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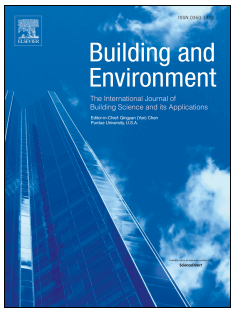

Reducing building life cycle carbon emissions through prefabrication: Evidence from and gaps in empirical studies

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Reducing Building Life Cycle Carbon Emissions through Prefabrication: Evidence from and Gaps in Empirical Studies

Abstract

The use of prefabrication for building has many benefits, including improved construction process efficiency and reduced waste and environmental effects over a building's life cycle. Studies have investigated building life cycle carbon (LCCa), but the extent of reported carbon reductions achieved through prefabrication remains inconsistent, and it is still unclear how different variables influence a prefabricated building's LCCa. This paper aims to systematically examine the evidence for reducing building LCCa through prefabrication, and to identify gaps in existing knowledge for future research. The relevant published empirical studies were examined using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses method, based on a systems framework of 12 variables influencing prefabricated building LCCa. In total, 27 cases of prefabricated buildings, carefully identified through an onerous process, were examined. The results show that the embodied and operational carbon emissions of these cases varied significantly from 105 to 864 kg CO_2/m^2, and from 11 to 76 kg $CO_2/m^2/yr$, respectively. The results also indicate that, on average, 15.6% of embodied and 3.2% of operational carbon reductions were achieved through prefabrication, as compared with their traditional base cases. However, five and three cases, respectively, actually had increased embodied and operational carbon as a result of prefabrication compared with their traditional counterparts. These results suggest an inconsistent influence of different variables on prefabricated building LCCa, and provide a clearer and more critical understanding of prefabricated building LCCa. A systems framework is developed to identify seven gaps in existing knowledge and recommend directions for future research.

Keywords: prefabrication; life cycle carbon emission; carbon reduction; low carbon building.