

Life Cycle Assessment of Mass Timber Structure, Construction Process as System Boundary

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Abstract : Today, life cycle assessment (LCA) is a leading method in mitigating the environmental impacts emerging from the building sector. In this paper, LCA is used to quantify the Green House Gas (GHG) emissions during the construction phase of the largest mass timber residential structure in the United States, Adohi Hall. This building is a 200,000 square foot 708-bed complex located on the campus of the University of Arkansas. The energy used for buildings' operation is the most dominant source of emissions in the building industry. Lately, however, the efforts were successful at increasing the efficiency of building operation in terms of emissions. As a result, the attention is now shifted to the embodied carbon, which is more noticeable in the building life cycle. Unfortunately, most of the studies have, however, focused on the manufacturing stage, and only a few have addressed to date the construction process. Specifically, less data is available about environmental impacts associated with the construction of mass timber. This study presents, therefore, an assessment of the environmental impact of the construction processes based on the real and newly built mass timber building mentioned above. The system boundary of this study covers modules A4 and A5 based on building LCA standard EN 15978. Module A4 includes material and equipment transportation. Module A5 covers the construction and installation process. This research evolves through 2 stages: first, to quantify materials and equipment deployed in the building, and second, to determine the embodied carbon associated with running equipment for construction materials, both transported to, and installed on, the site where the edifice is built. The Global Warming Potential (GWP) of the building is the primary metric considered in this research. The outcomes of this study bring to the front a better understanding of hotspots in terms of emission during the construction process. Moreover, the comparative analysis of the mass timber construction process with that of a theoretically similar steel building will enable an effective assessment of the environmental efficiency of mass timber.

Keywords : construction process, GWP, LCA, mass timber

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