CERIS : Civil Engineering Research and Innovation for Sustainability

Integration of LCA and LCC with BIM for the environmental and economic assessment of buildings

Summary

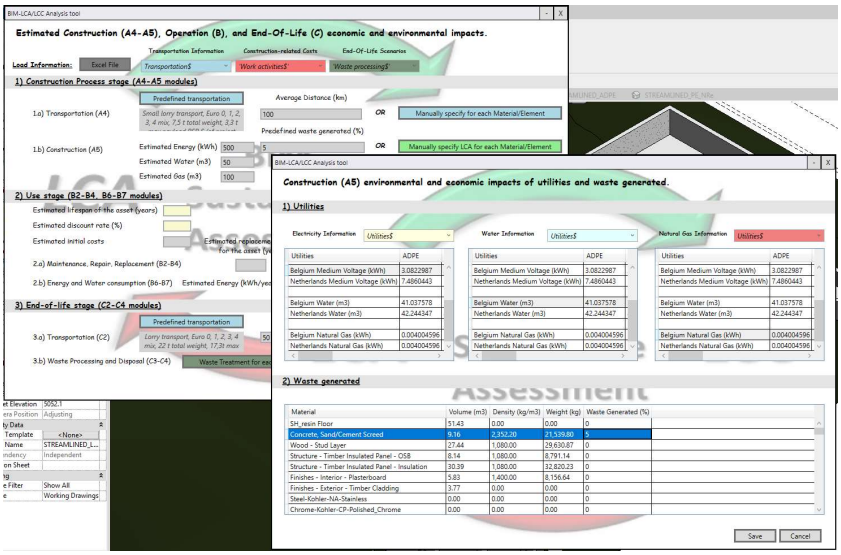
The integration of LCA and LCC with BIM has been explored in recent literature, being argued that the use of BIM tools can greatly mitigate some of the limitations of LCA and LCC analyses (e.g. time consumed in collecting the input data). Currently, different approaches are observed in the BIM-LCA/LCC integration literature. Scholars either use a wide range of tools for the project modelling and performance of different simulations or use BIM tools to automatically extract the bill of quantities and connect it with LCA/LCC databases. However, a third approach still remains unexplored, which is the incorporation of sustainable information within BIM models to promote automatic simulations and improve information exchange.

In order to answer this third approach, a prototype tool is developed. The BIM-based environmental and economic life cycle assessment (BIMEELCA) tool is developed in C# language and uses a Revit application programming interface (API) platform. Moreover, the proposed framework, IDM/MVD and tool are validated with a pilot case study. The case study is an office building under construction in the Netherlands. In this regard, it is observed that an automatic Streamlined LCA/LCC analysis is possible but not a Complete LCA/LCC analysis. The need to provide project-specific information is the main reason why a comprehensive and automatic analysis is not achievable. Nonetheless, the incorporation of information within the BIM model can greatly reduce the workload and consumed time to perform LCA and LCC analyses.

The findings presented in this study indicate that the capacity to add or edit environmental and economic information within the LCA or LCC tools integrated with BIM is fundamental for an accurate analysis of the project. The databases' flexibility and how it reads the information contained within the BIM tools greatly influence the quality and representativeness of the results. If only generic data can b used in the analyses, the obtained results will likely not be as precise as if specific data (e.g. environmental product declarations) were to be used. In this regard, the main contribution of the approach proposed in this research is the use of BIM models as data repositories and the demonstration of how semantically-rich BIM objects can significantly influence the automation of simulations, thus promoting the sustainability of constructions.

Keywords

Building Information Modelling (BIM), Life Cycle Assessment (LCA), Life Cycle Costing (LCC), integration, sustainability, optimisation.



BIMEELCA software.

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