**RENOVATION AND CIRCULAR ECONOMY**

*Materials At The Heart Of The Transition Towards A Sustainable City*

# *Which Priorities and Objectives for Construction Materials?*

*17th of January 2024*

Wendy BOSWELL

Sustainable Building Facilitator

# PRESENTATION OF THE SPEAKER

Wendy Boswell is an architect with 20 years' experience in construction projects and she has worked on several exemplary buildings. She's part of the expert team of the Sustainable Building Facilitator for nearly 9 years now, where she provides guidance on questions concerning materials, circular economy and tools such as GRO. She's also part of advisory committees for construction projects in Brussels as Sustainable Building Facilitator. Wendy is also a researcher at CERAA, where she works on the development of the GRO-tool and on circular economy consultancy for the different regions in Belgium.

As part of the Sustainable Building Facilitator and as an architect, Wendy's often confronted with material selection criteria. This seminar will clarify how decisions in a renovation project impact material consumption and waste production. The focus will be laid on prevention and reuse, knowing that these topics have the highest priority. Other topics such as reversible building design, biodegradable materials and recycling will also be covered briefly.

# PRESENTATION OBJECTIVES

- Understand that resources are scarce
- Clarify how decisions in a renovation project impact material consumption and waste production
- How to address materials in a circular project

# CONTENTS

# TOWARDS A CIRCULAR ECONOMY

## Economy

- based on consumption
- relies on the assumption that raw materials are virtually inexhaustible

## Demography

- increase of the population
- increase of the purchasing power

## WORLD

- raw materials are exhaustible

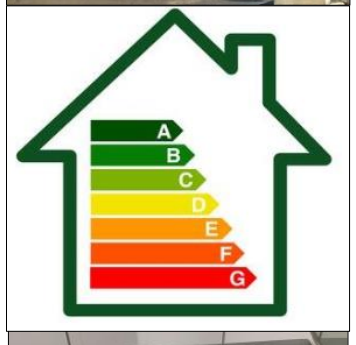
# TOWARDS A CIRCULAR ECONOMY

## Linear model in the construction sector

EXTRACT → MAKE → USE → THROW AWAY

**CONSUMER OF RESOURCES**

**33%** of incoming resources




**76%** of energy demand

**98 %** of water flow

**WASTE MAKER**

**33%** of non-household waste
650,000 T / year

**65%** of greenhouse gas emissions

© Sobotka

# TOWARDS A CIRCULAR ECONOMY

## Social and environmental consequences

- **Pollution**, **social inequalities** and **resource scarcity** are consequences of a linear economy

**POLLUTION**


**SOCIAL INEQUALITIES**


**RESOURCE SCARCITY**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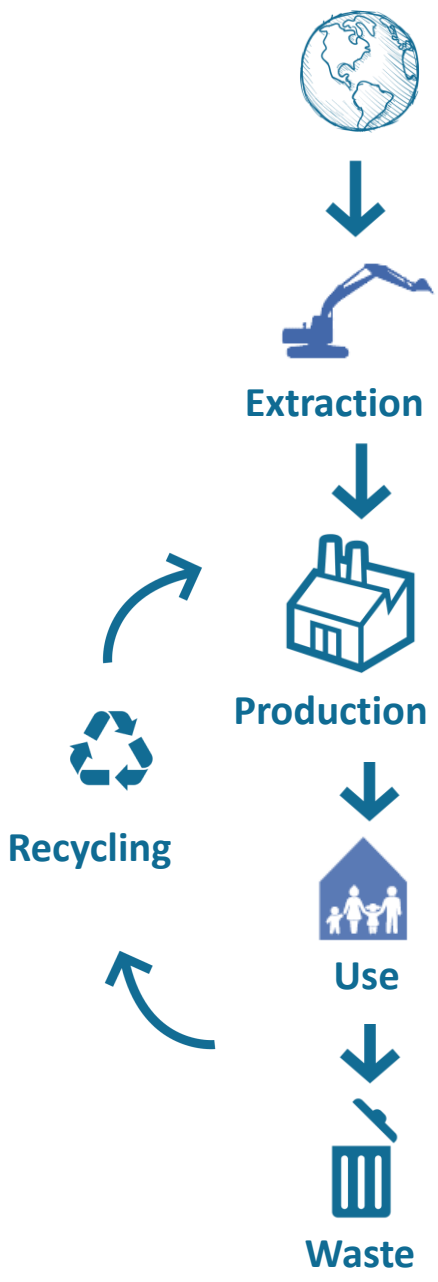
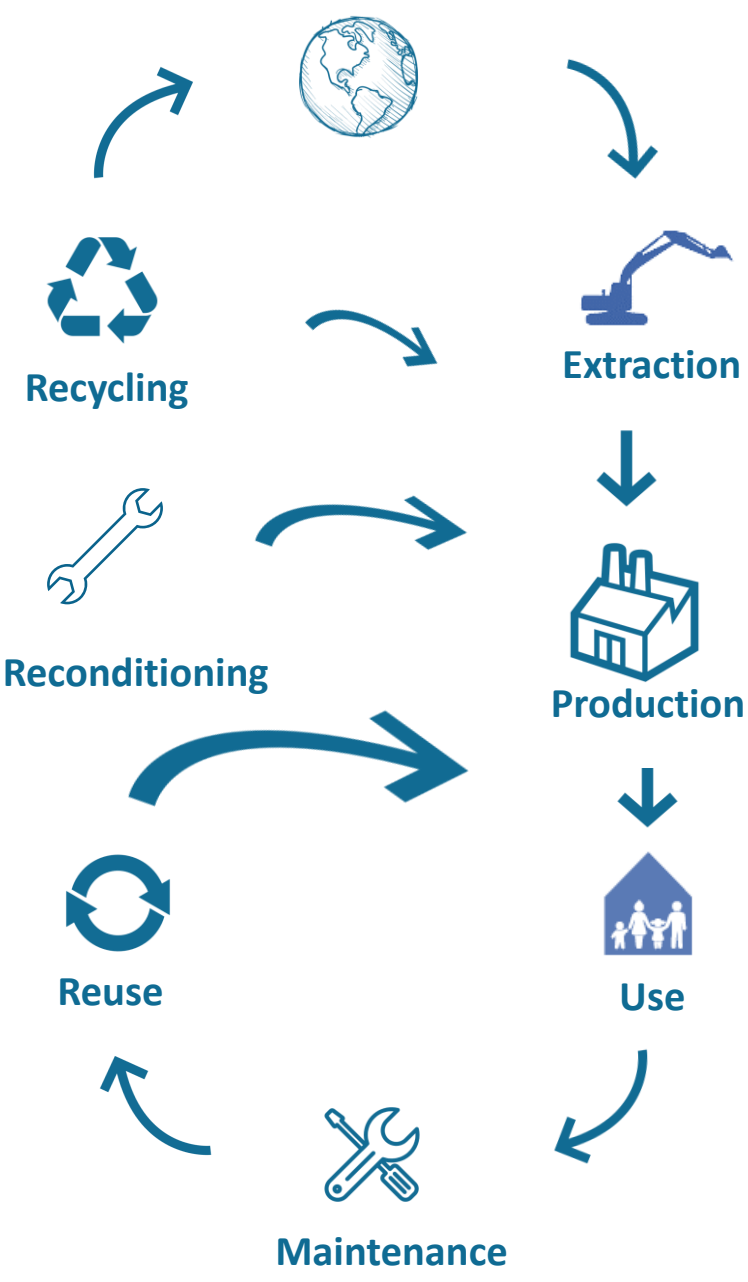
# TOWARDS A CIRCULAR ECONOMY

## Linear


## Recycle




## Circular



# TOWARDS A CIRCULAR ECONOMY

## A global consideration of GHG emissions

- *Increase of energy efficiency*
- *Reduction of **direct** greenhouse gas emissions*

- *Increase of circular economy*
- *Reduction of **indirect** greenhouse gas emissions*

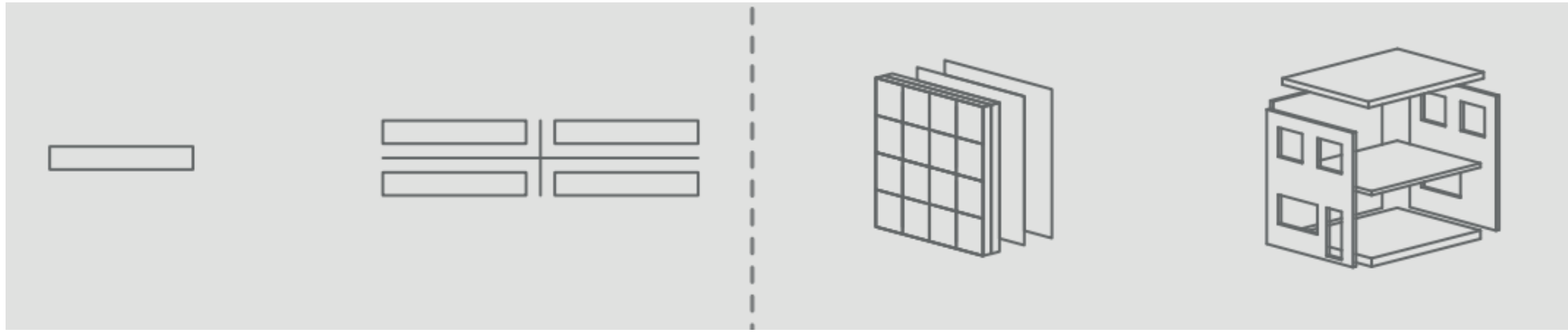


Renovating for energy efficiency leads to more material use, choose your materials wisely !

# MATERIALS, COMPONENTS AND ELEMENTS IN BUILDINGS

- Different levels in a building
- Different degrees of use and technical durability

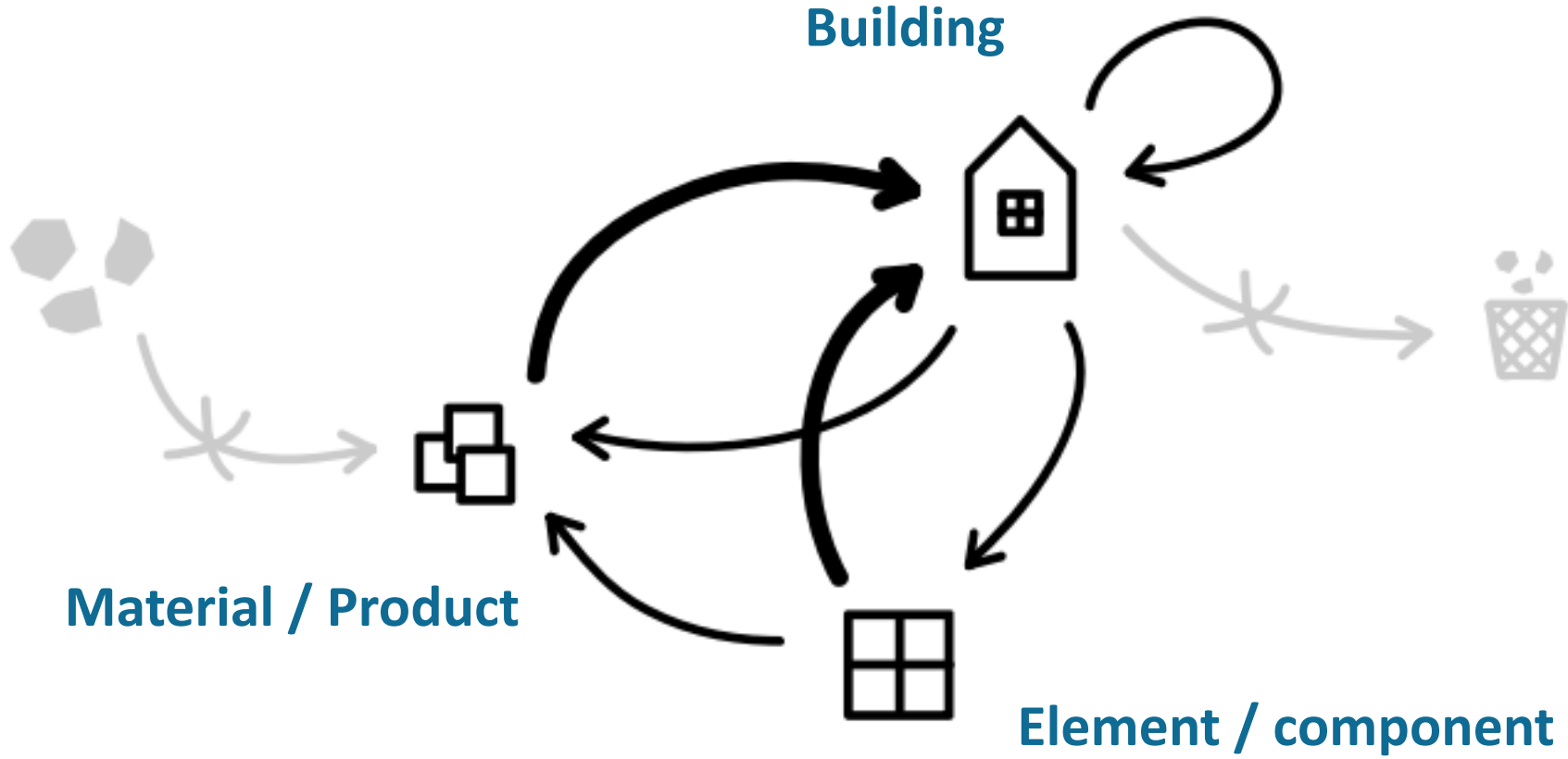
Material Component Element Building



© Guide Reversible Design – Brussels Environment

# MATERIALS, ELEMENTS AND COMPONENTS IN BUILDINGS

- No resource scarcity and no waste
- All materials are kept in circulation




© Design for Change, W. Galle VUB

# HOW TO REDUCE MATERIAL CONSUMPTION

## Priorities

- **Prevention** and **reuse** have the highest priority


© The Lansink Ladder – Milgro.eu

# HOW TO REDUCE MATERIAL CONSUMPTION

## Prevention

*© CERAA*

*Lack of prevention:*

*leak and damage*

*after renovation of the building*

# HOW TO REDUCE MATERIAL CONSUMPTION

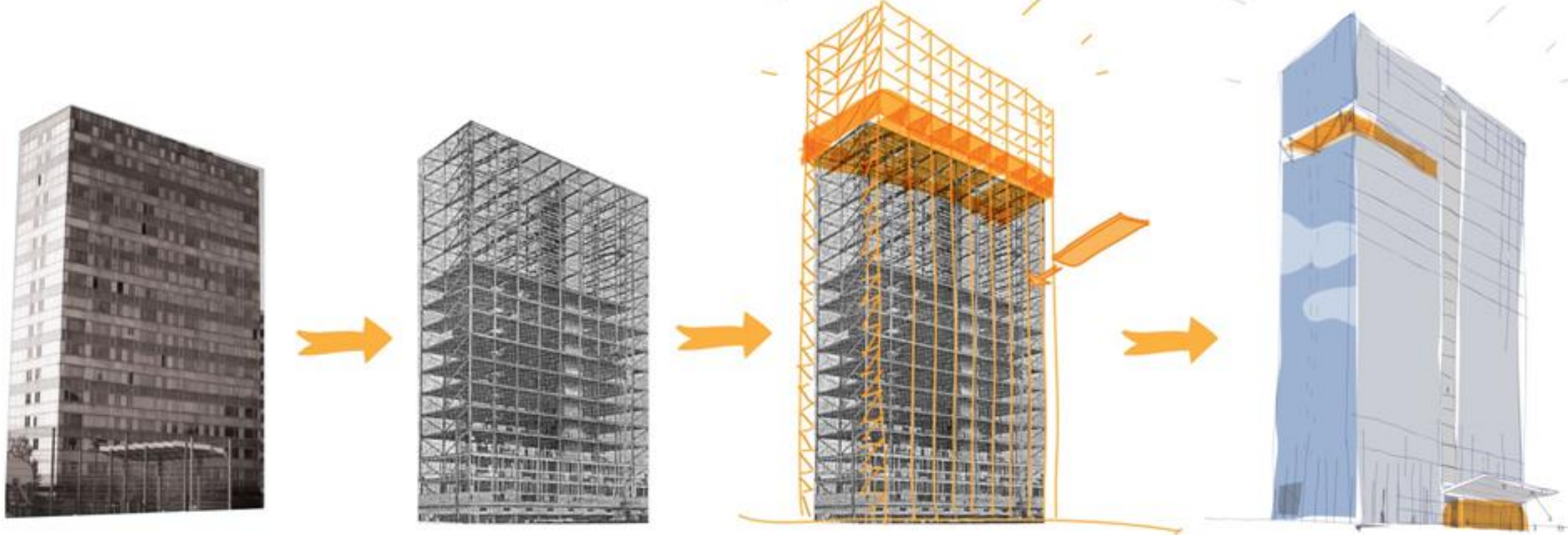
## Prevention

- **Rethink** the programm of your building
- **Conservation** of existing buildings and their history
- **Avoid demolition** of existing buildings
- Reduce material consumption through **maintenance** of buildings
- **Repair** where needed for a longer lifetime
- Using **no hazardous** materials

# HOW TO REDUCE MATERIAL CONSUMPTION

## Prevention

- **Conservation** of the existing buildings
  - *Analysis of the existing buildings*
  - *Ambition to maintain as much as possible*
  - *Do not waste resources and materials*



*© Dethier Architecture & A229 - Brunfaut toren*

*Good example of the conservation of the existing structure in a renovation project*

# HOW TO REDUCE MATERIAL CONSUMPTION

## Prevention

- **Afternoon visit**

*USQUARE*

- ► Conservation of historical buildings
- ► Temporary occupation
- ► Reuse

© Usquare - SAU - [Be Sustainable 2023]

# HOW TO REDUCE MATERIAL CONSUMPTION

## Reuse

[© Opalis]

# HOW TO REDUCE MATERIAL CONSUMPTION

## Reuse

- **Reuse** of existing buildings, components, elements and materials
- Preserve **historical value**
- **Avoid** buying new materials
- **Less** demolition waste
- Need for **careful** deconstruction
- Need for **tests** (deconstruction, characteristics…)

# HOW TO REDUCE MATERIAL CONSUMPTION

## Reuse

- **Reuse in situ**
  - *Reuse directly on the construction site*
  - *Preserve historical value in the building itself*
  - *Avoid transportation*
- **Reuse ex situ**
  - *Materials leaving the construction site and reuse elsewhere*
- **Incoming reuse**
  - *A project using reused materials instead of new*

# HOW TO REDUCE MATERIAL CONSUMPTION

## Reuse

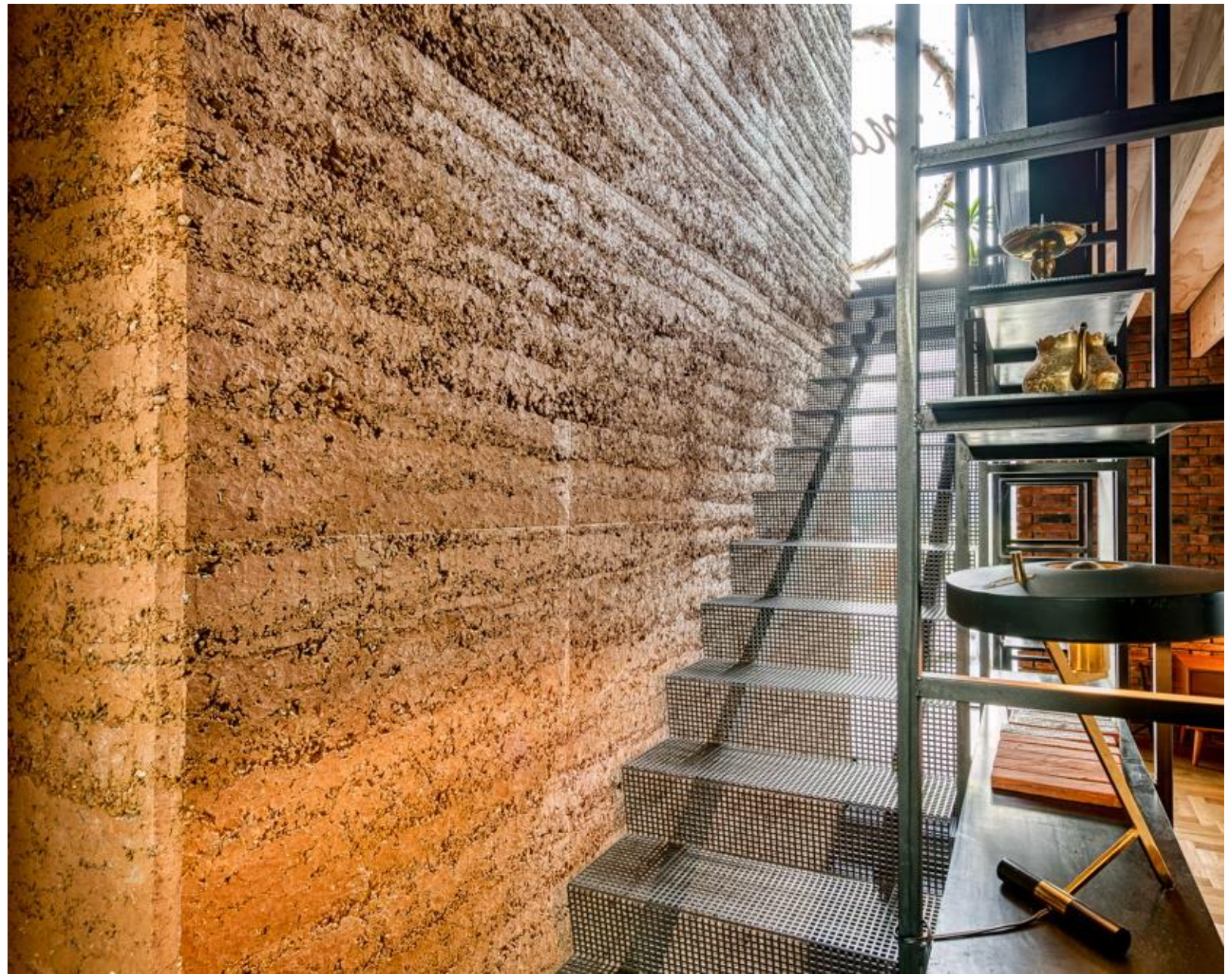
- **Example**
  - *Reuse of brickwork*
    *36 m² of facade*

*© Karbon - Opalis*

# HOW TO REDUCE MATERIAL CONSUMPTION

## Reuse

- **Example**
  - *Earth based materials*



*© Maarten De Bouw – AST77 – BC Materials*

# HOW TO REDUCE MATERIAL CONSUMPTION


© FCRBE

## Reuse

- **Inventory of existing materials and elements**
  - *Template and guide (FCRBE)*
  - *Detailed analysis of existing building*
  - *Assembly techniques*
  - *Potential for preservation or reuse*

# HOW TO REDUCE MATERIAL CONSUMPTION

## Reuse

- **Inventory of existing materials and elements**

RECLAMATION INVENTORY

ELEMENT SHEET

Element identification

| | |
|---|---|
| ID number | A1 |
| Element name | door THEUMA - (left opening) |

Complementary pictures

Element data

| | |
|---|---|
| brand | Theuma |
| Specificity | 51 pcs, left opening (according to EN 12519:2004) |
| Implementation date | 2012 |
| Certification | Fire resistance of 30 minutes, Validity Belgian ATG (ATG 2287) (see picture) applicable until 2020. |
| Constituent Material | Core: Hardwood<br>Finishing: Laminated with black HPL coating<br>Door Handles: stainless steel |
| | / door handles are in perfect condition |

to ICE DB V2,0 7 Nov 2019)

Asbestos Inventory: Confirmed free of asbestos hinges

Additional documents

| | |
|---|---|
| asbestos inventory | inventory dd. 20/11/2021 |
| Location plan | ref. as build plan dd. 12/05/2012 |
| Original manufactureres catalogue | ref. Theuma, 2011 |

RECLAMATION INVENTORY

PRIMARY INFORMATION

| Identification | | | Picture | Quantity | | Dimensions | | | | Mass | | Total | | | Location in situ | Condition | Remark(s) | Reclamation phase | suggested destination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID number | Element group | Element name | | amt. | unity | width | length | hight | unity | amt. | unity | total surface | total volume | total mass | | | | phase for collection on site | actor/site |
| A | Interior doors | | | 103 | pce | | | | | | | | | | | | | pre-deconstruction | |
| A1 | | door THEUMA (left opening) |  | 51 | pce | 92 | 3,4 | 211 | cm | ~50 | kg | / | / | 2550 | Building A, 22nd floor | A few doors have scratches on their surface | Fire-resistant 30 min. | pre-deconstruction | reclamation dealer |
| A2 | | door THEUMA (right opening) |  | 52 | pce | 92 | 3,4 | 211 | cm | ~50 | kg | / | / | 2600 | Building A, 22nd floor | A few doors have scratches on their surface | Fire-resistant 30 min. | pre-deconstruction | reclamation dealer |

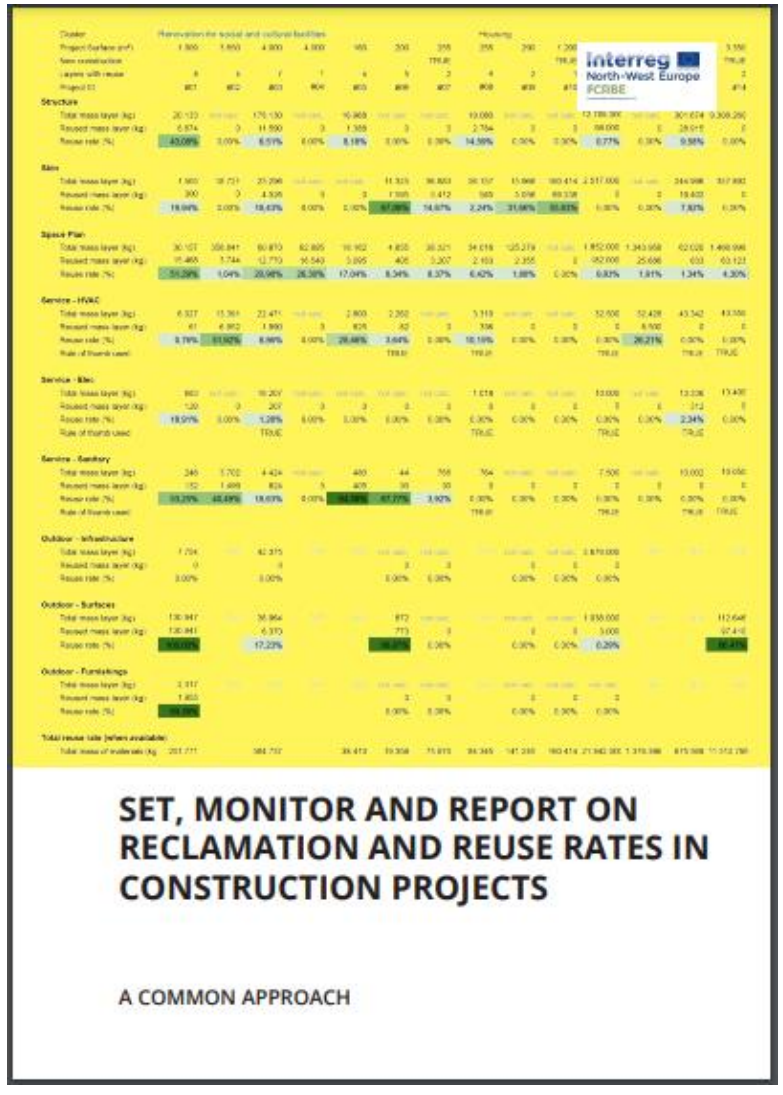
# HOW TO REDUCE MATERIAL CONSUMPTION


© FCRBE

## Reuse

- **Procurement strategies for material reuse**
  - *guide (FCRBE)*

# HOW TO REDUCE MATERIAL CONSUMPTION




© FCRBE

## Reuse

- **Definition, monitoring and reporting of reuse targets**
  - *Guide (FCRBE)*
  - *Setting a reuse target for the project*
  - *Inspiration for circular specifications*

# HOW TO REDUCE MATERIAL CONSUMPTION


© FCRBE

## Reuse

- **Choice of materials**
  - *Material sheets (FCRBE)*
  - *Reuse guidelines for 36 materials*

# HOW TO REDUCE MATERIAL CONSUMPTION

## Reuse

- **Afternoon visit**

*BATITERRE*

- Supplier of reclaimed building materials
- Recovering
- Reconditioning

© hub.brussels Ecobuild - Batiterre

# HOW TO REDUCE MATERIAL CONSUMPTION

## Recycling

# HOW TO REDUCE MATERIAL CONSUMPTION

## Recycling

- Only when preservation and reuse aren't possible
- **Upcycling** instead of downcycling
- Choose materials that are **upcyclable**
- Choose products with **recycled content**

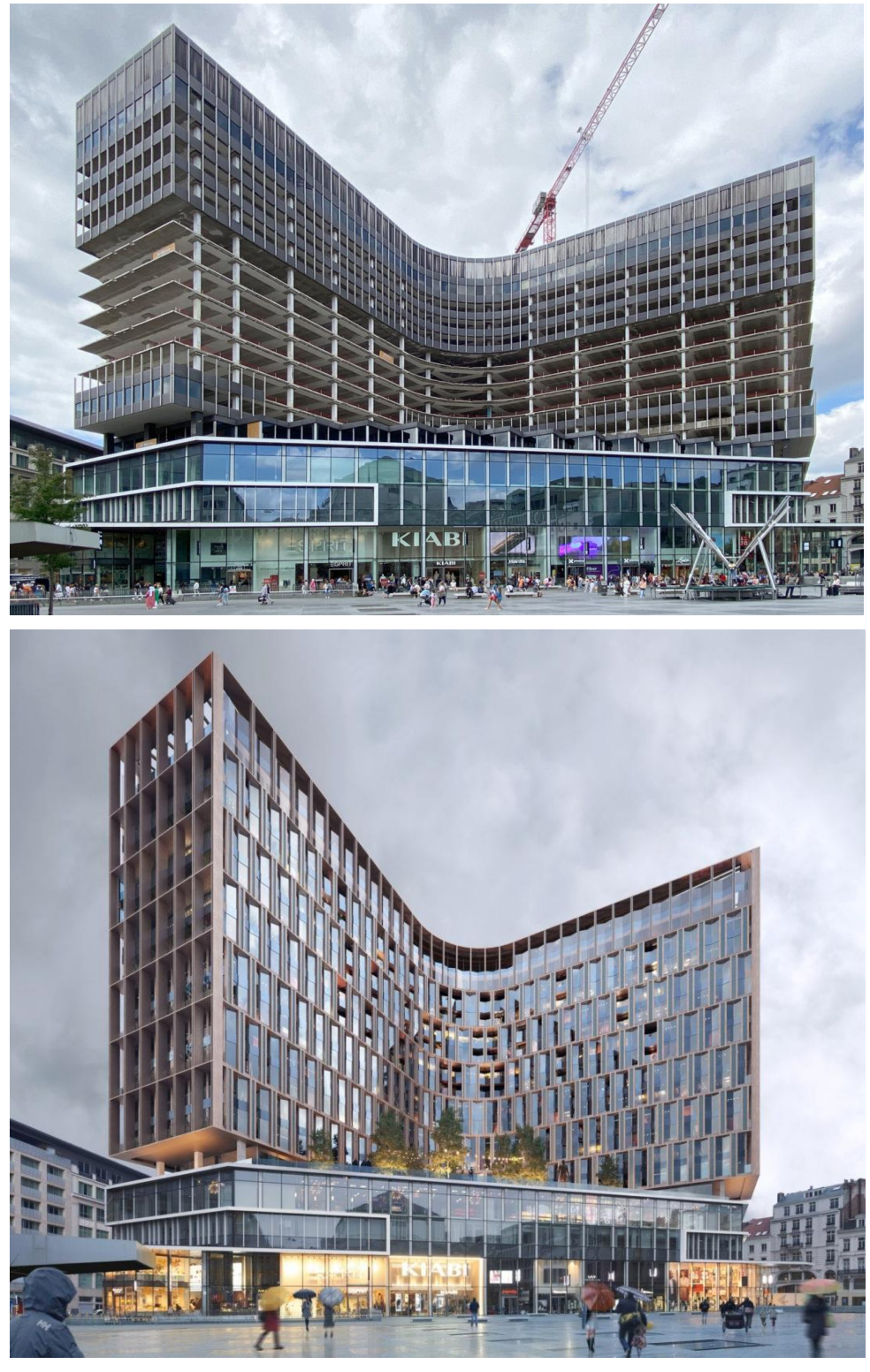
# HOW TO REDUCE MATERIAL CONSUMPTION

## Recycling

- **Afternoon visit**

*OXY*

- Recycling of 90% of demolition waste
- Integration of 75% of recycled aluminium into the facade
- Reuse of existing structures
- In situ reuse
- Urban mining




© Oxy Project – Snohetta / BINST architects / DDS+ / ADE

# HOW TO REDUCE MATERIAL CONSUMPTION

## Reversible building design

*@ Mokulock*

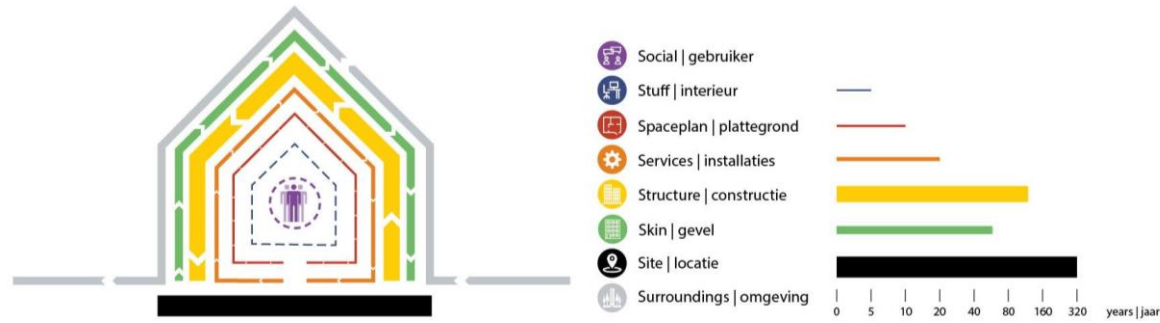
# Reversible building design

**Design for change**


© Durmisevic

General principles ?

- ▶ **Buildings as material banks**
- ▶ **Reversible building design**
  - Spatial reversibility
  - Technical reversibility

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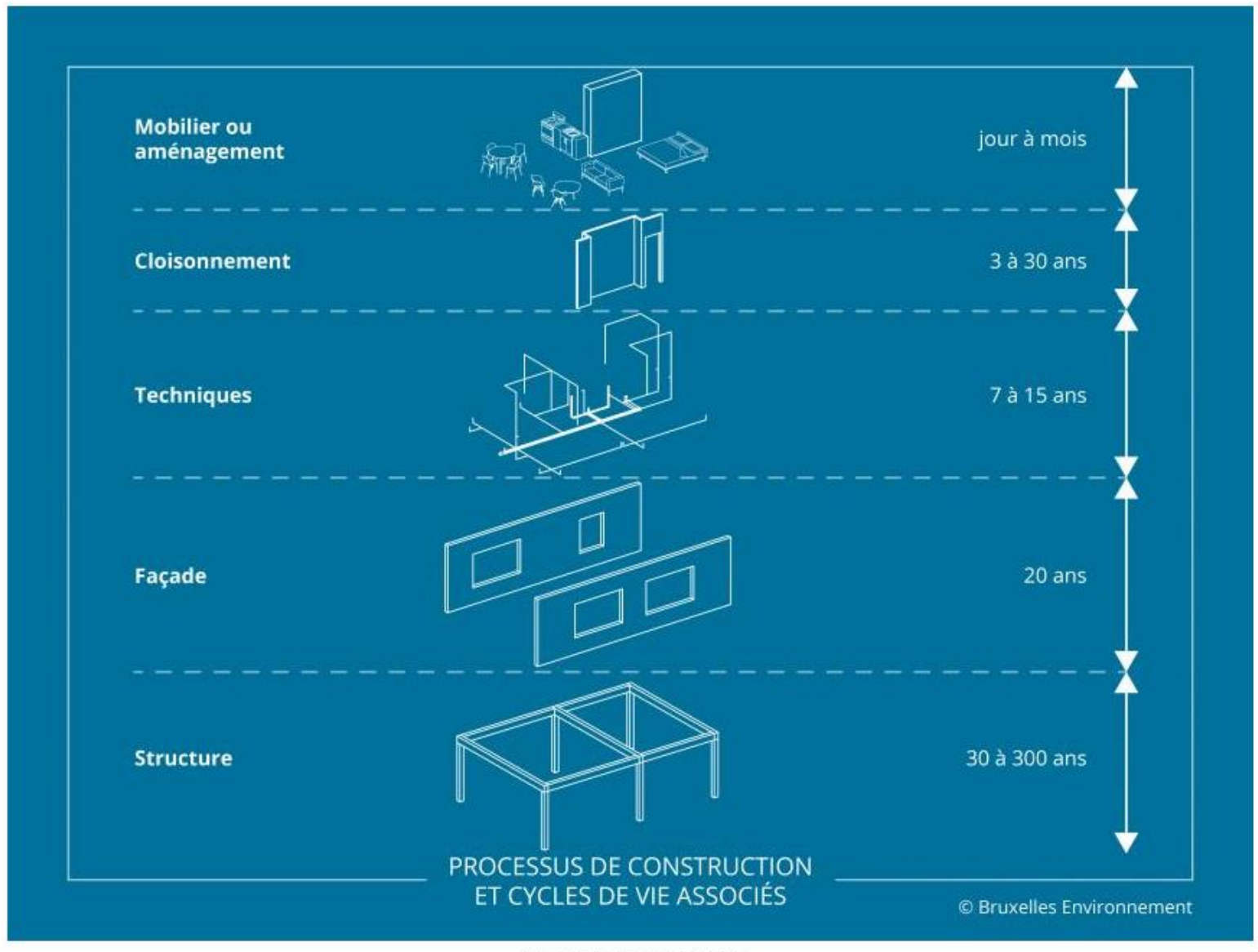
# Reversible building design

## Design for disassembly and future reuse

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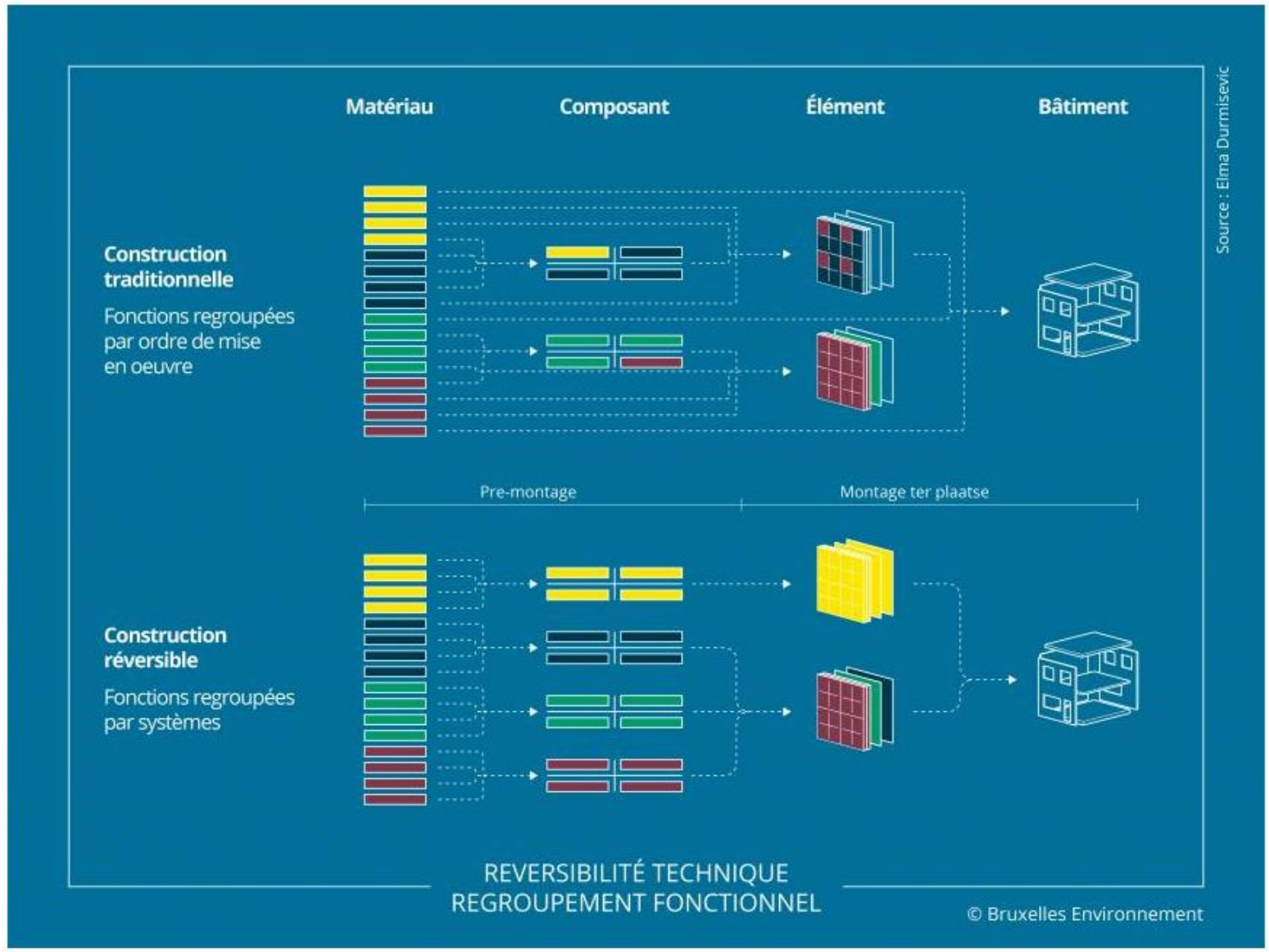
# Reversible building design

## Design for disassembly and future reuse




*Source : Elma Durmisevic © Bruxelles Environnement*

# Reversible building design

## Spatial & technical reversibility

Reconversion of old buildings is often difficult

- ► **Lack of proper insulation**
- ► **Do not comply to norms (fire prevention…)**
- ► **Floor height is too low**
- ► **Depth of the building**
- ► **No technical reversibility of components**

*© Séverin Malaud / AgwA: transformation of an old office building into a school with sporting facility and a cafeteria in Molenbeek*

# HOW TO REDUCE MATERIAL CONSUMPTION

## Reversible building design

### Design for change

► Checklist Reversible design

**REVERSIBLE DESIGN**
CHECKLIST

brussels environment .brussels

deze tool is ook beschikbaar in het Nederlands | cet outil est aussi disponible en français

**CONTEXT**

This checklist, developed by **Brussels Environment**, aims to support clients and designers in the realization of reversible and circular buildings. Reversible design is synonymous with future-oriented construction and renovation. Buildings are designed in such a way that spatial typologies can easily be adapted and that building components can be disassembled and reused. In doing so, we strive to keep the value and quality of the building and its components as high as possible, with a minimum of material damage and as little construction waste as possible.

The checklist is conceived as a **qualitative design tool**. It can be used from early on in the design process, for example in the definition of the project brief, but is also a good reference document when making the first design sketches or to follow up on design choices throughout the different stages of the project.

This checklist focuses exclusively on the **reversibility** of buildings. Other aspects, such as the reuse of existing materials, and the assessment of the environmental impact over a whole life cycle, are dealt with in other, complementary tools. These tools are presented in the 'Guide Bâtiment Durable' (FR) available on this web page:
www.guidebatimentdurable.brussels/fr/outils.html?IDC=10990

Those who wish to delve further into the topic of this checklist can consult the '**Guide Conception Réversible**' (FR). For most strategies in this checklist, info buttons will take you to the corresponding content in the' **Guide Bâtiment Durable**' (FR), providing further explanations and examples based on the contant of the '**Guide Conception Réversible**' (FR)

Many of the strategies in this checklist are based on indicators from the **Reversible Building Design Tools** (RBD), developed by Dr. Elma Durmisevic. These quantitative tools were developed within the H2020 European innovation project **Buildings as Material Banks** (www.bamb2020.eu). You can explore these tools on the following web pages:
www.bamb2020.eu/wp-content/uploads/2019/05/Reversible-Building-Design-Strategies.pdf
www.bamb2020.eu/wp-content/uploads/2018/12/Reversible-Building-Design-guidelines-and-protocol.pdf

The use of this checklist is subject to **licensing conditions**. These are described in the tab 'Legal disclaimer'.

**SCOPE AND OBJECTIVES**

**The purpose of this checklist is to**

- provide different **design solutions** for the spatial and technical reversibility of buildings
  The checklist can be considered a catalogue of different design options and strategies. Depending on the project context and reversibility ambitions, it allows you to define and work out a specific set of solutions.
- provide objective criteria to **compare** design proposals

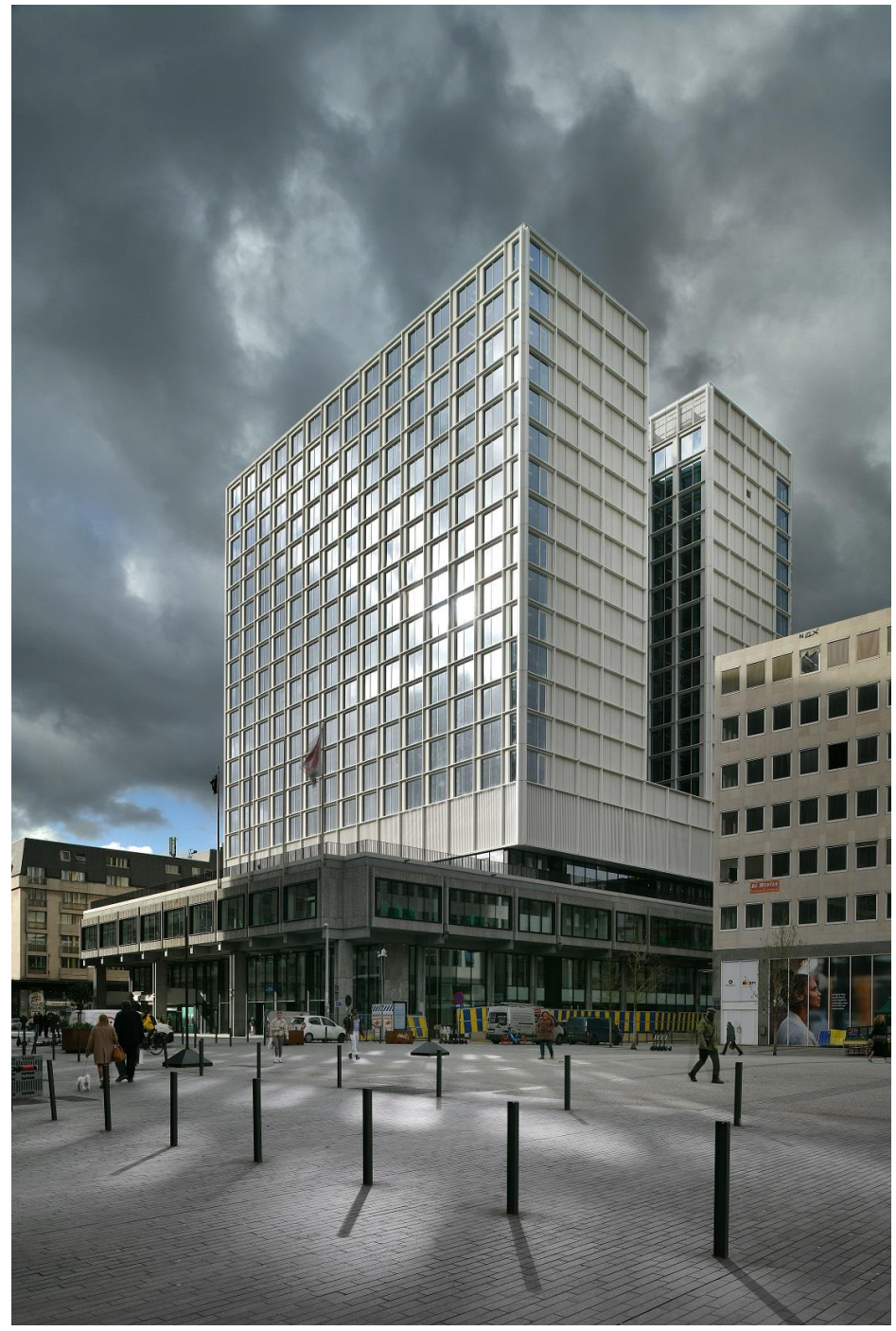
# HOW TO REDUCE MATERIAL CONSUMPTION

## Reversible building design

- **Afternoon visit**

*MULTI*

- Future proof
- 98% of the facade is removable and recyclable
- Reuse



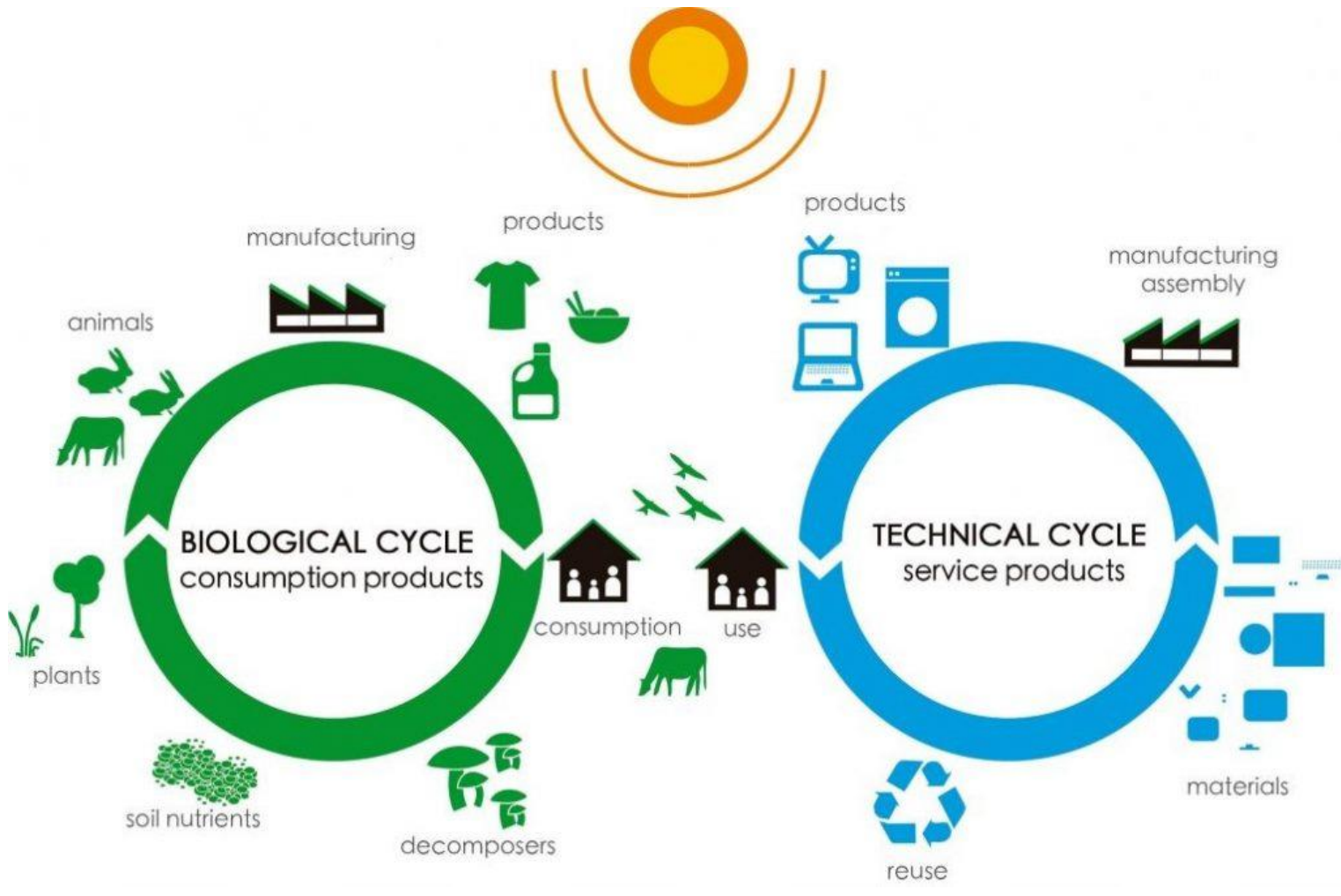
© Multi Project – Conix – RDBM Architects

# Biodegradable materials

© EcoCocon

# HOW TO REDUCE MATERIAL CONSUMPTION

## Biodegradable materials

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# HOW TO REDUCE MATERIAL CONSUMPTION

## Biodegradable materials

- **Afternoon visit**

*AG CAMPUS*

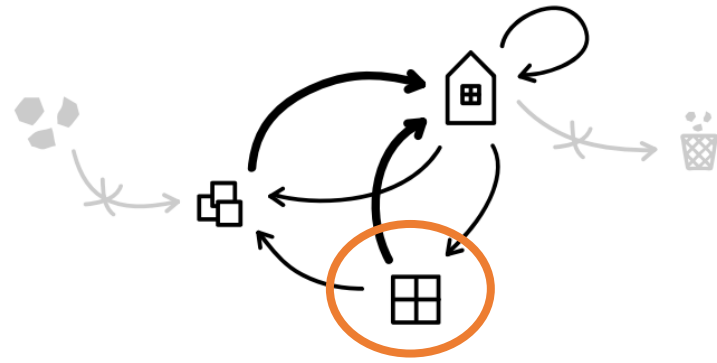
- Timber
- Green roof
- Gardens
- Reuse

© Stijn Bollaert - AG Campus – EVR architecten - [be.exemplary 2019]

# CONCLUSION

## CIRCULAR PRINCIPLES FOR MATERIALS

- A circular strategy on a **component level,** means they are:



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reused

reversible

simple

fast

compatible

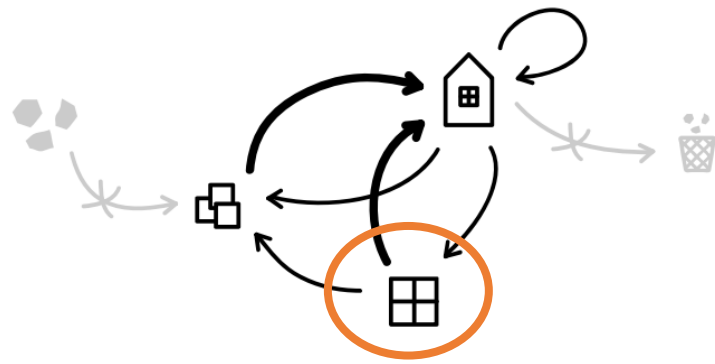
robust

© c-bouwers.be

# CONCLUSION

## CIRCULAR PRINCIPLES FOR MATERIALS

- A circular strategy on a **component level,** means they are:



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manageable

independent

layered

prefabricated

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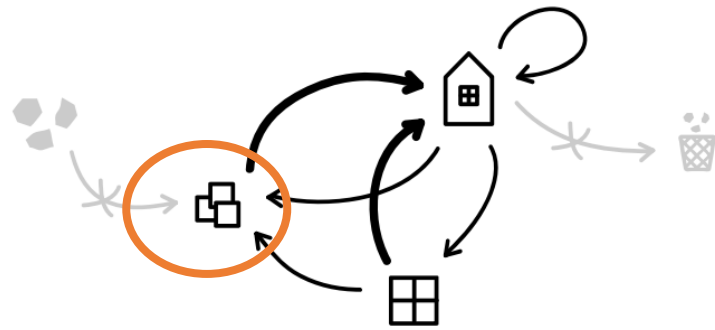
# CONCLUSION

## CIRCULAR PRINCIPLES FOR MATERIALS

- A circular strategy on a **material level,** means they are:



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recycled

renewable

healthy

upcycled

biodegradable

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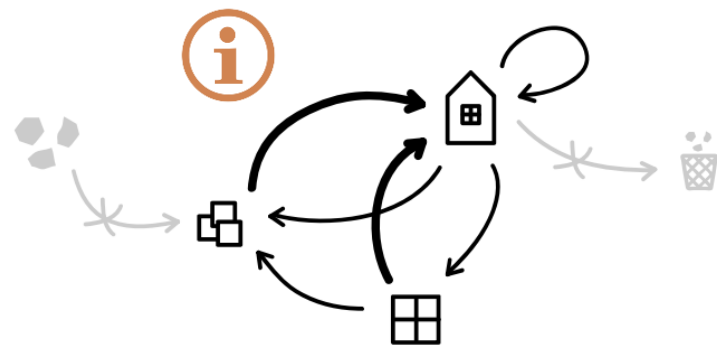
# CONCLUSION

## CIRCULAR PRINCIPLES FOR MATERIALS

- A circular strategy on a material level, means **information** is provided:



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material passport

environmental impact

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# KEY POINTS

- Look at what’s already there: prevention and reuse are the highest priority
- Change is the only constant: design for change
- Choose and use new materials wisely

# TOOLS, WEBSITES, BIBLIOGRAPHY

- Sustainable Building guide

  www.guidebatimentdurable.brussels
  > 10 themes > Circular Economy

- Vademecum Circular construction

- Circular Flanders

- OVAM: How to make my building future proof?

- Opalis: documentation on reuse, suppliers and materials for reuse

- Totem: Tool to Optimise the Total Environmental impact of Materials

- Buildwise: circular concrete

- C-bouwers: database for circular products

# CONTACT


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