sconces
3 kg
- 418,9 $kgCO_2eq$



Circl Pavilion

Circular project at every step: from the origins of some building components to their future reuse.

Program: *Offices*
Building type: *New Construction*
Surface area: *3.350 m²*
Contracting authority: ABN AMRO
Architect: *Architects Cie / Hans Hammink*
Reuse assistance: *TU Delft and the BAM*
Contract: *Private*
Year of completion: *2017*

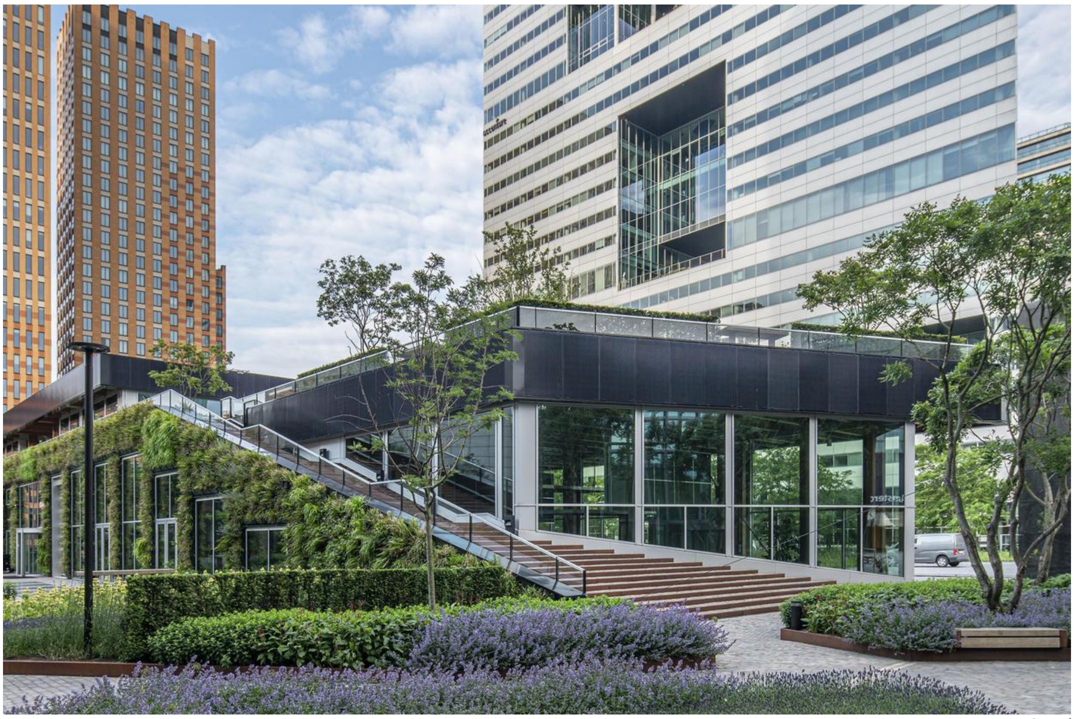


Image source: Cie.nl

The Circl Pavilion, completed in 2019 in the heart of Amsterdam's business district, stands as a practical example of circular design. The pavilion hosts meetings and conferences related to the circular economy. It also aims at becoming a hotspot in the Zuidas business district, offering a restaurant and a rooftop bar.

Architects Cie, together with their clients ABN AMRO, and in collaboration with the TU Delft and BAM as circular assistants, have designed a demonstration project, showcasing the bank's commitment to sustainable development.

Different circular strategies are encompassed by the project:

- The thorough management of the information about the materials, via material passports and a 'digital twin' of the building.
- The adoption of design for dismantling principles, ensuring that most components can be easily removed and reused afterwards.

- The use of recycled building materials, including recycled concrete for the roofing, recycled aluminium for the façade, recycled hardwood as flooring and recycled denim for the insulation.

The project also reused three batches of materials: interior wooden window frames, sand for the screed, and natural stone for paving surfaces. As in other projects analysed, reusing concrete pavers is an effective way to achieve high reuse rates in the Outdoor Surfaces layer (when these are calculated by mass).

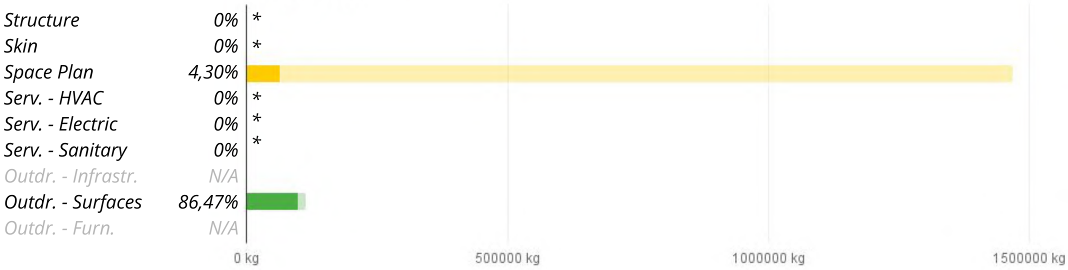
Legend:

Reused mat. *Other mat.*

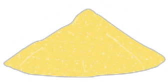
** = not calculated because the layer does not contain reused element*
N/A = the project does not include this layer

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

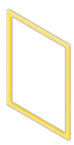
Reuse rate per layer (in mass)



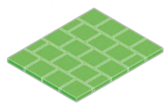
Building elements reused in the project (per layer)



Sand screed
63.122 kg
- 142,5 $kgCO_2eq$



Window frame
3.290 kg
- 6.748 $kgCO_2eq$



Concrete pavers and slabs
97.410 kg
- 4.897 $kgCO_2eq$

Mundo - Madou

Long-term vision, sobriety and innovation were the keys for this renovation project in Brussels.

Program: *Offices*
Project type: *Transformation of an existing building*
Surface area: *6.500 m²*
Contracting authority:
Mundo Lab
Architect: *Stekke + Fraas*
Contractor: *Mundo-Lab*
Contract: *Private*
Public support: *BeCircular 2020*
Year of complement: *2020*

Image source: Laurent Vivier

The Mundo LAB centres are an ensemble of offices and meeting spaces hosting non-profit organisations and social enterprises. Eco-design, circular, ecological and social aspects are central in all Mundo LAB's premises. Mundo Madou was no exception. Completed in 2020, this renovation emphasised low-impact materials and local crafts·wo·manship.

Applying the principle according to which the best construction is the one that is already there, the project developers seeked to preserve as much of the existing building as possible. The envelope and structure have hardly been touched. The main interventions concerned the technical services and the interior fittings.

The HVAC and sanitary facilities from the existing infrastructure have been retained and adapted to the new standards. The project developers managed to reuse a wide range of interior fittings: plasterboards, glass partitions, stone claddings, insulation panels, interior doors, caseworks, wood finishes, ceramic tiles, carpet tiles...

To increase the design's adaptability, modular partitions have been designed to be easily dismantled and reused. They are made of reused metal structures, insultation, plasterboards and plywood boards. The partitions are screwed in such a way that they can be easily dismantled.

In this project, only the Space Plan layer is concerned by reuse. It reaches a reuse rate of 24 % (in mass). Overall, the inflows in this layer weigh 130 tonnes, a pretty low figure which is in line with the principle of material sobriety applied in this project.

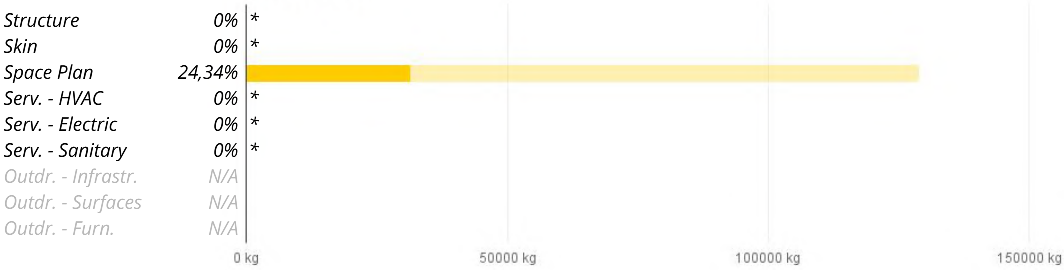
Legend:

Reused mat. *Other mat.*

** = not calculated because the layer does not contain reused element*
N/A = the project does not include this layer

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Reuse rate per layer (in mass)



Building elements reused in the project (per layer)

Plasterboard
13.920 kg
-12.961 $kgCO_2eq$

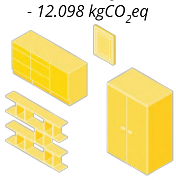
Glass partition walls
5.900 kg
- 12.098 $kgCO_2eq$

Stones finishes
3.920 kg
- 128,4 $kgCO_2eq$

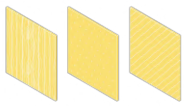
Mineral wool insulation
3.820 kg
- 3.869 $kgCO_2eq$

Interior doors
1.365 kg
- 8.272 $kgCO_2eq$

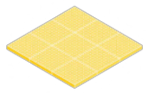
Metal studs
1.335 kg



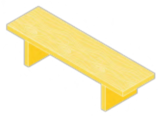
Casework
372 kg



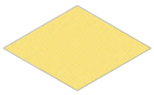
Wood finishes
264 kg



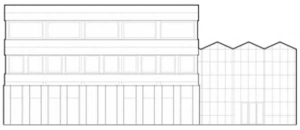
Ceramic tiles
180 kg
- 130,2 $kgCO_2eq$



Built-in wood bench
32 kg



Carpets
21 kg
- 1.069 $kgCO_2eq$



Biopartner 5 Laboratory

A scientific laboratory that was also a laboratory of circular building strategies.

Program: *Laboratories + offices*
Project type: *New construction*
Surface area: *6.827 m²*
Contracting authority: *Biopartner Center Leiden*
Architect: *Team PTSA Dave Oorschot, Thinh Pham, Cas Bollen, Andrei Voaides, Josse Popma, Jan Willem ter Steege*
Contractor: *De Vries en Verburg (main contractor)*
Engineering assistance: *IMd Consulting Engineers (construction), Deerns Nederland (installations and building physics), NIBE B.V.*
Contract: *Private*
Year of completion: *2021*

Image source : René de Wit

Biopartner 5 is the fifth building of BioPartner, an organisation in charge of developing a science park to host startups and spin-offs from Leiden University. It has been designed by Popma Ter Steege Architects with a strong emphasis on circular approaches, including reusing building materials. They were assisted by NIBE b.v., who accompanied the impact calculations of the project.

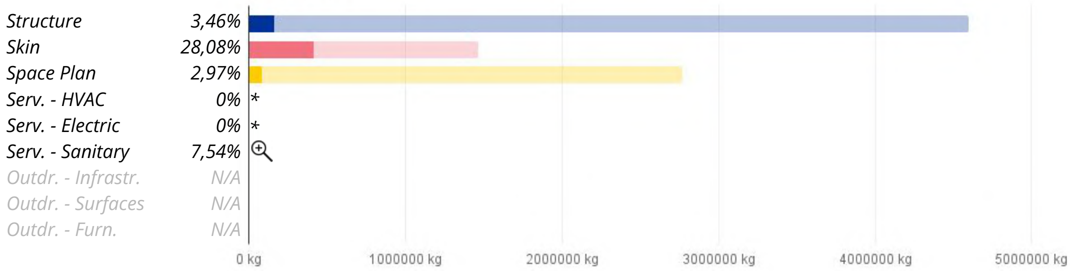
As a result, the project managed to incorporate a significant quantity of reused elements. A noticeable batch is the reused steel structure reclaimed from the demolition of the Gorlaeus laboratory, a nearby building. In total, 159 tonnes of steel could be reused for structural purposes in Biopartner 5.

Another striking batch is the 54 tonnes of reclaimed tiles, stone slabs, and clay pavers, lay-outed in a sophisticated flooring pattern—reminiscent of Dimitris Pikonis' 1954 design of the path to the Acropolis, in Athen.

In addition, the project also reuses a huge quantity of masonry rubble (411 tonnes stacked into gabions for the façade wall), glass partition walls, carpet tiles (re-coloured on site), oak panels, and sanitary equipment.

Overall, the project managed to include reused elements in most of the construction layers, reaching reuse rates (in mass) that are far from being negligible for a building of this size: 3 % in the Structure layer, 29 % in the Skin layer, 3% in the Space Plan layer and 7 % in the Sanitary layer.

Reuse rate per layer (in mass)



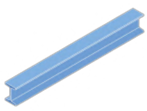
Legend:

Reused mat. | Other mat.

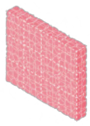
** = not calculated because the layer does not contain reused element*
= not visible at this scale
N/A = the project does not include this layer

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

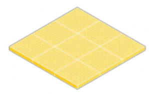
Building elements reused in the project (per layer)



Structural steel
159.000 kg
- 386.012 kgCO_2eq

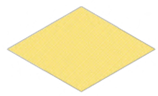


Masonry rubble
411.170 kg
- 16.716 kgCO_2eq



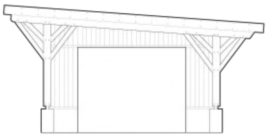
Ceramic tiles
54.900 kg
- 7.398 kgCO_2eq

Glass partition walls
17.972 kg
- 28.111 kgCO_2eq



Carpets
9.379 kg
- 79.670 kgCO_2eq

Toilet bowls
285 kg
- 1.595 kgCO_2eq



Kaysersberg waste collection centre

Reuse in different layers of this waste collection centre.

Program: *Waste disposal/sorting*
Building type: *New construction*
Surface area: *7.830 m²*
Contracting authority: *Communauté de communes de la Vallée de Kaysersberg*
Architect: *ER Architectes*
Contractor: *Lingenheld*
Reuse assistance: *Bellastock*
Engineering assistance: *SETUI - INOTEC - DEKRA*
Contract: *Public*
Public support: *ADEME région Grand Est*
Year of completion: *2022*

Image source : Bellastock

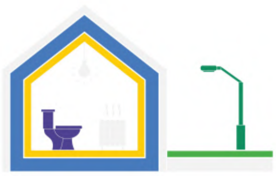
As part of the implementation of their circular economy strategy, municipalities from the Kaysersberg valley (France) seeked to redevelop an existing waste collection centre. It had to become a central place to collect and sort different types of waste, but also to foster the salvage of reusable items.

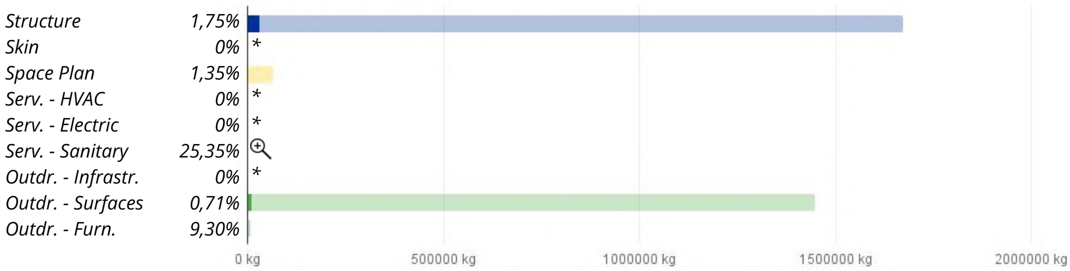
The redevelopment entailed the expansion of the original centre and the building of new infrastructure and equipment. These drew on two main principles: first, using local timber for the structure and the cladding; second, reusing elements salvaged either from the original facilities (like the T-shaped precast retaining walls) or sourced from local salvage dealers (such as structural steel, wood finishes, sinks, asphalt slabs, gates and lifting barriers, etc.).

The architects were accompanied by a reuse assistant, Bellastock, to maximise the reuse of building elements.

Together, they explored how to implement reuse strategies in many different constructive layers, reaching interesting results in the Structure, Space Plan, Sanitary, Outdoor Surfaces and Outdoor furniture layers.

Reuse rate per layer (in mass)





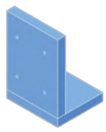
Legend:

Reused mat. *Other mat.*

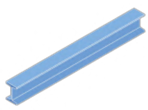
** = not calculated because the layer does not contain reused element*
= not visible at this scale

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

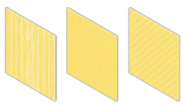
Building elements reused in the project (per layer)



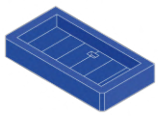
Concrete retaining wall
28.798 kg
- 966,5 $kgCO_2eq$



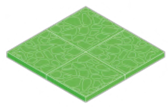
Structural steel
785 kg
- 1.905 $kgCO_2eq$



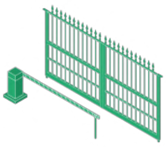
Wood finishes
873 kg



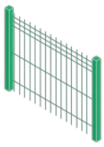
Concrete sink
143 kg
- 15,5 $kgCO_2eq$



Asphalt slabs
10.340 kg
- 9.031 $kgCO_2eq$



Gates
354 kg
- 1569 $kgCO_2eq$



Wire fence
352 kg
- 2763 $kgCO_2eq$

Botany institute ULg

Sustainable and respectful renovation of a 1970s university building.

Program: *Offices / University*
Project type: *Transformation of an existing building*
Surface area: *8.600 m²*
Contracting authority: *Liège University*
Architect: *ULIEGE-ARI*
Reuse assistance: *Rotor*
Contract: *Public*
Public support: *EEEF (Europeen energy efficiency fund)*
Year of completion: *2018*

Image source : Samuel Defourny

The University of Liège (ULg) owns several buildings built in the late 1960s and early 1970s by Belgian modern architects. Most of them have a high heritage value but a poor energy efficiency. In the 2010s, the University launched an ambitious renovation programme supported by the European Energy Efficiency Fund (EEEF), with the aim to lower the buildings' energy consumption by at least 20 %. It is in this context that the renovation of the Botany Institute took place.

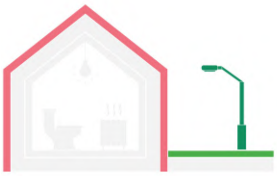
An energy audit concluded that the skin was a major source of energy losses in this building. The simple-glaze aluminium windows had to be replaced and the concrete façade had to be insulated. Because the building needed to remain in use, the architects had no choice but to insulate from the outside. Yet, the façade, with the concrete retaining the imprints of the veins of the wood of the formwork, was also a major architectural feature, worth preserving.

Image source : Samuel Defourny

The architects and the contracting authority solved this conundrum by opting for a cladding made out of reclaimed barnwood. This solution was compatible with the insulation system. It also alludes to the original façade, with the same kind of unpredictable texture.

This is not the only element to be reused in this project. The architects also reused azobe planks from former docks to create an outdoor terrace, metal roofing and 60 × 60 flooring concrete slabs (same site reuse). On top of that, the project retains most of the original building and puts some effort into restoring HVAC equipment.

Overall, the project limited its inflows to 578 tonnes of materials, with reuse rates of 7 % in the Skin layer, 22 % in the Outdoor Surfaces layer and 22 % in the Outdoor Furniture layer.



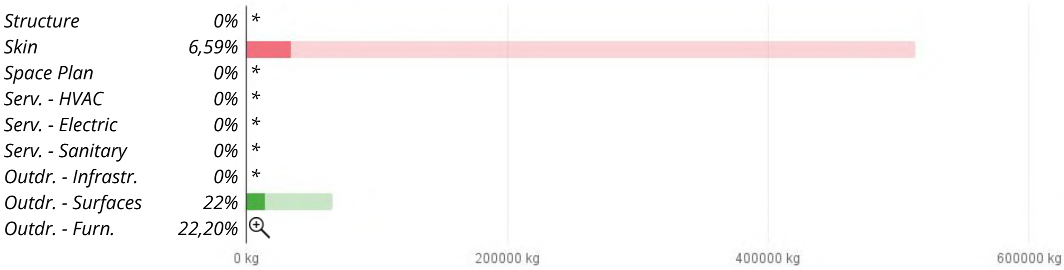
Legend:

Reused mat. | Other mat.

* = not calculated because the layer does not contain reused element
🔍 = not visible at this scale

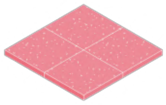
Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Reuse rate per layer (in mass)

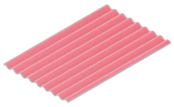


Building elements reused in the project (per layer)

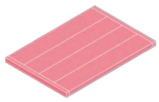
Wood cladding
22.667 kg
- 6.722 $kgCO_2eq$



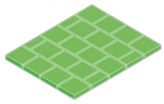
Concrete tiles
7.440 kg
- 291,6 $kgCO_2eq$



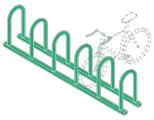
Metal sheet
2.800 kg
- 14.788 $kgCO_2eq$



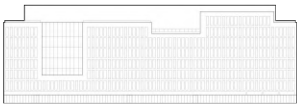
Wood decking
396 kg
- 6.672 $kgCO_2eq$



Concrete pavers and slabs
14.431 kg
- 1.917 $kgCO_2eq$



Bicycle racks
12 kg



Pulse Offices

Scale matters: 543 tonnes of reused raised floors system.

Program: *Offices*
Building type: *New construction*
Surface area: *33.588 m²*
Contracting authority:
Icade
Architect: *BFV*
General contractor: *Artelia*
Reuse assistance: *Bellastock*
Contract: *Private*
Project duration: *2017-2019*

Image source: Frederic Delangle, Léa Deniele

Pulse is a new office building completed in 2019 in Saint-Denis. This new large construction (seven floors and almost 30.000 m²) is at the heart of a former industrial area north of Paris. The floors are set around a large atrium. The ground floor hosts a co-working space, restaurants and cafés. The upper floors are for offices and terrasses. The rooftop houses a vegetable garden.

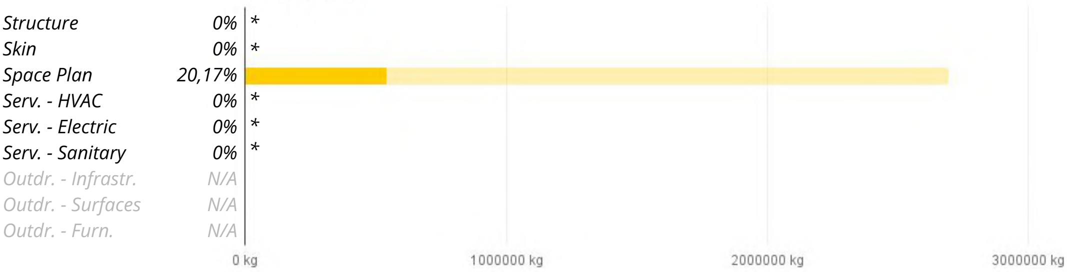
The project's developers strove to lower their carbon impact. For that, they considered a wide range of solutions, such as using bio-based materials (the timber structure, for instance), recycled materials (the textile-based insulation and the carpet tiles with a high recycled content, for instance), and reused building elements.

Reducing carbon emissions in a project of that scale is a big challenge. Project developers inevitably had to make compromises, like using a bit of concrete in the timber structure. Reuse-wise, together with their reuse assistant

Image source: Rotor

Bellastock, they narrowed down the possibilities to only two batches: handrails and raised floors system, both salvaged locally. The raised floors system alone, however, represents a very significant quantity of reused materials (543 tonnes exactly). It contributes to reaching a 20 % reuse rate in the Space Plan layer—demonstrating that a few strategic decisions can pay off!

Reuse rate per layer (in mass)



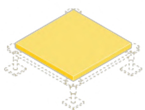
Legend:

Reused mat. *Other mat.*

** = not calculated because the layer does not contain reused element*
N/A = the project does not include this layer

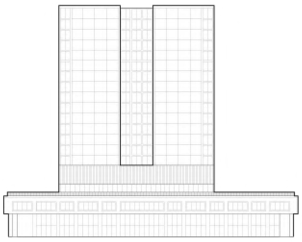
Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Building elements reused in the project (per layer)



Raised floor tiles
93.448 kg
- 60.972 kgCO_2eq

Metal handrails
690 kg
- 6.330 kgCO_2eq



Multi

An XXL renovation with circular strategies.

Program: *Offices / Restaurant / Work / Café*
Building type: *Transformation of an existing building*
Surface area: *45.120 m²*
Contracting authority: *Whitewood / immobel*
Architect: *Conix RDBM Architects*
Contractor: *Cordeel Zetel Temse NV*
Reuse assistance: *Rotor*
Contract: *Private*
Public support: *Be Exemplary 2017*
Year of completion: *2022*

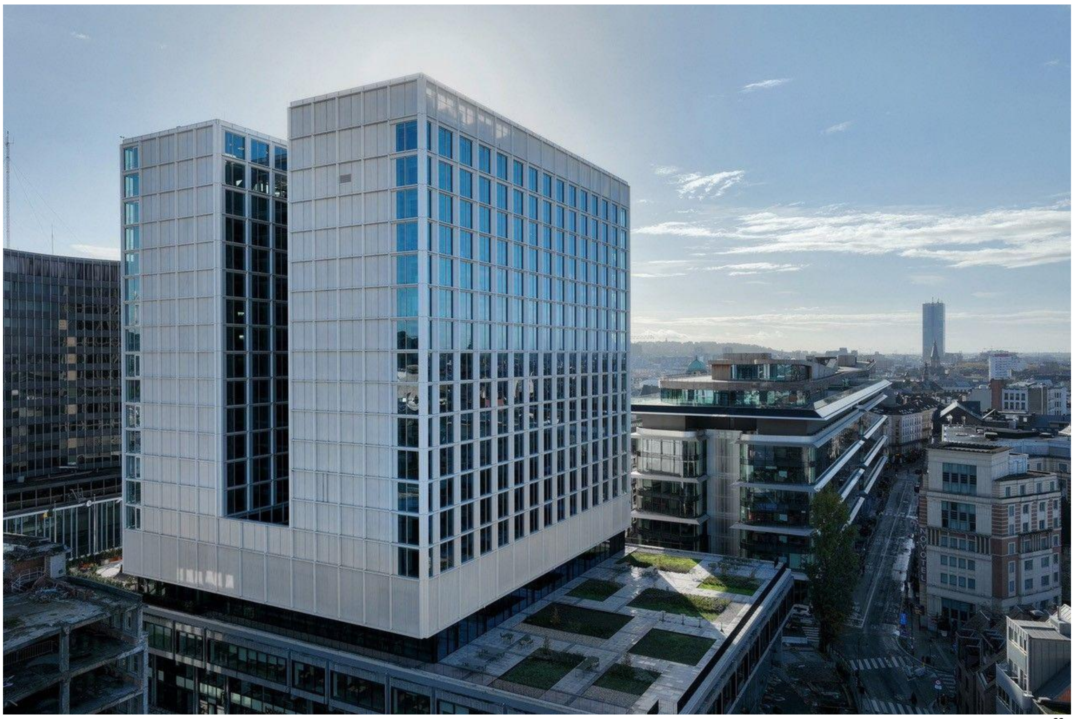
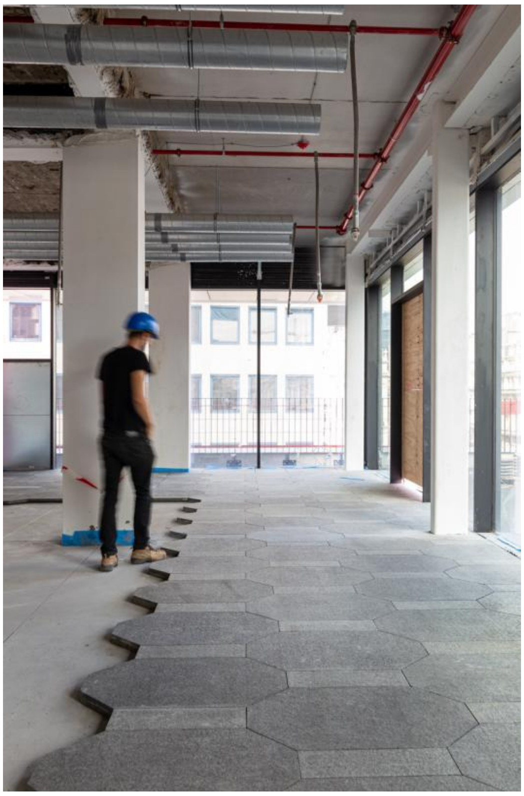


Image source : Marc Detiffe

Modern office buildings from the 1960's in Brussels are often considered by the public as an eyesore, an unfortunate heritage from a time that saw the old city being demolished to give place to high-rise buildings. As a result—and this is not without paradox—their reconversion today often involves heavy demolition and reconstructing new buildings. The Multi project wanted to explore a more circular pathway.

A key objective was to maintain most of the original building and design bespoke interventions to improve its urban character, notably through better connecting the ground floor with the public space and allowing public access to the terrasse on top of the base.

Multi's developers set for themselves ambitious circular targets: retaining as much of the original building as possible, and integrating 2 % of reused materials in the in-flows (both in mass and economic volume).



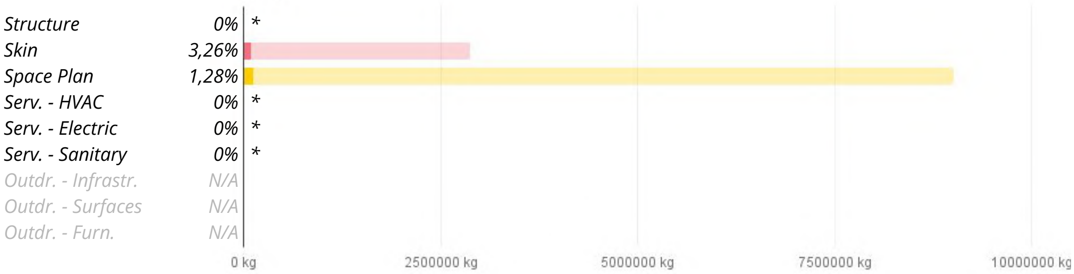
Images source : Jasper Van der Linden

They carried out many actions to reach these goals: study technical solutions to install HVAC equipment despite the low ceiling height (so as to retain most of the Structure layer), conduct a reclamation audit to identify reusable elements, instigate same-site reuse strategies, and use materials reclaimed from diverse locations through professional reclamation dealers.

Having a clear target in view facilitated bundling the different involved parties' efforts. It also allowed the project's architects and developers to support circular decisions that entailed slight divergences from usual workflows.

Overall, the project incorporates more than 12.000 tonnes of reused materials—the biggest quantity of reused materials in our sample of tertiary buildings. These materials are all located in the Skin layer (stone cladding and flooring) and in the Space Plan layer (stone flooring, aluminium profiles salvaged from the original façade).

Reuse rate per layer (in mass)



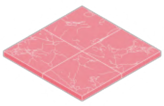
Legend:

Reused mat. *Other mat.*

** = not calculated because the layer does not contain reused element*
N/A = the project does not include this layer

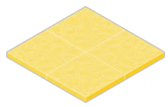
Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Building elements reused in the project (per layer)



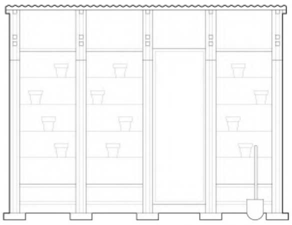
Stone slabs
49.442 kg
- 9.647 kgCO_2eq

Stone cladding
44.013 kg
- 4.822 kgCO_2eq



Stone finishes
93.141 kg
- 3.609 kgCO_2eq

Aluminium profiles
3.646 kg



Green House

Every single component of this project has already had another life, making this pavilion a demonstration of reuse.

Program: *Green house*
Project type: *New construction*
Surface area: *7,7 m²*
Contracting authority: *Lmnl Architect and landscape*
Architect: *Studio ACTE, Team: Estelle Barriol, Hannah Sherin, Lotte Wigman, Toma Murtic, Alessandra Esposito, Fanny Bordes*
Contract: *Private*
Year of completion: *2023*

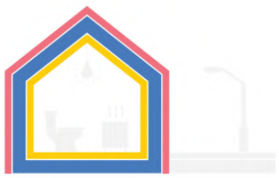
Image source : Stijn Bollaert

The Green House—as its name suggests—is a small plant nursery (7,7 m^2). It is located in Brabant (NL) for a period of 5 years. This micro building is made out of wood, polycarbonate and ropes that are put in tension to provide stability against strong winds.

Almost all the building components are salvaged from nearby projects. It includes other temporary cabins built by the same architecture practice, among which the Circular Pavilion, from where the Green House's timber structure, aluminium corrugated roofing sheets and plywood boards originate, for instance. The floor infill is made out of 228 solid bricks, reclaimed from the LNML garden. Local salvage dealers also provided some elements, such as the indoor planter shelves or the gravel (1 tonne).

As a result, the project reaches pretty high reuse rates in the three only layers concerned (Structure, Skin and Space Plan).

This is no surprise given the scale and the nature of this project. Interestingly, the designers blueprinted this project directly from reusable elements they knew where available, making it a bespoke reuse demonstrator.



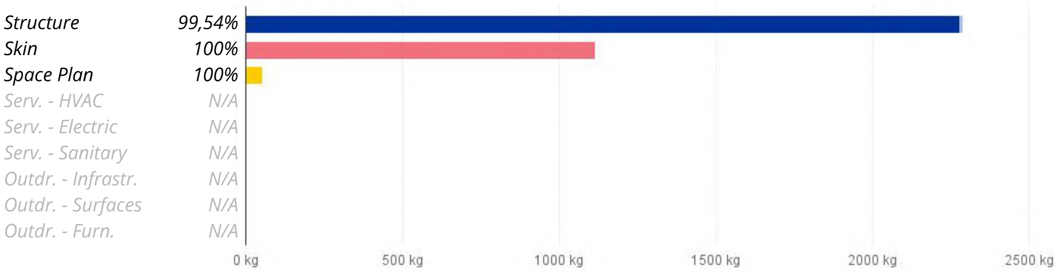
Legend:

Reused mat. *Other mat.*

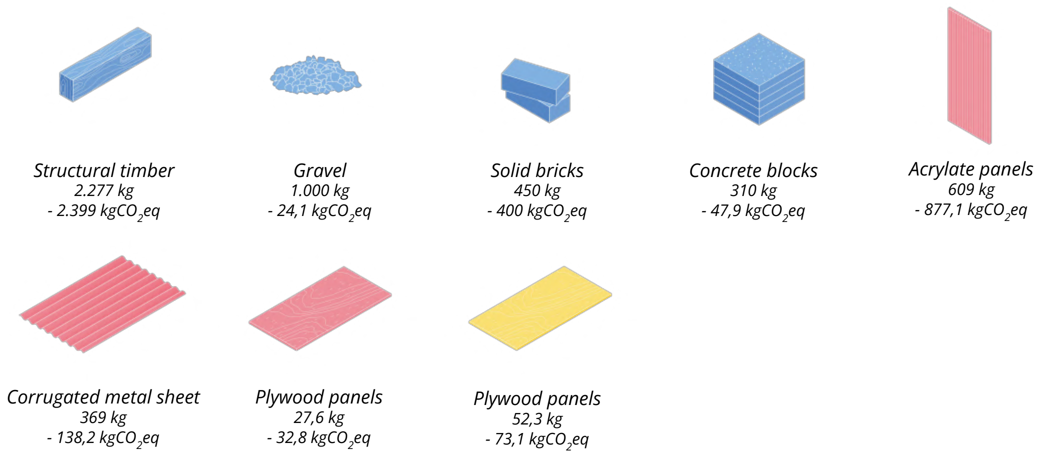
N/A = the project does not include this layer

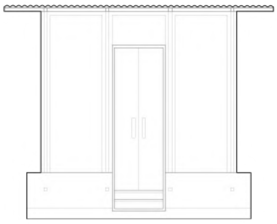
Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Reuse rate per layer (in mass)



Building elements reused in the project (per layer)





Circular Pavilion

With elegance and simplicity, this temporary, small-scale structure achieves a very high reuse rate.

Program: *Sleeping cabin*
Project type: *New construction*
Surface area: *7,7 m²*
Contracting authority: *Culture Campsite / De kroon / Studio ACTE*
Architect: *Studio ACTE, Team: Estelle Barriol, Filipe Borges, Enzo*
Contract: *Private*
Year of completion: *2021*

Image source : Rubén Dario Kleimeer

The Circular Pavilion was a temporary 7.7 m² cabin commissioned by an art foundation in Rotterdam. It was designed and built by Studio ACTE as a demonstration that sustainable and circular construction can convey a new aesthetic.

With a relatively simple programme (sleeping cabin/retreat space/winter garden...) and a short expected lifespan (1 year), it mostly focussed on sourcing low-impact materials and installing them with skills and elegance.

Almost all of its components have been salvaged from nearby sources, reaching an overall reuse rate of almost 100 % for the in-flow (in mass). They are mostly modern and—one may say—banal building materials, such as hollow concrete blocks, OSB panels, acrylic panels, formwork panels, plywood boards, and so forth.

However, their assemblage manages to transcend their mundane origin to convey a certain poetry and allure to this small pavilion. Temporary by essence, it was designed to be easily dismantled after its use. Most of the materials then found their way to other, similar projects.

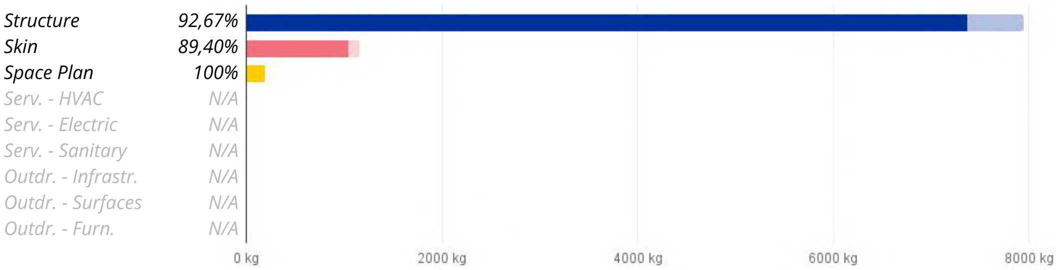
Legend:

Reused mat. *Other mat.*

N/A = the project does not include this layer

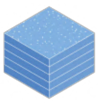
Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Reuse rate per layer (in mass)



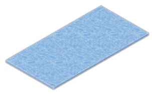
Building elements reused in the project (per layer)

Rammed earth
4.500 kg
0.00 $kgCO_2eq$

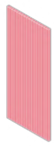


Concrete blocks
1.680 kg
- 99,4 $kgCO_2eq$

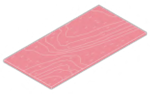
Gravel
1.000 kg
- 24,1 $kgCO_2eq$



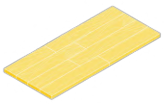
OSB panels
185 kg
- 270,4 $kgCO_2eq$



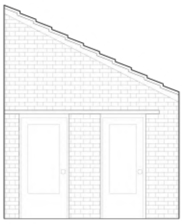
Acrylate panels
931 kg
- 1.338 $kgCO_2eq$



Plywood panels
106 kg
- 145,8 $kgCO_2eq$



Wood flooring
192 kg
- 170,2 $kgCO_2eq$



Sanitary block

Pushing for reuse in a small-scale but demanding building.

Program: *Restroom*
Project type: *New construction*
Surface area: *18 m²*
Contracting authority: *Municipality of Dilbeek*
Architect: *Rotor*
Contractor: *Coopérative construction Autrement*
Contract: *Public*
Year of completion: *2019*

Image source: Rotor

This small building is designed as an extension to an ancient farm now hosting a youth organisation's facilities (the *Chiro* from Itterbeek). This extension houses a mundane but important programme, namely public bathrooms. The client wanted a project with as much reuse as possible—a challenge taken up by the designers and the contractor all along the way.

A local dealer in reclaimed bricks supplied all the material used for the façade. The designers chose three types of bricks and blueprinted different bonds, to come up with a façade that blends well into its context (the adjacent farm and a nearby chapel) while retaining its individuality.

The interior fittings also give pride of place to reused elements. The floor and the walls are protected with ceramic tiles that were reclaimed during the demolition works of a 1930s primary school located a few kilometres away.

Image source: Rotor

The sanitary appliances (urinals, toilet bowls and sinks), lighting and mirrors were all salvaged from diverse buildings and supplied by professional dealers.

More modern materials, used for the load-bearing structure (concrete blocks) and the roof (including thermal insulation), come from site surplus or production overstocks. While slightly different from new materials, they are not reclaimed either since they have never been installed. Therefore, such materials are not counted as 'reuse' in our analysis of the in-flow.

In the end, the project achieved relatively high reuse rates in the Skin, Space Plan and Sanitary layers. Although modest in scope, this project nonetheless followed each phase of a traditional construction project and involved every type of work usually found in larger construction sites (foundations, sewers, structural work up to the roof, plumbing, electricity and interior fittings). It also operated with a relatively tight budget. Therefore, the reuse rates achieved there give a fair image of what can be done in this kind of context, with a mix of goodwill and motivation, but also economic and practical constraints.

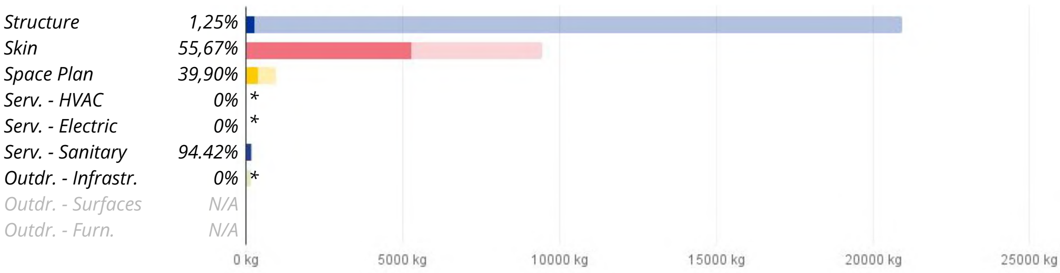
Legend:

Reused mat. Other mat.

* = not calculated because the layer does not contain reused element
N/A = the project does not include this layer

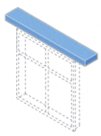
Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Reuse rate per layer (in mass)

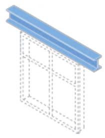


Building elements reused in the project (per layer)

Solid bricks
5.114 kg
- 460 $kgCO_2eq$



Concrete lintels
160 kg
- 98,2 $kgCO_2eq$

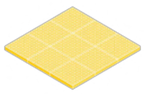


Steel lintels
101 kg
- 244,9 $kgCO_2eq$

Exterior door
90 kg
- 226,6 $kgCO_2eq$

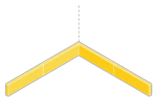
Exterior windows
30 kg
- 76,1 $kgCO_2eq$

Rigid insulation
29,4 kg
- 72,6 $kgCO_2eq$



Ceramic tiles
322 kg
- 325,6 $kgCO_2eq$

Mirrors
30 kg
- 42 $kgCO_2eq$



Ceramic plinths
22,5 kg
- 93,1 $kgCO_2eq$

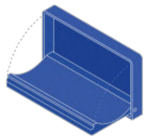
Toilet bowls
60 kg
- 335,7 $kgCO_2eq$

Ceramic sinks
45 kg
- 103,2 $kgCO_2eq$

Urinals
24 kg
- 167,8 $kgCO_2eq$

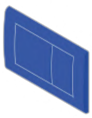
Stainless steel sinks
12 kg
- 15,4 $kgCO_2eq$

Urinal dividers
12 kg



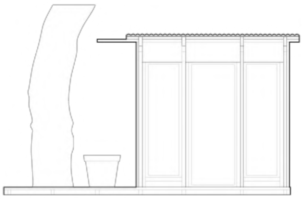
Changing tables
9,7 kg

Toilet paper holders
2,8 kg



Flush plates
1,5 kg

Grab bars
0,4 kg



Tree House

A tiny building with huge reuse rates.

Program: *Garden office*
Project type: *New construction*
Surface area: *24 m²*
Contracting authority: *Iona Foundation*
Architect: *Studio ACTE,*
Team: Estelle Barriol, Ruth Gonzalez Garcia, Hannah Sheerin, Tania Sediame, Lotte Wigman, Georges Taminiau
Contract: *Private*
Year of completion: *2022*

Image source : Stijn Bollaert

The Tree House is a 24 m² cabin located in the garden of the Iona Foundation in Amsterdam, at the feet of a majestic tree. It has been designed and built by Studio ACTE, an architecture practice aiming at promoting low-tech, resilient and hands-on architecture.

Although modest in size, the cabin has a sleek design evoking a small shrine in a dense forest. The 'Tree House' manages to look very coherent despite using materials salvaged from very different—and sometimes unexpected—sources (but all within a short distance from the project).

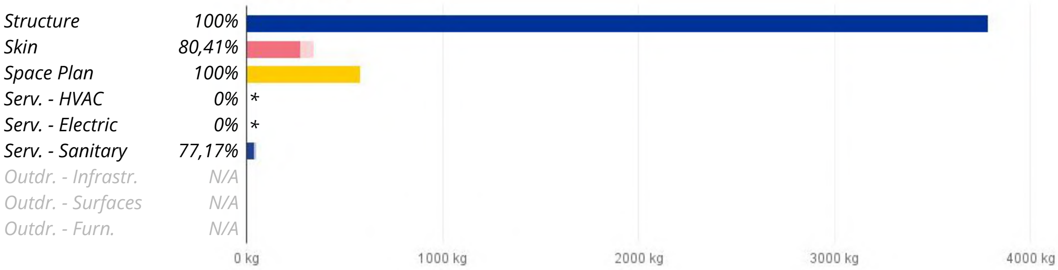
The timber structure and wood floors are made of reclaimed Basralocus, a tropical hardwood that grows in French Guiana and Suriname (a former Dutch colony). This wood is often used for maritime construction. This very batch arrived in Rotterdam 150 years ago and was used in the harbour before being salvaged and reused in the Tree House.

The foundation only uses 100 kg of rammed earth, salvaged from another temporary pavilion designed and built by Studio ACTE. The beams of the floor are laying on 14 blocks of natural stone, coming from the same pavilion. Additional gravel and concrete blocks are salvaged from a local source.

The walls are made of eight leftover plywood boards and ten acrylic panels salvaged from the demolition of a chicken farm. The roof is made of salvaged corrugated metal sheets sourced locally. It is reinforced with formwork elements salvaged from the transformation of a nearby nightclub.

A reclaimed wine barrel serves as a water tank, adding a final touch to this almost 100 % reuse project. Overall, the project reaches very high reuse rates, which is not too surprising given its scale and its nature.

Reuse rate per layer (in mass)



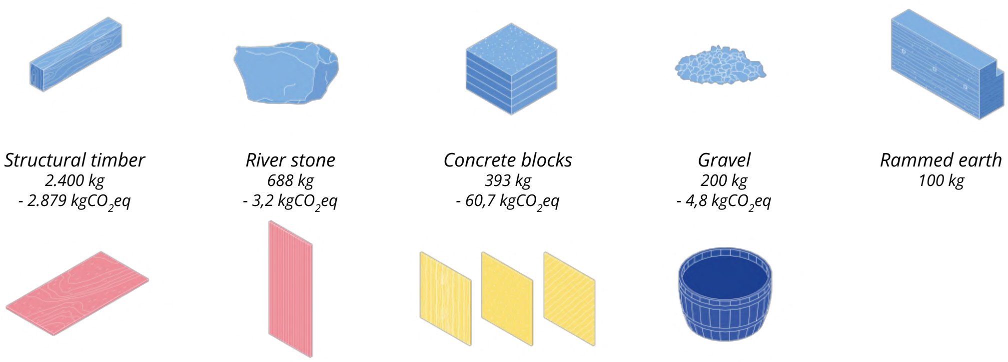
Legend:

Reused mat. *Other mat.*

** = not calculated because the layer does not contain reused element*
N/A = the project does not include this layer

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Building elements reused in the project (per layer)



Structural timber
2.400 kg
- 2.879 kgCO_2eq

River stone
688 kg
- 3,2 kgCO_2eq

Concrete blocks
393 kg
- 60,7 kgCO_2eq

Gravel
200 kg
- 4,8 kgCO_2eq

Rammed earth
100 kg

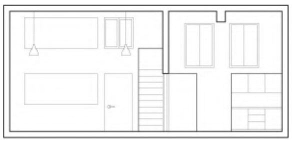
Plywood panels
190 kg
- 298,7 kgCO_2eq

Acrylate panels
83 kg
- 119,4 kgCO_2eq

Wood finishes
576 kg
- 448,3 kgCO_2eq

Water tank
39 kg
- 28,9 kgCO_2eq

Interreg North-West Europe FCRBE
European Regional Development Fund



VLA office

Designers' offices as a visit card to promote reuse.

Program: *Offices*
Project type: *Adaptive reuse*
Surface area: *100 m²*
Contracting authority:
Vla architecture
Architect: *VLA architecture*
Contract: *Private*
Public support: *Be Exemplary 2017*
Year of completion: *2018*

Image source : Rotor

When the Brussels architects of VLA-architecture moved into their new offices, they wanted to showcase their interest in reusing building elements through the design of the interior fittings. These have been thought as a demonstration to their clients that reusing building materials was not only feasible but could also be attractive.

Beside reuse, the project endorses other facets of circular construction. The offices have been designed in a reversible way, for instance. Should VLA leave this place, the space could easily be converted into housing. Also, the architects systematically opted for materials with a low embodied energy when they could not find them from salvage sources. All these aspects enabled the project to be selected for a Be.Circular award in 2017—a regional public scheme aiming at accompanying ambitious circular projects, notably through financial support.

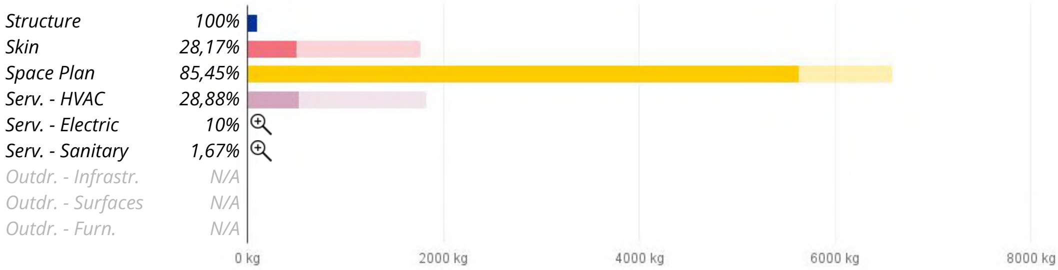
Thanks to their professional activities, the architects are regularly in contact with reusable materials on their different sites, or that of the contractors they work with. This was an important source for the materials reused in their own offices. Some elements were also bought from local salvage dealers. If opportunities for reuse were not missing, storage space was much scarcer. All the materials needed to be brought and stored on this relatively small site until their reinstallation, entailing complex site management. This was possibly the main challenge of this project.

An important feature of the project is the long partition wall *slash* bookshelf *slash* closet separating the hall from the different rooms. It is a clever assemblage built from a collection of diverse casework elements. This kind of bespoke built-in furniture is usually rather expensive and timely to design. Working with salvaged material made the process slightly easier (and much cheaper): since the elements were already there, the design became a matter of wittily assembling things together. Somehow, the elements themselves determined their future destination.

Another remarkable feature is the partition wall between the kitchen and the offices. It is mostly made of single-glazed windows reclaimed from the back façade, providing natural light and a view over the garden to the offices while enclosing the kitchen area.

If the project concerns many layers (incl. Structure, Skin, Space Plan and all three Services), most interventions were pretty minimal—which is fully in line with another crucial circular strategy, that of retaining what is already there. Overall, only 11 tonnes of materials were needed for this project. They are mostly concentrated in the Space Plan layer, which also features an impressive reuse rate of 85 % (in mass).

Reuse rate per layer (in mass)



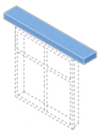
Legend:

Reused mat. *Other mat.*

🔍 *= not visible at this scale*
N/A = the project does not include this layer

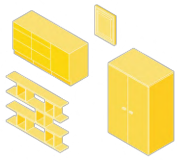
Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Building elements reused in the project (per layer)

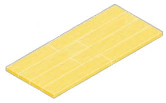


Concrete lintels
93 kg
- 55,8 kgCO_2eq

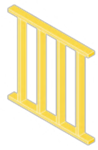
Rigid insulation
497 kg
- 123,2 kgCO_2eq



Casework
1.735 kg

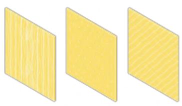


Wood flooring
1.568 kg
- 440,8 kgCO_2eq



Wood structure
1.527 kg
- 1.608 kgCO_2eq

Glass partition walls
357 kg
- 825,5 kgCO_2eq



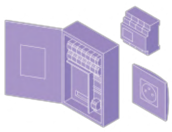
Wood finishes
148 kg

Interior doors
140 kg
- 226,6 kgCO_2eq

Mineral wool insulation
126 kg
- 60,9 kgCO_2eq

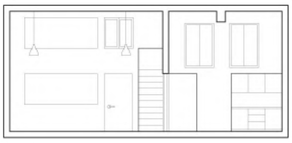
Metal studs
23 kg

Cast iron radiators
528 kg
- 243,2 kgCO_2eq



Electrical components
40 kg
- 331,3 kgCO_2eq

Stainless steel sinks
5 kg
- 15,4 kgCO_2eq



Droits et Habitats premises

Lustrous reuse that blends perfectly into an elegant white space.

Program: *Offices and place of welcome*
Project type: *Interior renovation*
Surface area: *135 m²*
Contracting authority: *Association Droits et Habitats*
Architect: *Faire Avec Architecture*
Contractor: *Odéon SARL / Palam / Coup d'Main*
Engineering assistance: *Concepteurs Lumière Sans Frontières*
Contract: *Private*
Public support: *City of Paris*
Project duration: *2019-2020*

Image source: Eléonore Lubna Secondi

It is in 2020 that the association *Droits et habitats,* which provides support for people in precarious housing situations, moved into new premises leased by the Paris city council. An empty high-ceiling space was to be arranged to host desk-based activities, large meetings but also small gatherings with inhabitants.

The project focused on interior design. It aimed at making the space comfy and inviting for the association's members and their visitors.

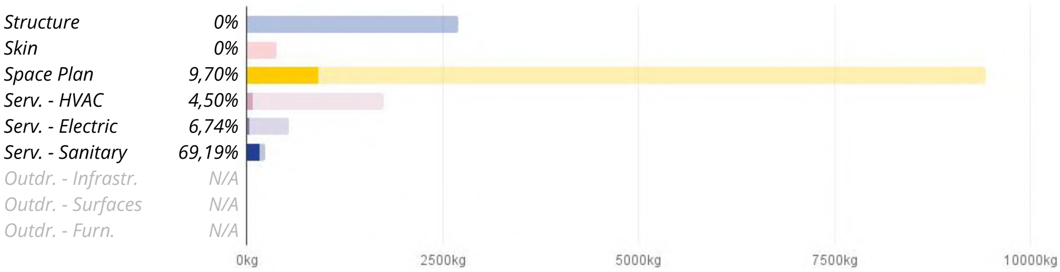
Taking advantage of the high ceiling, the designers planned an extra floor for the offices, which occupies about half of the total volume. This solution leaves open a large space that can accommodate other purposes. The new partitions have been approached as if they were interior façades. They are designed with a lot of windows and white surfaces as to diffuse natural light throughout the rooms.

Image source: Eléonore Lubna Secondi

The designers also seeked to experiment with reuse in this project. A wide range of salvaged elements are elegantly installed in the different spaces. Sometimes, they are so well integrated that it is hard to distinguish them from new materials. It is notably the case of interior windows, doors, tiles and some glass partition walls.

The very nature of this project entails an exclusive focus on the interior layers: Space Plan, HVAC, Electricity, and Sanitary. It is in the latter that the project reaches the most impressive reuse rate (69 % in mass), thanks to reusing equipment such as a hot water tank, sinks and toilet bowls together with smaller accessories (faucets, flush plates...).

Reuse rate per layer (in mass)



Legend:

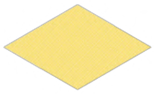
Reused mat. *Other mat.*

N/A = the project does not include this layer

Building elements reused in the project (per layer)

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

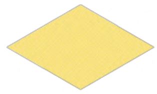
Interior windows
242 kg
- 1.114 kgCO_2eq



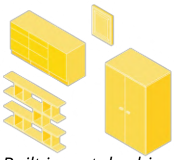
Ceramic tiles
180 kg
130,2 kgCO_2eq

Interior doors
150 kg
- 679,8 kgCO_2eq

Glass partition wall
139 kg
- 654,7 kgCO_2eq



Carpet
130 kg
- 1.162 kgCO_2eq



Built in metal cabinet
50 kg

Mirrors
15 kg
- 21 kgCO_2eq

Spot lights, lamps, sconces
180 kg
- 25.134 kgCO_2eq

LED tube lights
130 kg
- 7.682 kgCO_2eq

Sheet steel radiators
80 kg
- 621,9 kgCO_2eq

Stainless steel sink
61 kg
- 15,4 kgCO_2eq

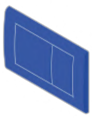
Hot water tank
47 kg
- 24,7 kgCO_2eq

Ceramic toilet bowls
30 kg
- 167,8 kgCO_2eq

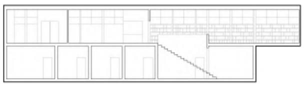
Faucets
20 kg
- 171,1 kgCO_2eq

Sinks
30 kg
- 103,2 kgCO_2eq

Grab bars
6 kg



Flush plates
1,5 kg



Reuse centre La Fabrique

When reuse resonates with both the form and content...

Program: *Reuse shop*
Project type: *Interior renovation*
Surface area: *240 m²*
Contracting authority: *Fondation de l'Armée du Salut*
Architect: *Faire Avec Architecture*
Designer *: Nivine Chaikhoun*
Contractor: *BRB - Hydrotherm - Palam*
Engineering assistance: *Inoveha - BETEX ingenierie - Concepteurs Lumière Sans Frontières (CLSF)*
Contract: *Private*
Public support: ***P****articipatory budget of the City of Paris and the Ile-de-France region.*
Year of completion: *2021*

Image source : Jonathan Llense

La Fabrique 230 is an organisation that seeks to foster the reuse of everyday goods. They carry out a large range of activities for this purpose: collecting reusable items, cleaning them, selling them at fair price and raising awareness of the public on this issue. When it came to design their new premises, it seemed self-evident to go for reuse.

La Fabrique's new installations are located on the ground floor of a housing block in Paris. They host a public shop, a workshop and a storage area for a total surface area of 240 m².

Reuse is at the heart of the design project. 22 % (in mass) of the interior finishings have been sourced from salvage channels : demolitions and contractors' stocks. Wood finishes, glass partitions and kitchen casework could be collected that way. The project also contains salvaged sinks, lighting rails and many other small accessories.

In this project, the content and the form are very much aligned. The interior fittings demonstrate the reuse can rhyme with sleek and elegant design, hence suggesting a much richer range of possibilities than the ‘pallet design’ to which it is sometimes limited.

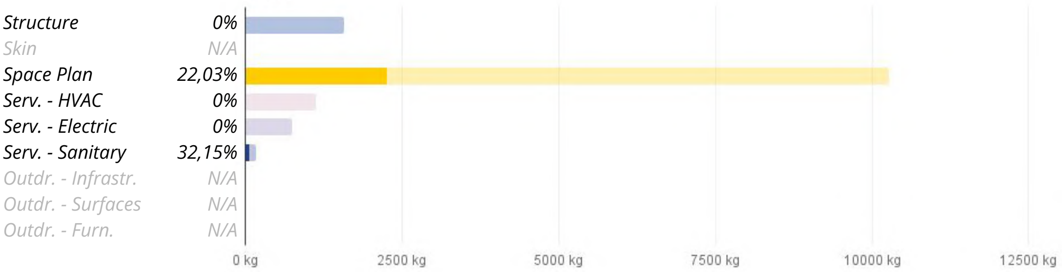
Legend:

Reused mat. Other mat.

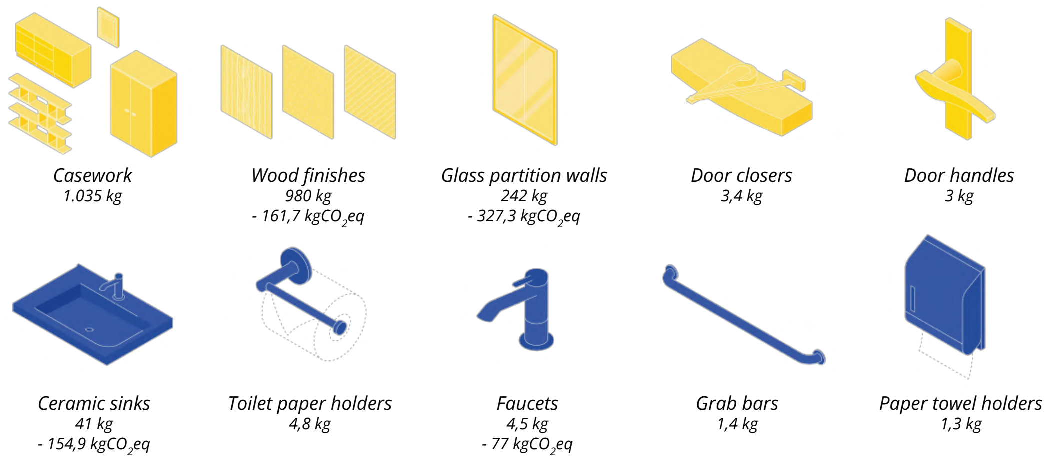
N/A = the project does not include this layer

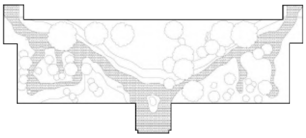
Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Reuse rate per layer (in mass)



Building elements reused in the project (per layer)





Garden of Reuilly

When the unexpected finding of antique cobblestones triggers a large reuse operation.

Program: *Public garden*
Project type: *Outdoor facility*
Surface area: *4.820 m²*
Contracting authority: *Paris Habitat*
Architect: *h2o - d&h paysagistes*
Reuse assistance: *Rotor*
Engineering assistance: *id+ engineering*
Contract: *Public*
Project duration: *2019-2021*

Image source : Stephane Chalmeau

The redevelopment of the Caserne de Reuilly is a major urban project in the 12th arrondissement of Paris. The overall project involves the reconversion of a former military site into housing, student residences, nursery, commercial facilities and a public garden. The latter is at the centre of the project at stake here. The brief was to transform a very mineral military courtyard into a green space open to the public.

During the earthworks, the workers dug out unexpected materials from the ground: while drilling pits and trenches, they found a batch of big-sized sandstone cobblestones originating from Fontainebleau—a model commonly called 'Napoleon cobblestones' in the region. Because of their value, the project developer decided to reuse them on site in the courtyard. 1.440 m² of ancient cobblestones thus found a new use in the garden of Reuilly. To reach the total surface area needed, the project also drew on two dealers in reclaimed materials who supplied an additional 1.650 m² of pavers.

Image source: Myr Muratet

In total, the Outdoor Surface layer counts 543 tonnes of reused pavers, which corresponds to 36 % of the mass of all the materials used in this layer.

The cobblestones from the Garden of Reuilly were stored and reconditioned off-site, at the Bonneuil-sur-Marne platform. There, the cobblestones were sawn or cleaved to a height of at least 8 cm, depending on the finishes required for the project. For the quite large antique cobblestones, this process generates 2 to 3 times more paving surface area. It also results in pavers with a smoother surface, which can be reused for walkaways accessible to people with reduced mobility. In some parts of the project, there is grass between the pavers, providing a gentle transition to the planted areas.

Legend:

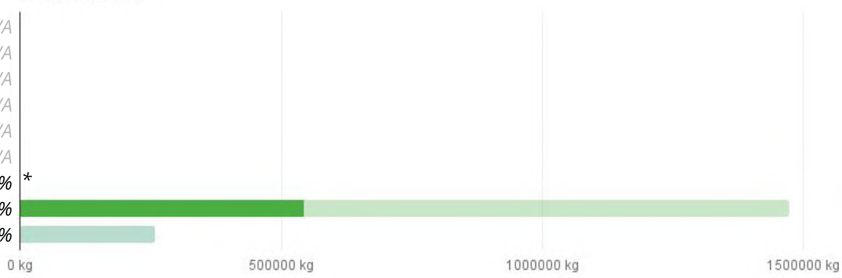
Reused mat. | Other mat.

* = not calculated because the layer does not contain reused element
N/A = the project does not include this layer

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

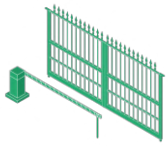
Reuse rate per layer (in mass)

Structure	N/A
Skin	N/A
Space Plan	N/A
Serv. - HVAC	N/A
Serv. - Electric	N/A
Serv. - Sanitary	N/A
Outdr. - Infrastr.	0% *
Outdr. - Surfaces	36,92%
Outdr. - Furn.	0,39%

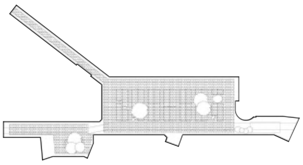


Building elements reused in the project (per layer)

Stone pavers
543.840 kg
- 2.250 $kgCO_2eq$



Gates
1.000 kg
- 784,4 $kgCO_2eq$



Molenbeek town square

Classical porphyry setts for a new town square.

Program: *Public square*
Project type: *Outdoor facilty*
Surface area: *6.300 m²*
Contracting authority: *Beliris*
Architect: *Anorak sprl*
Contractor: *Verbruggen sprl*
Contract: *Public*
Year of completion: *2014*

Image source : Marie-Françoise Plissart

Historically, Belgium was one of the largest producers of porphyry setts. They were known worldwide for their "hard, even [...] and traffic-friendly" surface. It is for the same reasons that they have been chosen for the redevelopment of the Molenbeek-Saint-Jean town square and the adjacent streets in 2013.

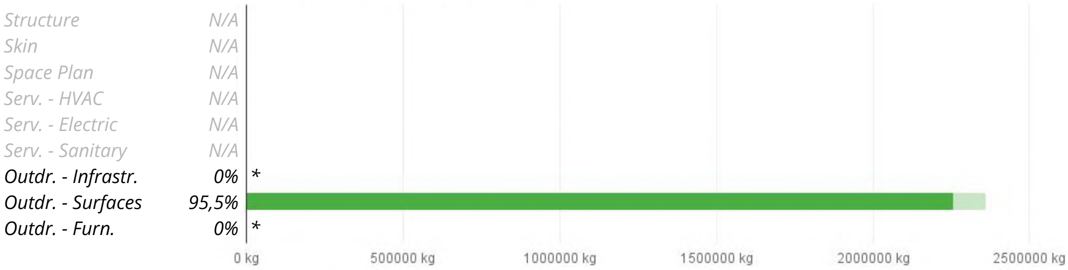
Yet, the production of porphyry pavers stopped in Belgium in the 1950s. Nowadays, the only way to procure them is through the reclamation trade. Fortunately, this segment of the trade is pretty well organised in Belgium. Well-established stockholders can supply it in large quantities.

The architects of the new town square knew from the inception phase of the project that they would use reclaimed porphyry pavers. They wrote their specifications accordingly in the call for tenders for the works. When the surfacing works began, the contractor bought pavers from a local dealer located 40 km away. This specialised dealer had previously sawn the pavers in two parts.

This is quite common with reclaimed pavers: it ensures greater uniformity of surfaces and improves the comfort for bikers and other users (notably those with reduced mobility).

This approach allowed the project to reach a reuse rate of 96 % in the Outdoor Surfaces layer, corresponding to a total of 2.400 tonnes of porphyry (which, obviously, counts amongst the most ponderous building materials). The remaining 4 % corresponds to the new mortar used between the setts, which we counted separately in the in-flow analysis.

Reuse rate per layer (in mass)



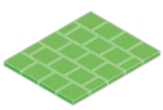
Legend:

Reused mat. *Other mat.*

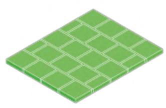
** = not calculated because the layer does not contain reused element*
N/A = the project does not include this layer

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

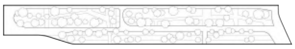
Building elements reused in the project (per layer)



Porphyry paving stone
2.237.376 kg



Concretes pavers and slabs
17.039 kg
- 367,2 kgCO_2eq



Croeselaan

A sustainable street in a busy city centre.

Program: *Cycling and walking area*
Project type: *Outdoor facility*
Surface area: *13.599 m^2*
Contracting authority: *The Municipality of Utrecht*
Reuse assistance: *Dura Vermeer/ Sweco / NIBE*
Contract: *Public*
Year of completion: *2021*

Image source: Dura Vermeer

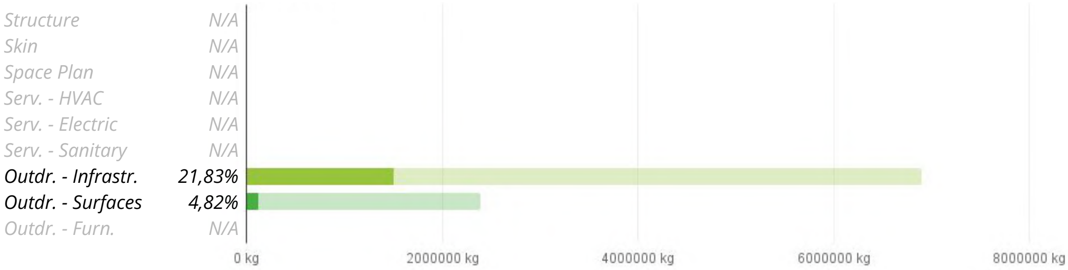
Croeselaan (avenue Croese) serves as a cycling and walking route to the Central Station of Utrecht. This avenue underwent a major renovation to become again one of Utrecht's most iconic green avenues. The City of Utrecht collaborated with Dura Vermeer to implement circular construction practices in this project.

The City of Utrecht wanted to make this renovation a circular pilot project, and turn Croeselaan into one of most circular roads in the Netherlands. The project received a quality score of 100% and had a fixed budget of 1,5 million euros.

The project and the tender process were designed to prioritise circular practices. The municipality awarded the contract for the "Realisation of a Sustainable Croeselaan" to the tenderer who presented the most economically advantageous bid based on the best value-for-money..

To ensure transparency and traceability, all materials and elements used in the project are documented in a material passport. The project includes a rare case of reuse in the Outdoor Infrastructure layer. It indeed managed to salvage 1.505 tonnes of mixed aggregate from the original installation and reuse this material for the new roadworks. The project also reused 115 tonnes of clay pavers, further contributing to the project's sustainability goals.

Reuse rate per layer (in mass)



Legend:

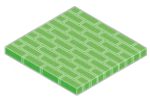
Reused mat. *Other mat.*

N/A = the project does not include this layer

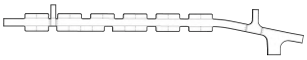
Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

Building elements reused in the project (per layer)

Mixed aggregate
1.505.000 kg
- 36.471 kgCO_2eq



Brick pavers
115.000 kg
- 3.938 kgCO_2eq



Cremerstraat

Same-site reuse of roadworks material and equipment for a new bicycle route.

Program: *Cycling infrastructure*
Project type: *Outdoor facility*
Surface area: *12.000 m²*
Contracting authority: *The Municipality of Utrecht*
Reuse assistance: *Echochain*
Contract: *Public*
Year of completion: *2018*

Image source : Gemeente Utrecht

The City of Utrecht has committed to prioritising cycling infrastructure. In recent years, the City made significant efforts to develop new bicycle routes. In February 2014, the City planned the renovation of the Cremer street to become an initial step to enhance the city cycling routes network. Not only was this project about soft mobility but it also aimed at reducing the environmental impact of asphalt in roadworks. It is in this context that the reuse of the pavers was investigated.

The City awarded the works based on the most economically advantageous tender. It means that the price was only a part of the assessment, together with other criteria. In this case, the call for tenders included criteria for reduced environmental impacts, such as the sustainability of the asphalt, the reduction of environmental damages, and the project's score on a CO2 ladder.

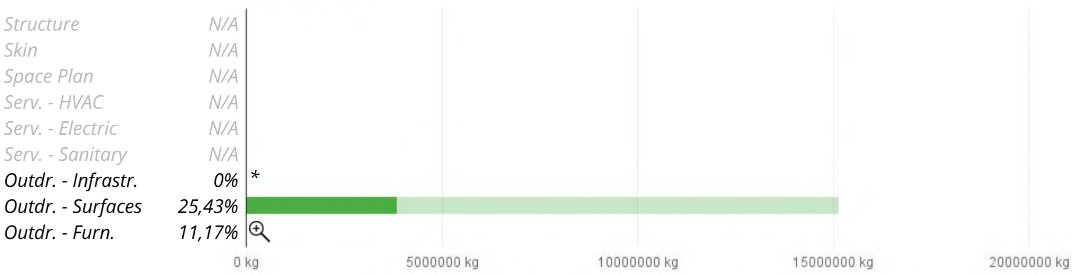
The contractor who was awarded the contract submitted an offer for a budget of about 1 million euros. It included strategies for sustainable construction, including reusing pavers from the original street.

In the end, the project managed to reuse different roadworks materials:

- Clay pavers (*Dutch clinkers*), chosen for their solidity and their aesthetic appeal. Some were reclaimed from the eastern part of the Cremer street while others were obtained from the reclamation trade.
- Concrete pavers, reclaimed from the parking lots and reused for marking the new parking places.
- Concrete curbs, reused on site.

Together, these materials reach a 25 % reuse rate for the Outdoor Surfaces layer.
The project also reused outdoor equipment, including 13 bicycle racks, 43 light posts and 3 parking metres (for a reuse rate of 11 % in the Outdoor Furniture layer).

Reuse rate per layer (in mass)



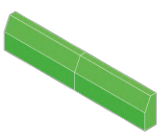
Legend:

Reused mat. *Other mat.*

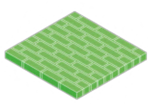
** = not calculated because the layer does not contain reused element*
= not visible at this scale

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

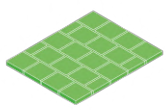
Building elements reused in the project (per layer)



Concrete curbs
2.628.282 kg
- 1.609 kgCO_2eq



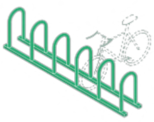
Brick pavers
630.720 kg
- 44.235 kgCO_2eq



Concrete pavers and slabs
501.975 kg
- 23.571 kgCO_2eq

Light post
898 kg

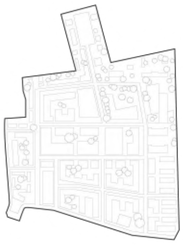
Parking meter
270 kg



Bicycle racks
91 kg

Interreg North-West Europe FCRBE

European Regional Development Fund



Garden of Mellinet

A wide range of applications for reclaimed stone in this landscape project.

Program: *Public garden*
Project type: *Outdoor facility*
Surface area: *130.000 m²*
Contracting authority: *Nantes Metropole Aménagement*
Architect: *TGTFP - Atelier Georges*
Contractor: *ID Verde (furnitures/landscape), Eurovia (roadworks)*
Reuse assistance: *Bellastock*
Engineering assistance: *BURGEAP, TUGEC, Nocitluca*
Contract: *Public*
Project duration: *2018-2021*

Image source : Atelier Georges

The garden of Mellinet is part of a large-scale urban project aiming at converting former military barracks into a residential area in the centre of Nantes. Partly completed in 2021, this phase of the project was about opening up the site to local residents by transforming the outdoor spaces into public family gardens.

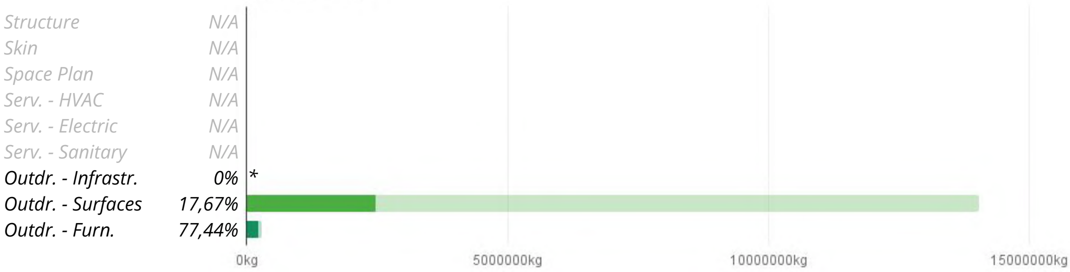
The project required the demolition of most of the former barracks. Prior to these demolitions, Bellastock carried out an inventory of the reusable elements. In it, they identified over 1.200 m³ of natural stone and timber that were then dismantled and stored on site. Bellastock investigated original ways to store these materials. Their stacking became a piece of temporary architecture, in a way to highlight their history and their potential to be reused.

Image source : Atelier Georges

Landscape designers Atelier Georges have shown great creativity in multiplying the possibilities for exterior landscaping, using the whole palette of reclaimed materials from the former buildings, mainly granite blocks. These were reused to build stair steps, Japanese steps, benches, road kerbs... The history of these old military barracks can be found in every detail of the garden.

The project we analysed only concerns roadworks and landscaping. It does not include the construction of new housing, which is part of another project. Unsurprisingly, it is in the Outdoor surfaces and Outdoor furniture layers that the project is achieving impressive reuse rates. That stone is such a heavy material obviously explains these results. In total, the project reused more than 2.700 tonnes of materials.

Reuse rate per layer (in mass)



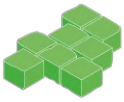
Legend:

Reused mat. *Other mat.*

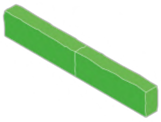
** = not calculated because the layer does not contain reused element*
N/A = the project does not include this layer

Data source for avoided GHG emissions: LBC database. This database provides data on GHG emissions at the level of material families, hence some discrepancies between the mass of the elements (corresponding to the exact product) and the GHG savings (corresponding to a more generic family).

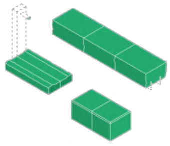
Building elements reused in the project (per layer)



Stone pavers
1.916.546 kg
- 6.260 kgCO_2eq



Stone kerbs
223,310 kg
- 238,6 kgCO_2eq



Stone furnishings
112.361 kg
- 36.901 kgCO_2eq