SPATIAL AND TEMPORAL MODELLING OF VIENNA'S BUILDING STOCK IN RESPECT TO ITS POTENTIAL AS A SECONDARY RESOURCE MINE

Ferdinand Reimer

E226 Institute for Water Quality and Resource Management, Technische Universität Wien, Vienna

INTRODUCTION

The European Union strives to boost the recycling and reuse of construction materials in the building sector. Materials of interest are, among others, concrete, gypsum and glass as well as various wood products, and metals.

To assess the material quantities in the urban building park and subsequently examine the material recoverability, different modelling approaches were applied in case studies all around the globe. These approaches vary in the types of materials they focus on, in the respective methodology and tools used, and in the quality and quantity of the underlying data.

Based on the experience from other studies, I am developing a new modelling approach and test it for the city of Vienna. The goal is to assess the volume and material composition of the building stock in terms of historical trends, the present situation, and furthermore, as a future projection of how the building stock will likely develop.

MODEL DATA AND DESIGN

I have developed a model prototype and limited the spatial system boundaries around the 18th city district. Several different sources of data for this district are available. For historical data, there is a city map from 1920 [1] in vector graphics format, a building directory from 1928 [2], which is an index of all buildings present at that point of time listing several properties for every building, and furthermore, a historical map of the building age in 1920 [3] for every building.

The combination of these data sources allows for each building the reconstruction of the building age and dimensions in the past. While the buildings' area is relatively certain due to a proportionally adequate map, the respective heights and volumes of these historical buildings are subject to qualified estimates.

In a subsequent step, also the material composition of the historical buildings has to be determined via the use of building archetypes that define characteristic materials used due to a buildings' construction period and its primary type of use.

For the examination of the historical changes in time of the building stock there are contemporary data available from the cities open government data platform [4]. The comparison of the buildings between 1920 with 2018 allows the tracing of construction and demolition activities over the last 100 years.

After the 1920 and 2018 situation of the building stock has been sufficiently covered, a system dynamics approach is designed to make use of the previous analysis and give an outlook to estimate expected future urban development, incorporating various chosen socio-economic and technical factors of influence to simulate their potential impact on the process of construction and demolition cycles.

RESULTS AND DISCUSSION

Preliminary results on the development of the buildings stock are given in Figure 1. The map shows which buildings have been constructed before 1920 and are still present, which buildings have been demolished and re-build and which have been built on previously open property grounds.

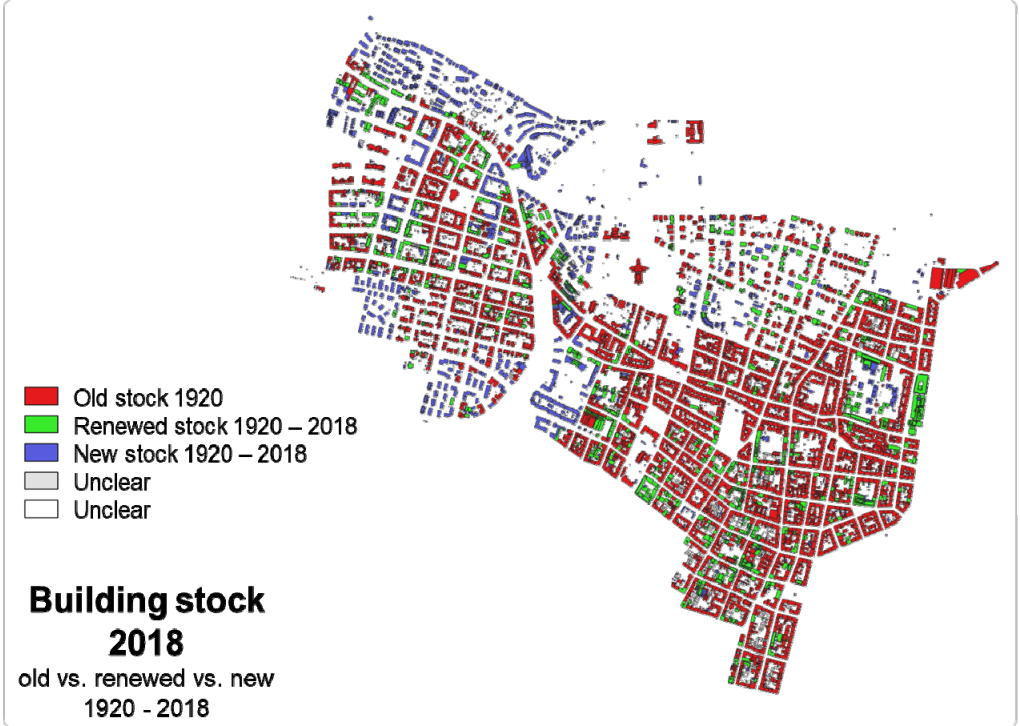

Figure 1: Inter-temporal comparison of buildings between 1920 and 2018, with resulting information about changes of the building stock in time

I have learned that the building stock models are mostly constrained by the availability of data. Furthermore, it is very important to give a qualified statement about the reliability of data, as in some cases it is merely possible to produce estimates. In other cases, it becomes clear that data are very reliable. One example is the 1920 city map [1], where the area and shape of the buildings in the map still fits perfectly well to the same building still existing in modern maps.

CONCLUSION

The compilation of historical and contemporary data is a viable option to model urban changes in time. The precision and reliability of the results depends on the available datasets and in turn, the question whether a dataset is adequate depends on the intended use of the resulting model.

To evaluate the quality of different modelling approaches and develop a coherent framework for the modelling of the urban building stock, increased efforts for the cross-examination of different studies and their methods is recommended.

REFERENCES

[1] Wiener Stadt- und Landesarchiv, *Grundlagenkarte des 18. Wiener Gemeindebezirkes für den Zeitpunkt um 1920*. Bereitgestellt von F. Hauer am Mittwoch, den 23. August 2017.
[2] Salzberg, J.W., *Häuser-Kataster der Bundeshauptstadt Wien (1927-1929). Band 9: 18. und 19. Bezirk*. 1928: Wien.
[3] Wiener Stadt- und Landesarchiv, *Historischer Atlas von Wien (17. Lieferung). Baualter 1920, 1. bis 20. Bezirk*. 2015
[4] Wiener Magistratsabteilung 41, Flächen-Mehrzweckkarte. Abrufen von https ://www.data.gv.at/katalog/dataset/stadt-wien_flchenmehrzweckkartevektordatenwien am 3. März 2018.