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DATA BASE FOR A RESOURCE EFFICIENT MANAGEMENT OF VIENNA’S BUILDING STOCK

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Background

Buildings constitute a major contributor to material use and accumulation in human settlements. Therefore, they play an important role when moving toward a more circular use of natural resources. Data about the material composition of buildings and dynamics in the building stock are considered a prerequisite to defining effective resource management measures. This work, therefore, aims at providing such data through investigating buildings as potential urban mines in the sense that existing material stock can be used as a future mine for secondary resources. The city of Vienna has been chosen as a case study.

Specific material intensities for different building categories

In order to generate data about the composition of buildings in Vienna, specific material intensities for different building categories are defined. This is done based on different data sources. A practical method is presented to characterize the material composition of buildings prior to their demolition. The characterization method is based on the analysis of available construction documents and different approaches of on-site investigation. The method is tested in case studies carried out, and results indicate that the documents are useful to quantify bulk materials (e.g. bricks, concrete, sand/gravel, iron/steel and timber). On-site investigations are necessary to locate and determine materials of lower concentration such as metals (e.g. copper and aluminium) or plastics.



Figure 6 Analysis of plan documents, on-site investigation, and analysis during the demolition.

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To enlarge the sample size of buildings being investigated, construction files of already demolished buildings are analysed to determine the specific material composition of the buildings. Additionally, new buildings are investigated based on existing life cycle assessments, accounting documents and construction plans. The database for specific material intensities for different building categories is complemented with data from the literature.

Building structure and material stock

In a second step material stocks in buildings and their spatial distribution are analysed. In particular, the building structure is analysed by joining available geographical information systems (GIS) data from various municipal authorities. The previously generated specific material intensities for different building categories are subsequently combined with the data on the building structure. This allows the overall material stock in buildings in Vienna to be calculated as well as the spatial distribution of materials in the municipal area to be assessed. This research forms the basis for a resource cadastre, which provides information about gross volume, construction period, utilization, and material composition for each building in Vienna.

In a further step, the information about the material composition of buildings is combined with data on the demolition activity in order to estimate quantity and quality of demolition waste generated. The volume of demolished buildings is calculated based on two different data sources (demolition statistics and change detection data) and multiplied with the respective material composition.

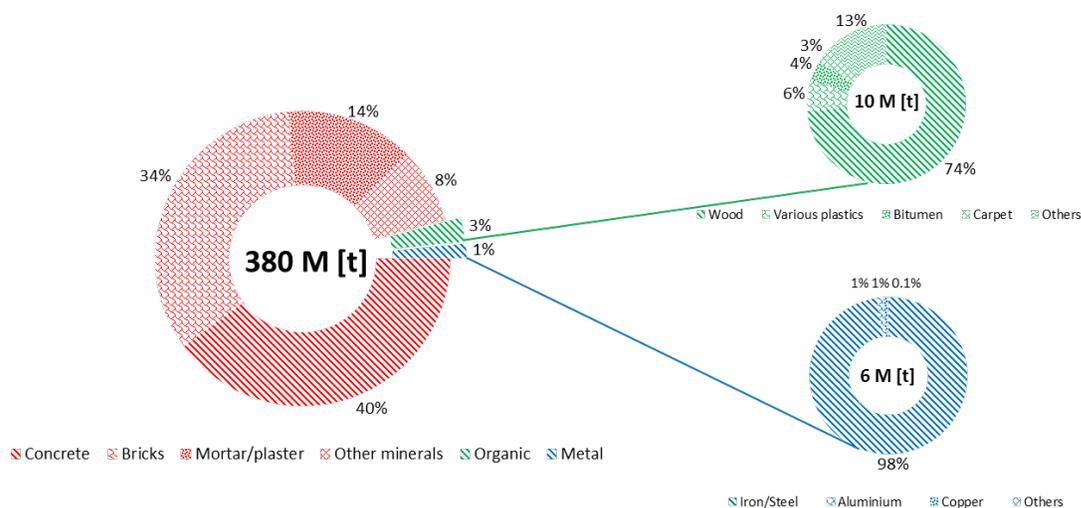


Figure 7 Material composition of the building stock in Vienna in million tons.

Demolition activity and associated demolition waste

In a third step an approach is presented that allows demolition statistics to be validated by using data of automatized change detection of the building stock. Based on this technique, building demolition activities in the municipal area are detected based on yearly aerial images. Results show that demolition statistics do not cover all demolition activity in Vienna and, consequently, demolition waste generation figures solely based on statistical data of demolition activities would underestimate the total waste generation. The approach used in this study can be useful for validating existing data on demolition waste generation and demolition statistics or to generate data if no data is available.

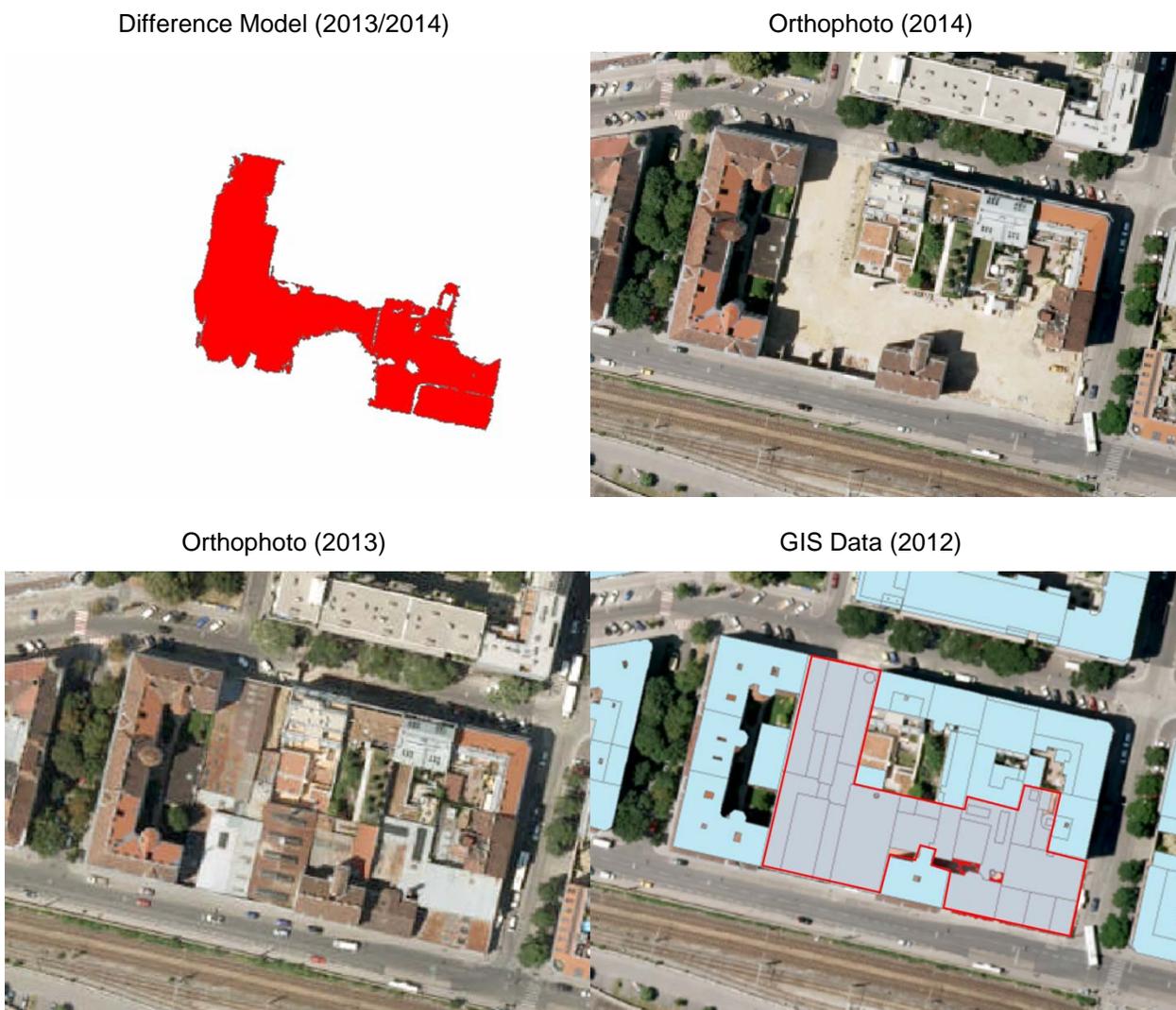


Figure 8 Identification of a demolition project based on the difference model from image matching change detection.



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