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Development of a Service Life Database of Building Elements Based on an International Data Collection

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1 Introduction

One important parameter influencing the replacement stage of the building LCA and LCC is the service life of the building elements. The literature shows that there is a variability linked to the definition and the corresponding estimation of the service lives, while there is no general agreement about the service life data, as stated in Dixit (2017).

In the context of increasing the reliability in LCA and LCC calculations, it is necessary to consider the inherent uncertainties of the service lives in LCA calculations, using a probabilistic framework. Thus, the aim of this paper is to present the development of a service life database that uses a hybrid decomposition (functional decomposition, according to eBKP-H – SN506511 (CRB, 2012) and material decomposition), which allows the determination of statistical distributions for service lives. In addition the database allows calculations in different level of details (LODs), as stated in Cavalliere *et al.* (Cavalliere *et al*., 2018) and it is, thus, compatible to the BIM-based LCA context.

2 Development of the DUREE Service Life Database

The research concerned service life data for the structural system, the technical installations, the façade elements and coatings, the roof elements, as well as the interior layout. Furthermore, the partners from the IEA EBC Annex 72 contributed to this research, by providing additional service life data, through a survey, conducted on national LCA methodologies, in the beginning of 2019 (Lasvaux *et al*., 2019). Figure 1 presents the building decomposition, according to the functional nomenclature of the eBKP-H – SN506511.

3 Descriptive Statistics

The database includes approximately 7’000 service lives data, for more than 2000 building elements. The global sample was separated in three categories, *i.e.* service lives used in LCA and LCC calculations, as well as service lives used in the Real Estate - Management sector. From these data, approximately 79% came from LCA and LCC sources. In addition, approximately 28% came from Switzerland and the rest were international data, mostly from European countries. The results show that there is a significant variability, concerning the service lives of the building elements.

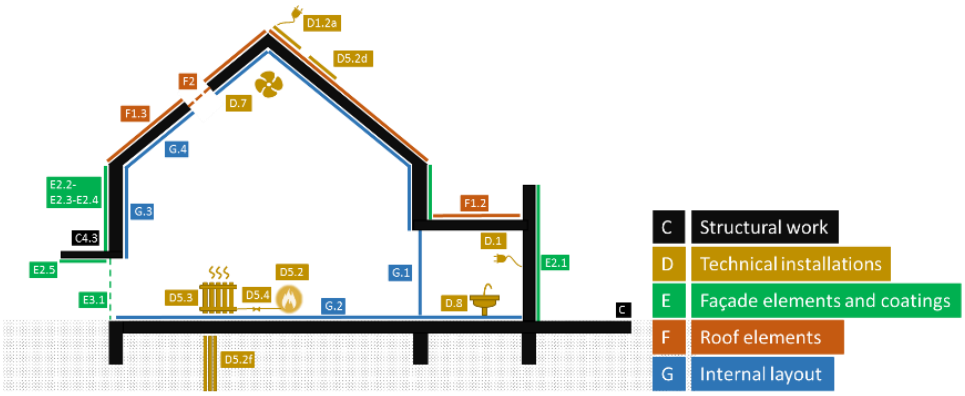

Figure 1. Main groups and intermediate element levels from the eBKP-H - SN 506511 nomenclature.

4 Fitting to a Statistical Distribution

A lognormal distribution was used to model the service lives of the building elements. The choice of the lognormal distribution is justified, since the input service life data constitute independent positive random quantities, (Voelkel, 2006). In order to assess the goodness of fit of the lognormal distribution, two statistical methods were employed for the service lives of the building elements, (Lasvaux *et al*., 2019). The results confirmed the initial hypothesis of the lognormal distribution.

5 Conclusions

The current study presents the development of a new database (DUREE database) for the service lives of building elements. Two of the main conclusions of the study are:

- The hybrid decomposition of the database allows the designer to fix service life data in different LODs, flexibility appropriate for BIM-based LCA analysis;
- The database offers the possibility to define statistical distributions, with a systematic way, for the service lives of the building elements.

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