

GTB LAB

www.gtb-lab.com

EU Laboratory for Green Transformable Buildings

by Elma Durmisevic

GTB Lab is an EU Laboratory for Circular Buildings that showcases circular building design and construction solutions. In the lab testing and validation tools measure the performance of circular design and construction.

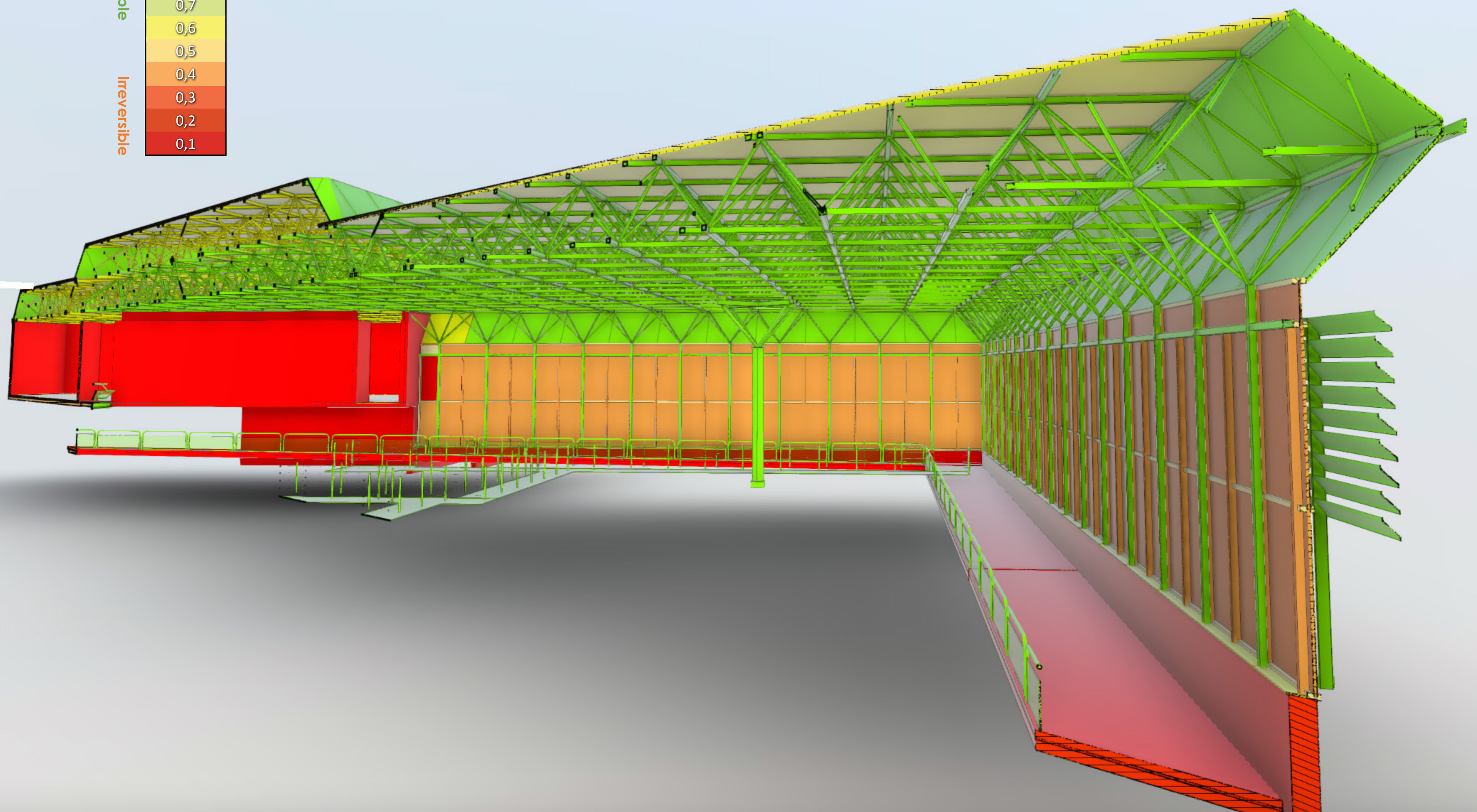
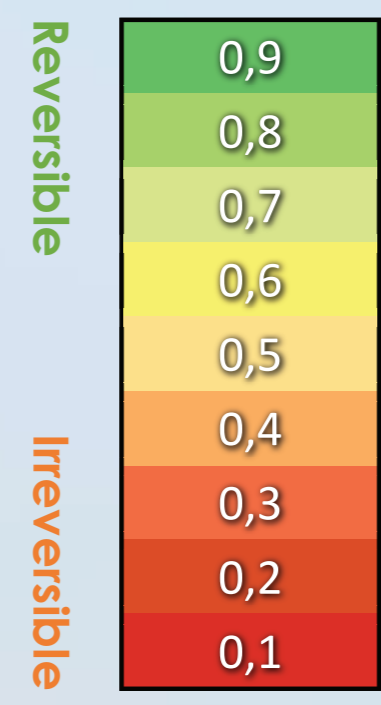
GTB Lab demonstrates:

- Circular building design
- Construction without value degradation of materials
- Use of Digital tools/BIM for management of circular material streams
- Standardisation of Circularity Profiles
- management of circular material streams

Architect: Elma Durmisevic, 4D Architects
Structural Engg: Jaap van Heijster, AB
Installations: Jaap Wiedenhoff, ABT bv
Contractor: Jongen Bouwpartners
Suppliers: De Groot Vroomshoop Groep, Jansen AG, Pilkington, TheNewMakers, Rodeca, AMMANU



Building Reuse Potential



Reversible BIM

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Digital inventory of Reuse Potential

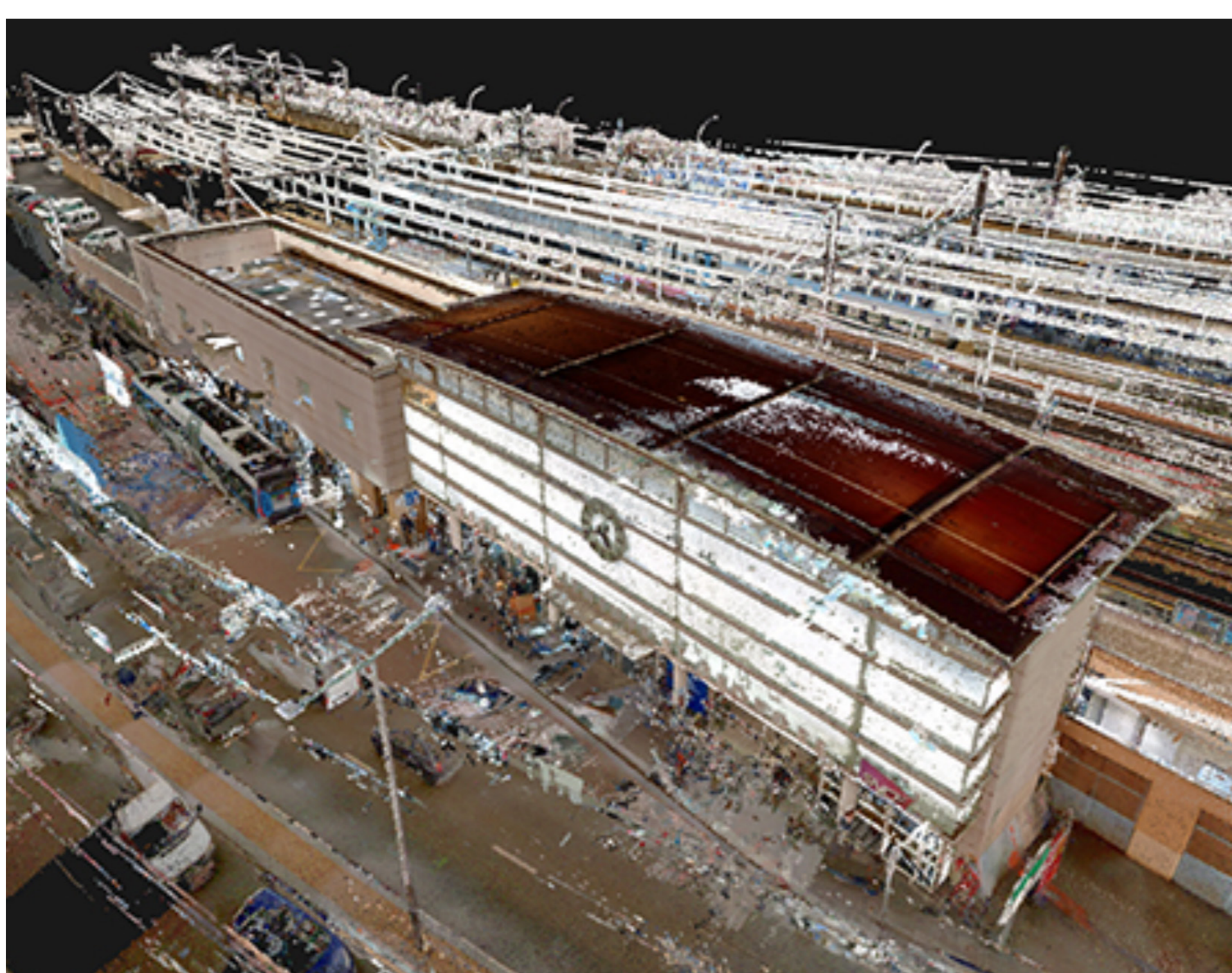
Reversible BIM is a digital tool that provides insight in the reuse potential of buildings and materials reflecting their embodied value and reuse strategies.

To do this, the model analyzes relations and dependencies that individual elements have within a building structure. The reuse potential of materials is mainly determined by their technical and physical dependencies within a building.

1. Data gathering

Point cloud data from 3D surface scanning is imported into Revit as the main modeling reference.

3D scanning files are mapped with the **technical drawings** which provide additional information not included in the point cloud.



2. Data processing

A **basic BIM model** is created taking care that all elements are clustered according to their main building function and their can be relations analyzed.

3 BIM plugins

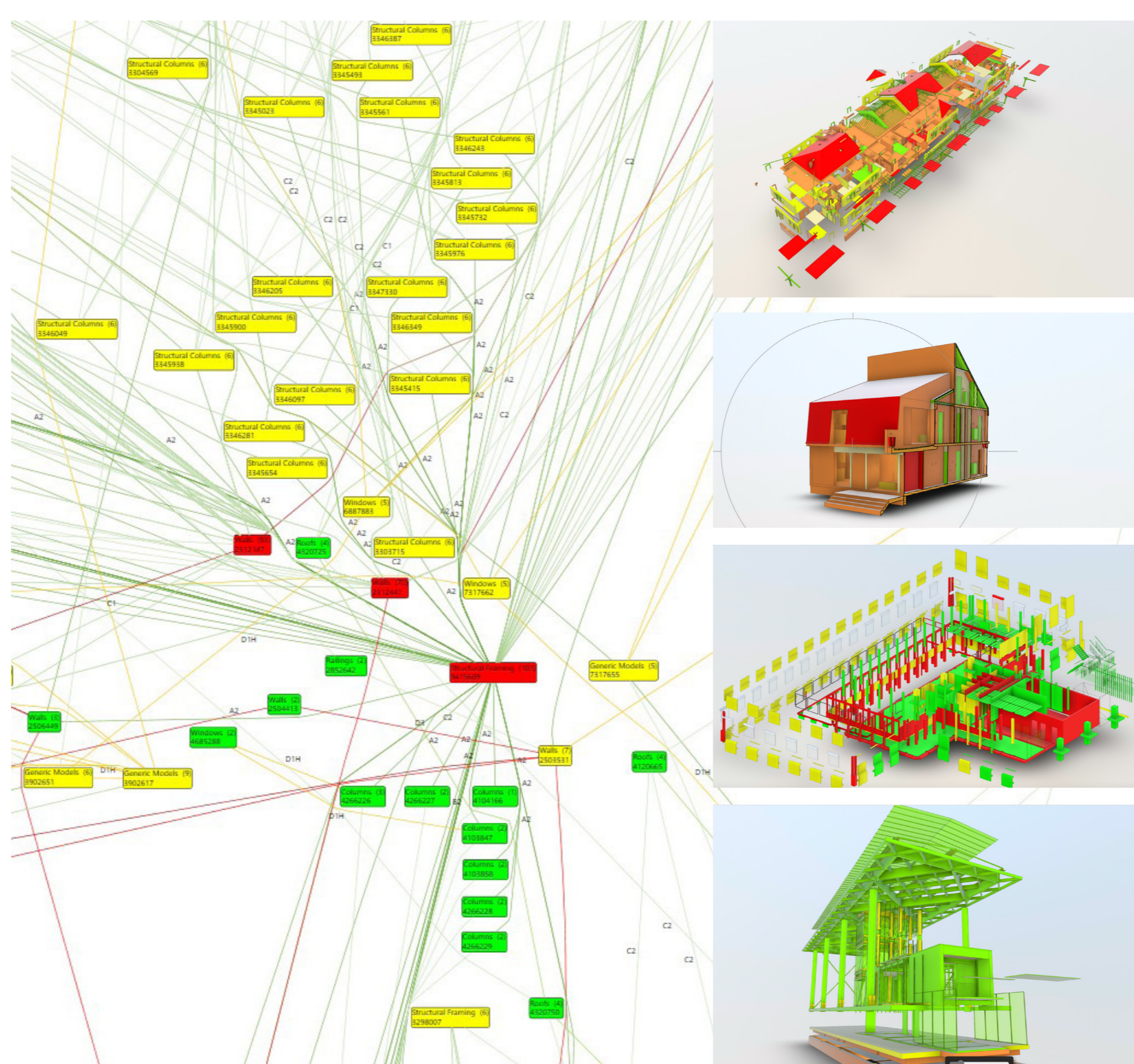
Reversible BIM plugins are used to add to each element reversibility parameters, such as connection type, lifecycle, basic function, assembly sequence, carbon footprint, level of prefabrication, product geometry, etc.

4. Revit2Excel2Revit

Reuse Potential is calculated and being exported to an element sheet including parametric values per element, per material type and per building function.

5. Reversible BIM

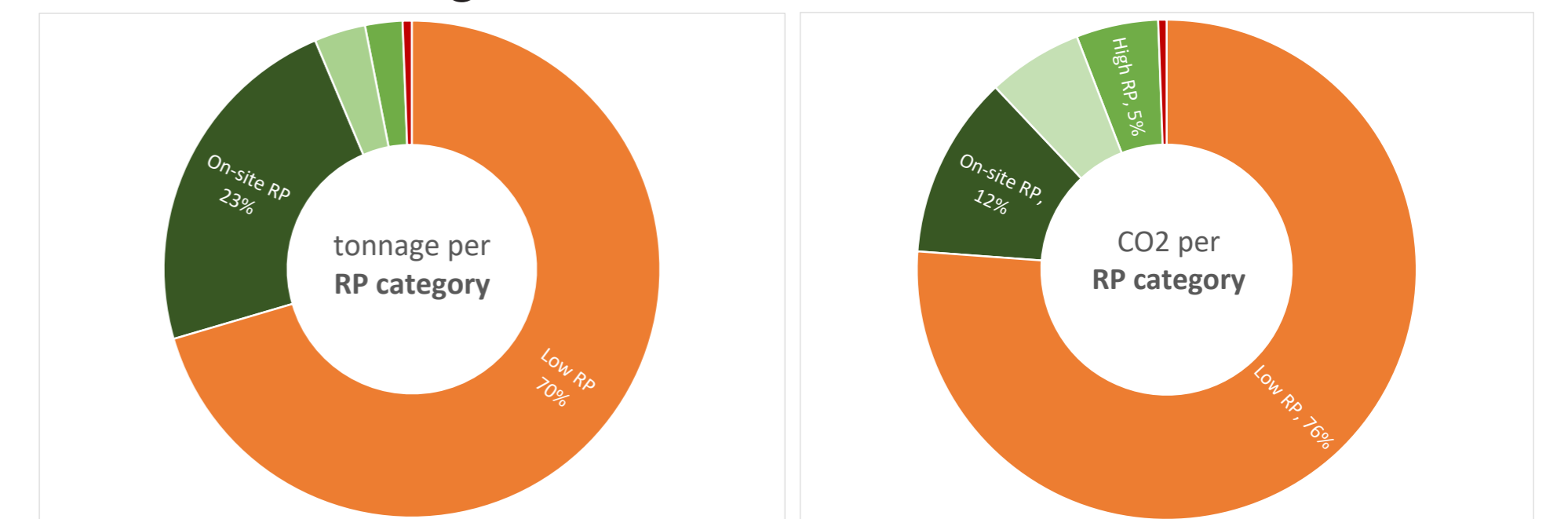
A **color-coded 3D Viewer** enables non-Revit users to view the model and retrieve reversible information through several custom-made color-coded views. The colors reflect the element functions, the assembly sequence, number of relations between elements, reversibility and Reuse Potential of the materials.



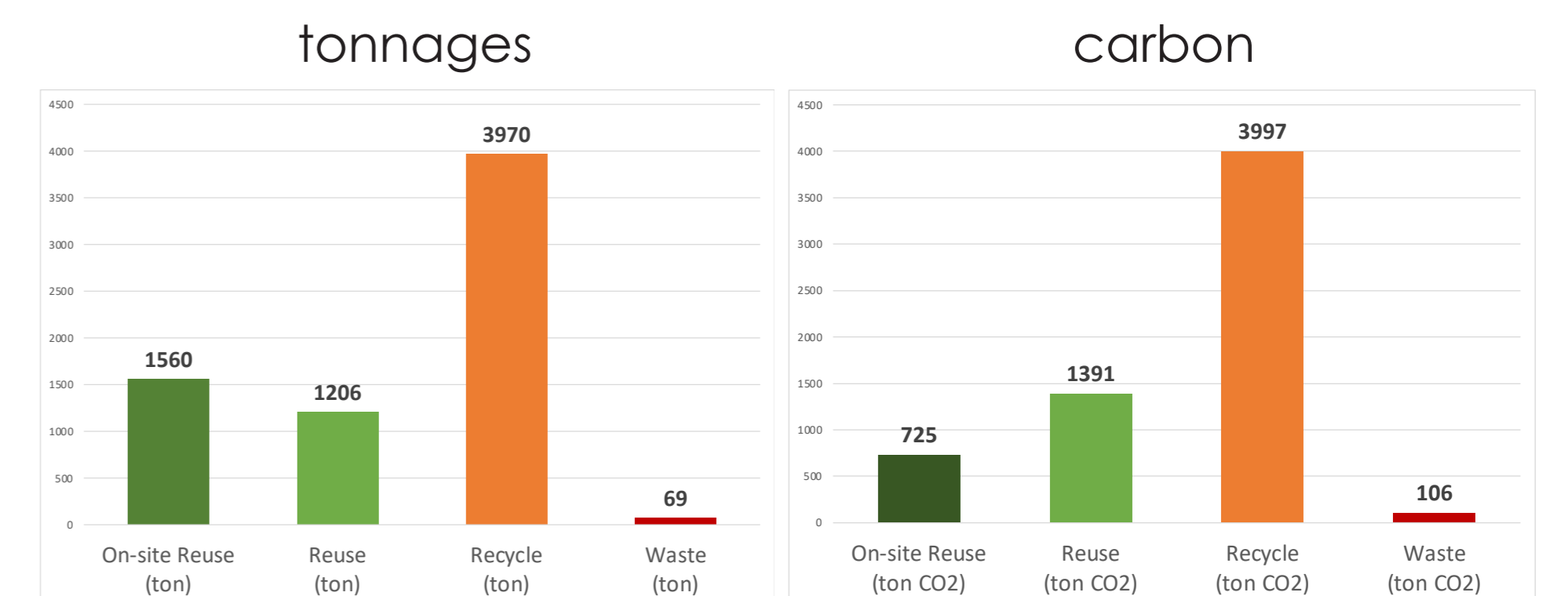
6. Reporting reversibility

Reversible BIM provides **several types of reports in graphical or numerical form** for decision-makers, such as position, dimensions, tonnages, carbon emissions and volume, and most important: the Reuse Potential of the material. This value corresponds to the reuse options of materials, deconstruction steps and indicates the embodied value of the material.

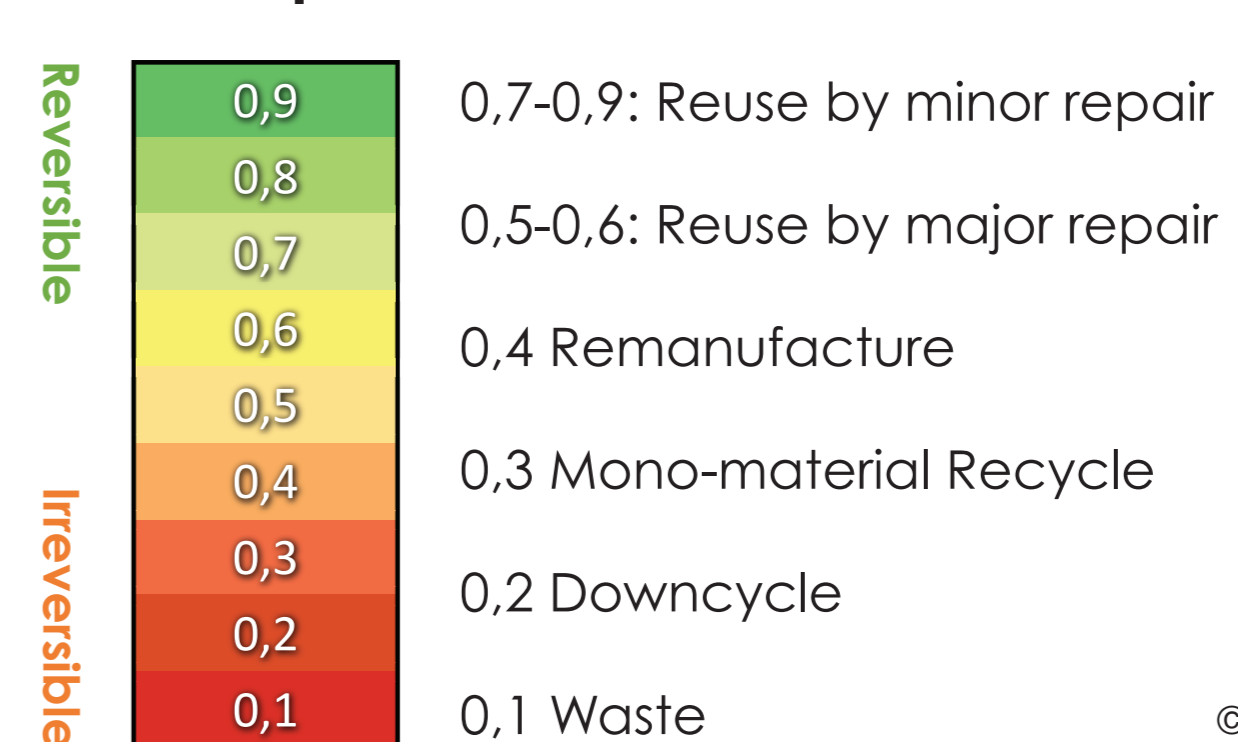
Distribution of materials



Reuse scenarios



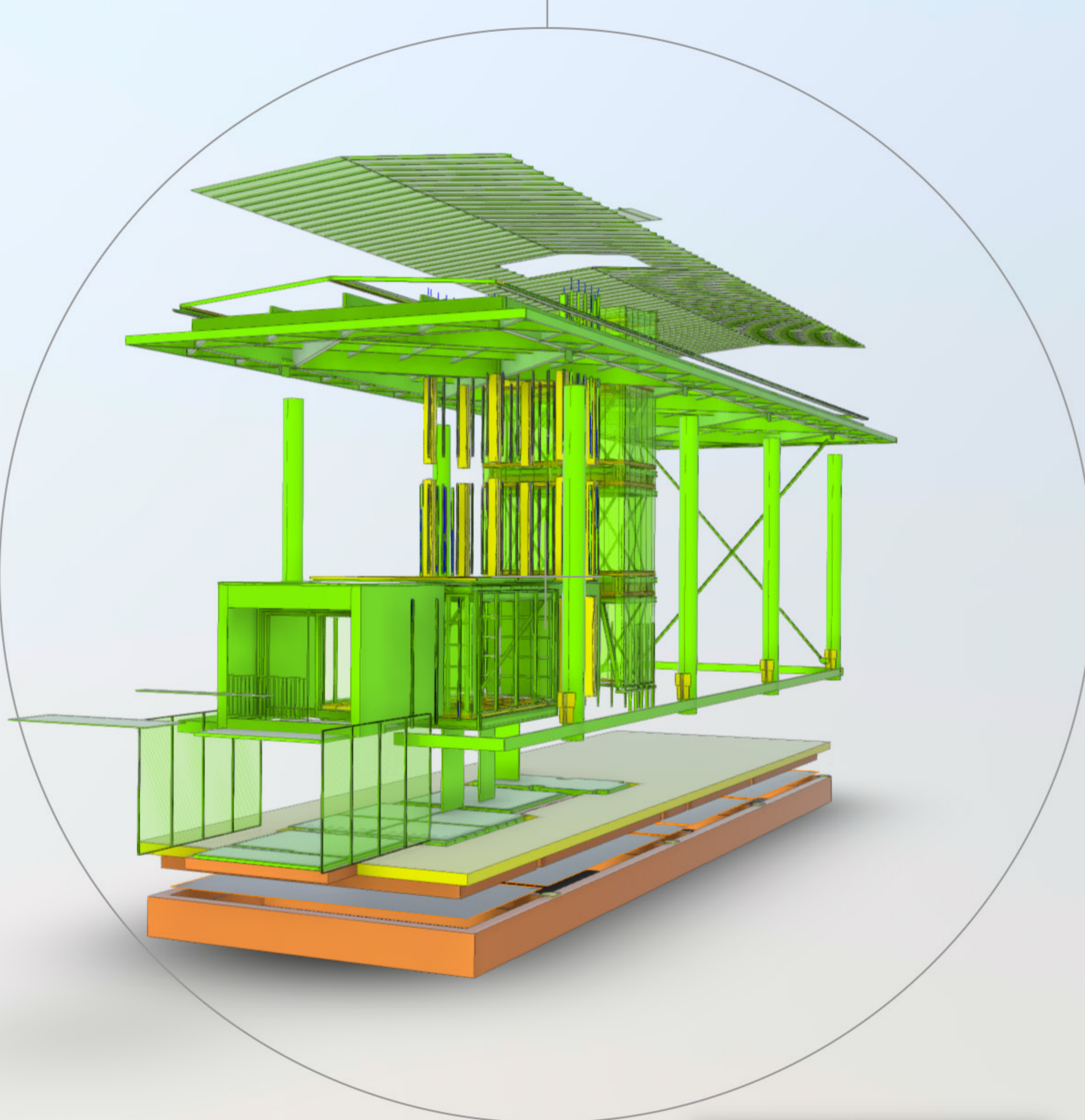
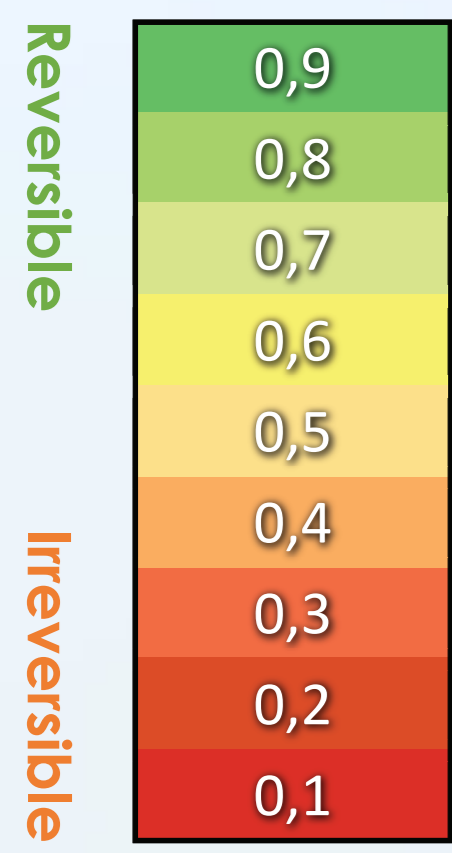
Reuse options



7. BIM objects library

Finally, a **BIM object library** of all elements with high reuse potential is made available to the architects. Such catalogs will boost reapplication of valuable materials in new designs.

Building Reuse Potential



Reversible BIM

Reuse Potential Tool

©Model Durmisevic 2015



Circularity profile

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Method Elma Durmisevic 2019 4D architects

Circularity Profile based on Reversibility indicators = Reuse Capacity of buildings and its materials

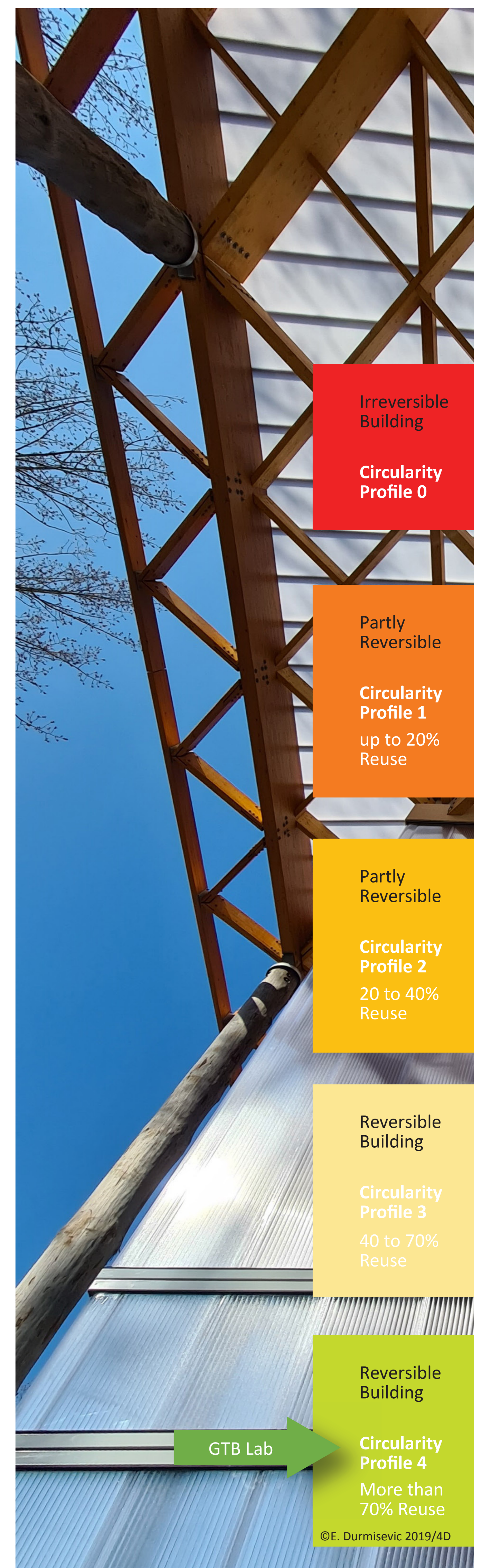
Reversible Building	RBD Category 0	High value materials reuse <10%	Downcycling >50%
Circularity profile 0	Spatial reversibility TC 0,1 Technical reversibility RP 0,1		
Reversible Building	RBD Category 1	Reuse building structure 15-39%	High value materials reuse 10-15%
Circularity profile 1	Spatial reversibility TC 0,2 & 0,3 Technical reversibility RP 0,2 & 0,3		Recycling >50%
Reversible Building	RBD Category 2	Reuse building structure 15-39%	High value materials reuse 15-39%
Circularity profile 2	Spatial reversibility TC 0,2 & 0,3 Technical reversibility RP 0,2 & 0,3		
Reversible Building	RBD Category 3	Reuse building structure 40-69%	High value materials reuse 40-69%
Circularity profile 3	Spatial reversibility TC = 0,4 to 0,6 Technical reversibility RP 0,4 to 0,6 TC > 0,7 RP 0,3 RP > 0,7 TC < 0,3		
Reversible Building	RBD Category 4	Reuse building structure >70%	High value materials reuse >70%
Circularity profile 4	Spatial reversibility TC > 0,7 Technical reversibility RP > 0,7		

Technical Reversibility

Separate materials Reconfigure structure

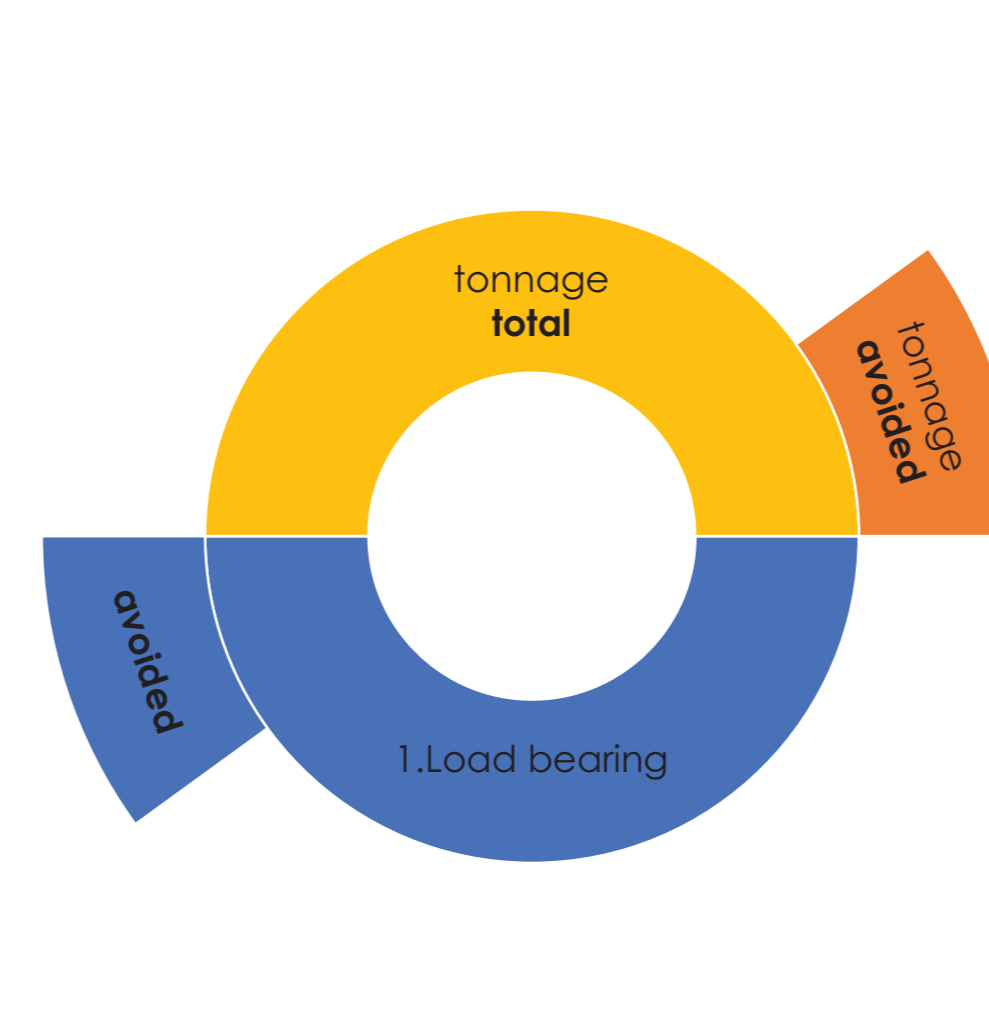
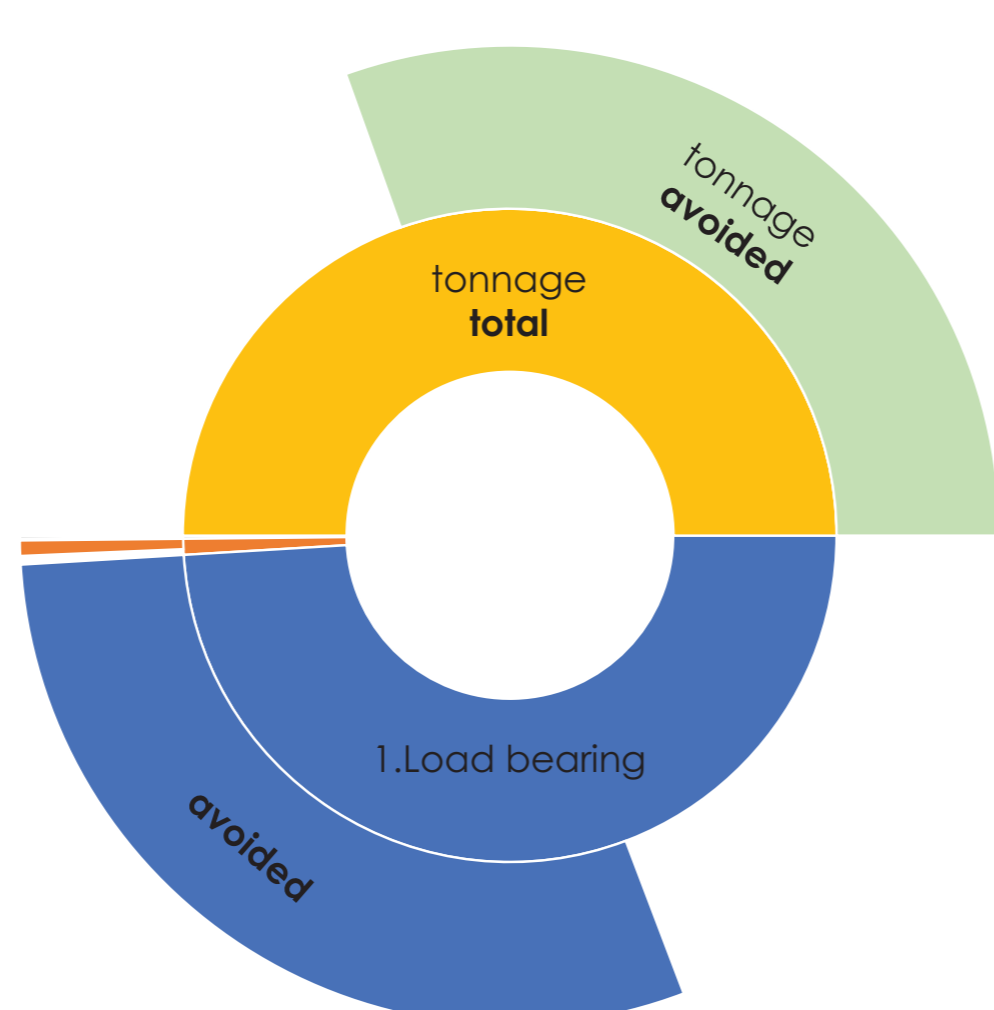
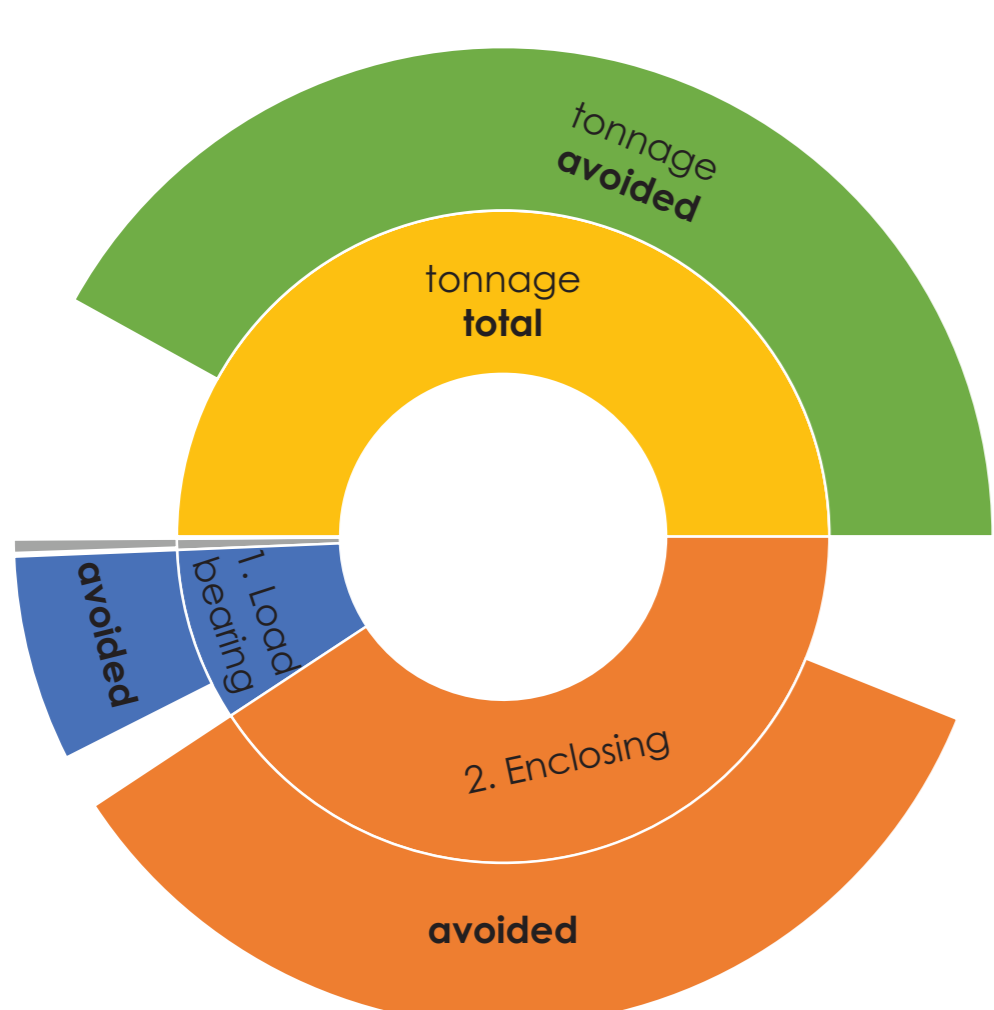
Spatial Reversibility

Adapt



Circular Building Profile is measured by mapping the Reuse Potential versus recycling and waste disposal.

Circular Building profile is a follow up of Reuse Potential calculation (method developed by E. Durmisevic and verified by EU H2020 project).





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knowledgeplatform.gtb-lab.com

Circular Building Knowledge Platform

The screenshot shows the homepage of the Circular Building Knowledge Platform. At the top, it features the GTB Lab logo and navigation links: HOME, CIRCULAR MAP, KNOWLEDGE PLATFORM, PROJECT BLOG, CONTACT, REGISTER, and LOGIN. A banner image with the text "We are building the future" is displayed. Below the banner, there's a "Circular Building Knowledge Platform" section with a brief description and a search bar. The main content area is divided into "Categories" and "News".

Categories:

- Circular Building Design Guidelines:** How-to's for reversible building design that helps avoiding waste and carbon emissions.
- Decision Support Policies & Standards:** Current circular building requirements that each construction must meet.
- Circular Building Tools:** Information and design specification tools to support reversible/circular construction for all sectors.
- Exemplary Projects Circular Building Projects:** Overview of best practices of circular building to take advantage of. Also general building projects for measuring regional material flows.
- Circular Manufacturing Systems & Products:** Manufacturers of circular building systems and products designed with reversibility in mind.
- Circular Production Materials:** Circular building materials can be endlessly reused without decrease in quality.
- Circular Market Places Matchmaking supply&de...:** Companies and organizations that are active in or facilitating the circular building economy.
- Digital Support System Digital Deconstruction:** Advanced digital solutions supporting high-quality reuse of building materials.
- Circular EU Projects EU Projects:** EU projects that enhance circular economy in construction across the continent.

News:

- GTB Lab Module
- Knowledge Platform online!
- First Phase of GTB Lab

Supported by:

- Ministerie van Binnenlandse Zaken en Koninkrijksrelaties
- provincie limburg
- parkstad stadstrategie limburg
- iba
- Heerlen

Partners:

The Circular building knowledge platform is one stop shop for information about circular built environment envisioned by Elma Durmisevic. Main objective of the platform is to inform stakeholders in the built environment about the state of the art regarding regions transition towards circular built environment. The platform provides information about circular building **policies, tools, guidelines**, and experiences from **exemplary projects**, and much more.

The Knowledge Platform also functions as a monitoring system of **circular material flows through regions and cities** by capturing the construction material stream through cities. In addition to circular design and construction methods, avoiding waste also starts with data collation and monitoring. Circular material flow monitoring and data collection will play a crucial role in shaping the circular region of the 21st century.

The screenshot shows the "Circular building mapping" interface. It includes a list of filter options for project types and building transformation types, along with dropdown menus for selecting a city and radius.

Circular building mapping filters:

- Outstanding projects
- New construction projects
- Planned construction projects
- Transformation projects
- Policies
- Guidelines
- Toolkits
- Refurbishment hubs
- Material recycling
- Certification labs
- Design & Living labs
- Circular building products
- Materials

Type of building transformation: Make a choice

City: Amsterdam

Radius: Make a choice

The map below shows a geographical view of Europe with various colored markers indicating project locations across different countries, primarily in the Netherlands and Germany.