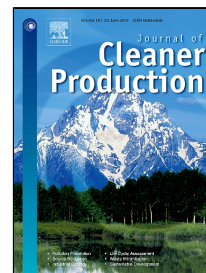


Accepted Manuscript

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PII: S0959-6526(18)31392-1
DOI: 10.1016/j.jclepro.2018.05.062
Reference: JCLP 12919
To appear in: *Journal of Cleaner Production*
Received Date: 05 October 2017
Revised Date: 01 May 2018
Accepted Date: 07 May 2018

Please cite this article as: Charlotte Dossche, Veerle Boel, Wouter De Corte, Comparative material-based life cycle analysis of structural beam-floor systems, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.05.062

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Comparative material-based life cycle analysis of structural beam-floor systems

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Keywords: Life cycle analysis; LCA; ISO 14040/44; construction materials; beam floor system

Abstract. In a residential building, various structural flooring systems are feasible. For moderate spans (4 m to 6 m) and for a predetermined column grid, distinct combinations of wood, steel and concrete elements can be implemented as beam-floor system. Besides comparing these beam-floor systems based on weight, cost, speed of installation etc., a comparison can also be based on their environmental impact. Indeed, whereas some materials appear to be environmentally friendly for many applications, this may not be true for this particular case. For such a comparison, a life cycle assessment (LCA) according to ISO 14040/44 has been implemented in this paper. In this study, the functional unit consists of a square meter of a structural beam-floor system of an arbitrary composition, i.e. three main beam materials (concrete, steel and wood) have been combined with appropriate structural floor systems. The paper presents the results of the LCAs for different impact categories, and both midpoint and endpoint assessment methods. This provides a broad idea of the environmental profile of the considered beam-floor systems representative for current Belgian building practice for the defined functional unit. Furthermore, the influence of the respective impact assessment methods (ReCiPe World versus Europe) was found to be important, especially regarding wooden structural elements. Lastly, some sensitivity analyses (use of recycled aggregates, use of aerated concrete waste, transport types and distances, ratio virgin-recycled steel) have been performed in order to obtain a more nuanced view on the setup and results of this study. These sensitivity analyses show that mainly the ratio virgin-recycled steel in a beam-floor system can result in widely varying impacts on the environment and thus give some opportunities for improved environmental impact.

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