

URMIBALI project: How digital documentation technologies can be a support for urban mining and reuse of building materials? A new method for data acquisition on traditional residential buildings in Liège.

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ABSTRACT

Wallonia, like many other European regions, is characterized by a diverse existing residential built environment, both urban and rural [1,2]. This building stock is primarily comprised of single-family houses [3,4], along with a significant number of old historic and traditional buildings [5,6]. Considered as energy intensive [3], it requires energy renovation by 2050 to meet both European objectives regarding building energy efficiency [7,8,9] as well as a rising focus on circular economy principles and sustainable resource and waste management [10,11,12]. Energy renovations on this building will intensify, leading to a substantial increase in demolition waste production. While these wastes represent 39% of all waste in Wallonia with significant environmental impacts [11], they are also considered, within an Urban Mining framework [13,14], as a deposit of material resources. They can be reused either directly in buildings or repurposed as raw materials in production cycles [15, 16]. Urban Mining studies primarily center on residential buildings, using top-down methodologies based on statistical data analysis [17, 18], and focusing on a single material such as aggregates, sand, or concrete. However, despite their prevalence in old traditional and historic buildings, wood, stone, bricks, and tiles have not received thorough examination. Moreover, a few studies have analyzed the entire deposit present in the existing traditional residential buildings stock and/or the influence of energy renovation on waste flows, especially due to a lack of data and methods [19,20].

Wallonia lacks detailed data with a high level of granulometry regarding its residential building stock, the existing material deposit, and the demolition waste flows. Collecting such data can only be achieved through a bottom-up approach involving in-depth study of representative case studies of various building types and statistical analysis of renovation operations. Due to the diversity of the Walloon building stock, these studies are time-consuming, resource-intensive, and expensive. It is therefore urgent and essential to focus on developing an on-site, rapid, and reliable method of acquiring detailed data on existing buildings.

In this context, the URMIBALI project aims to acquire knowledge about the material deposits present in historic and traditional buildings in Liège and the waste flows generated by energy rehabilitation operations. This knowledge is essential for both implementing circular practices in the construction sector and selecting appropriate solutions to improve the energy performance of these old and traditional buildings.

The project initiated in March 2024 integrates a broad reflection led by the two laboratories on the reuse of construction materials, and the study of old buildings, both from a historical perspective and a contemporary architectural approach, in line with a series of current societal and environmental challenges. Its first objective is to develop a method for rapidly acquiring detailed data to inventory and quantify the existing materials deposit, based on both six case studies (built between the 13th and 20th century), digital documentation technologies

commonly used in the field of heritage preservation [21] and existing historical and archaeological knowledge about this specific building stock, including its construction techniques and materials [22- 24]. The innovation of this method lies in the bottom-up and interdisciplinary approach, the multi-material focus, and the potential for transferability and generalization to other types of built environments and cities. A secondary objective is to create a theoretical framework, based on various scenarios, for accounting the different waste fractions generated during rehabilitation operations.

This contribution provides a brief overview of the methodological approach of the research project. It then presents the typological analysis of traditional residential buildings in Liège and the theoretical inventory of building materials, drawing on findings from two case studies. Finally, it discusses initial results concerning the nature and quantification of building materials available for reuse.

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