DS²BE

Doctoral Seminars on Sustainability Research in the Built Environment

ReInvenTe

Recycling Construction and Demolition Wastes Based on a Technical and Economic Inventory of Buildings

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OVERVIEW AND OBJECTIVES

Addressing the complex challenge of urban sustainability by repurposing **construction and demolition wastes** into valuable resources.

Produce :

- An inventory of the residential **building stock** in the Walloon region;
- An inventory and spatial distribution of **material stocks** present in buildings;
- An inventory of construction and demolition waste available for reuse and recycling.

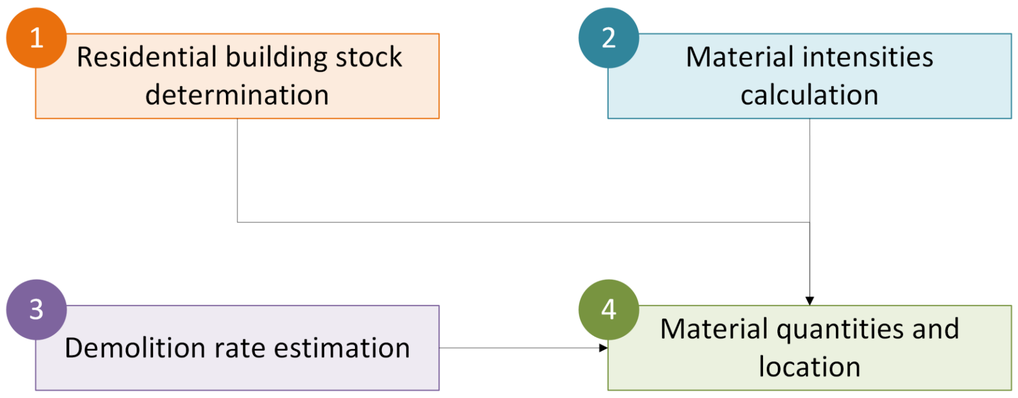

Figure 1 : General methodology

METHODOLOGY

1. Building stock inventory

- Collection and verification of building stocks;
- Detection of the **residential stock** based on the cadastral database and land use data;
- Determination of **typologies** based on the age (<1945, 1946-1970, 1971-1995, >1996), type (individual or collective), and jointness (terraced, semi-detached and detached);
- Extraction of building **footprint**: cadastral data;
- Extraction of building **height**: digital terrain model (DTM) and digital surface model (DSM);
- Calculation of building **gross volume**.

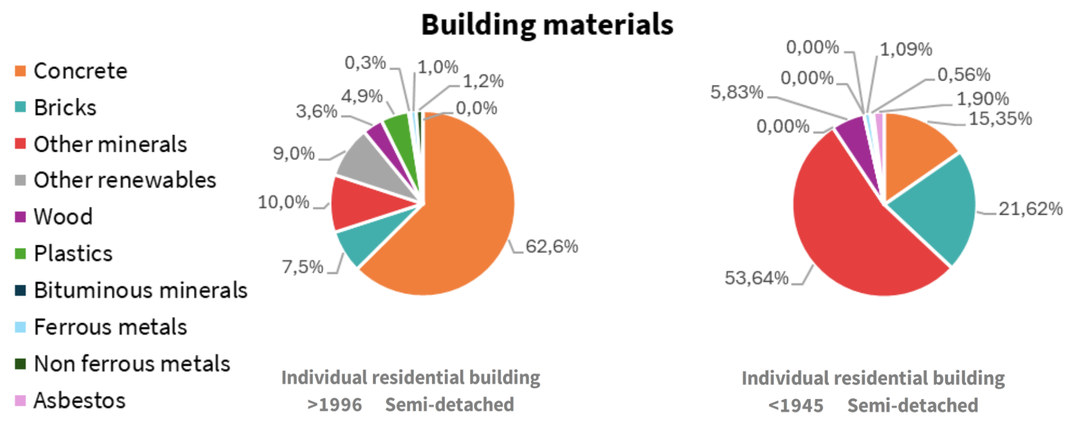

Figure 4 : Material compositions of two residential building examples in Wallonia

3. Demolition waste inventory

The quantities (ton) of each material present in the entire Walloon residential stock are determined by cross-referencing gross volumes (m^3) and material intensities (t/m^3).

The quantities and weight of **demolition waste** present in residential buildings for different years are obtained with an estimation of the **demolition rate** for recent and future years.

The estimation is determined with:

- Demolition permits database from 1996 to 2023;
- Change detection between cadastral data from different years (2010 VS 2021).

The Walloon region demolition rate for 2023 is 0.13% compared to 0.48% for the Flemish region and 0.06% for the Brussels-Capital region[2].

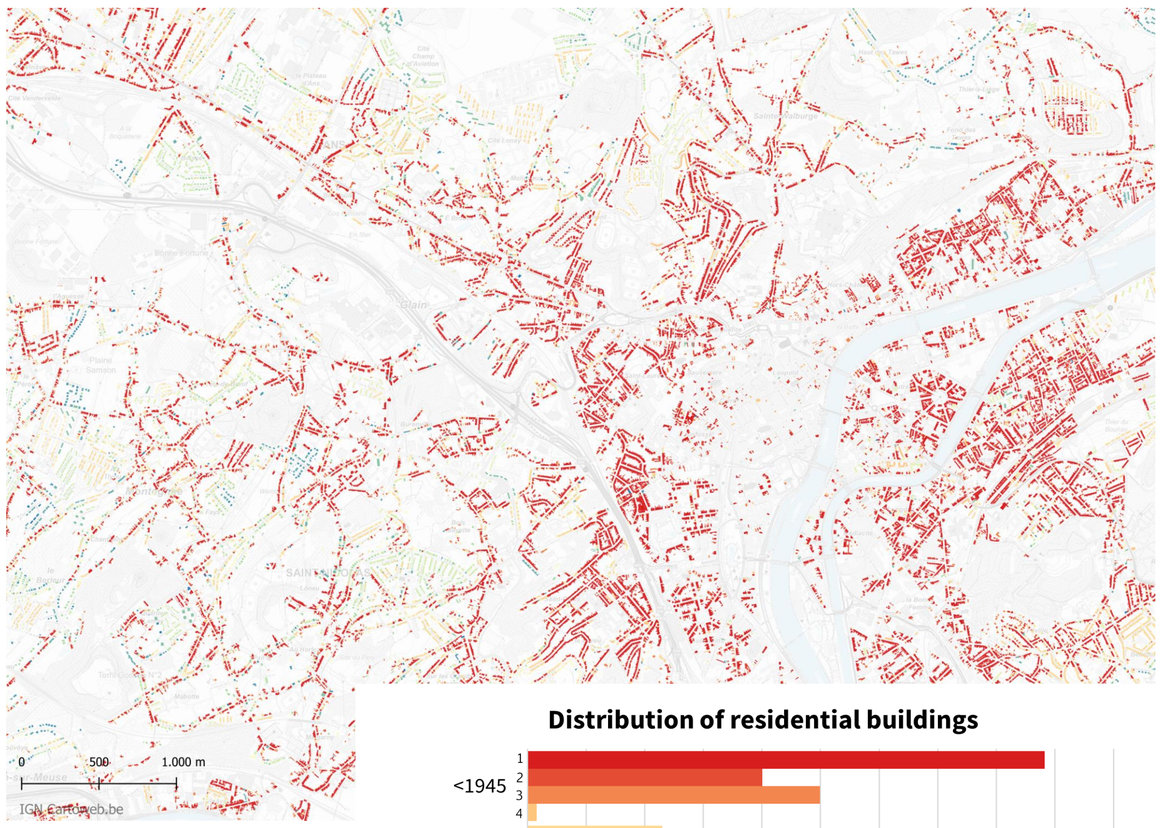

Figure 2 : Map of the repartition in typologies of the residential buildings in Liège, Wallonia

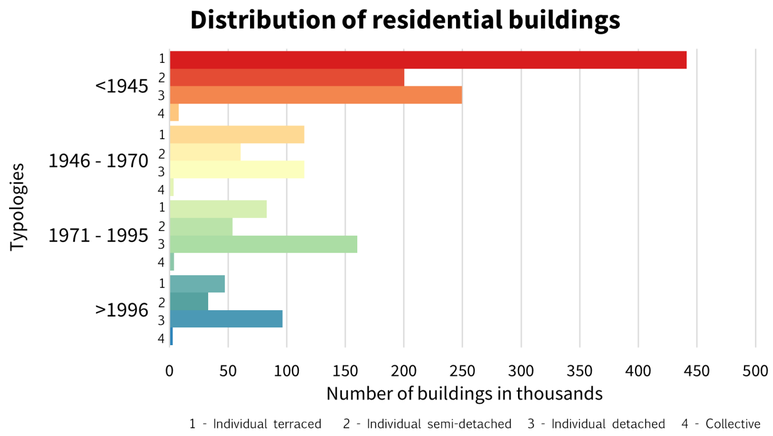

Figure 3 : Repartition in typologies of the Walloon residential building stock

2. Building material composition

Determination, for each typology, of the typical materials used for the construction of residential buildings and their quantities:

- Identification of a representative **sampling** of residential buildings;
- Analysis of material compositions for the selected buildings completed with the implementation of an **inventory protocol**;
- Calculation of the **material intensities** (t/m^3) of one building by dividing the quantities of each material (t) by the gross volume of the building (m^3);
- Aggregation of the material intensities of each material for each typology.

Material intensities are calculated for several types of construction materials: inert, non-hazardous inert and hazardous.

FIRST RESULTS

1,426,028	1.41 e9 m^3	1,457,728 m^3
Residential buildings	Residential buildings volume	Demolition volume (2023)

Material	Demolition weight (t)	*Demolition volume (m3)*
Concrete	223,061	*101,391*
Bricks	104,240.4	*57,911*
Other minerals	264,856	*220,713*
Other renewables	675	*4822*
Wood	9385	*14,438*
Plastics	1143	*952*
Bituminous minerals	351	*152*
Ferrous metals	24,949	*3178*
Non ferrous metals	33	*4*
Total	628,695.3	403,565.47

Figure 5 : Demolition waste quantities for 2023 in the residential buildings of Wallonia[1]

Partners

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References

1. The materials intensities used to obtain results in Figure 5 come from the German database "IOER Information System Built Environment", Leibniz Institute of Ecological Urban and Regional Development. *Materials indicators – IOER ISBE.* (s.d.). https://ioer-isbe.de/en/resources/construction-data
2. Nombre de bâtiments démolis. Statbel. (2024). Unpublished document.

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