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Feasibility study to estimate the environmental benefits of utilising timber to construct high-rise buildings in Australia

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Abstract

Reinforced concrete has played a significant role in the construction industry and is one of the most popular construction materials. However, different studies suggest that reinforced concrete is not environmentally friendly with a significant adverse environmental impact during its production, usage and end of life. Therefore, a more sustainable material that could perform as well as reinforced concrete can overcome this limitation. During the past decade, a number of studies on timber construction have shown the potential to replace concrete with timber in parts of a building without compromising the resilience of the structure. Most of them focused on greenhouse gas emissions rather than embodied energy and structural requirements. Therefore, this research has focused on the feasibility of timber and its potential benefits as a construction material in parts of a high-rise building located in Australia. The potential benefits and limitations of utilising timber to construct a high-rise building in Australia were investigated. For this purpose, a hypothetical 43-storey building is considered, to make it comparable with the existing studies in the literature; the baseline model is designed according to the study by Kuilen et al. (2011). Three scenarios were considered with different proportion of timber. Parametric studies were subsequently conducted on the effects of materials, size and shape of the structural elements on the performance of the building. It was found that in the selected site, using timber to construct internal parts of high-rise buildings would provide the best solution in terms of structural and environmental benefits.

Keywords: Timber; CLT; High rise building; Embodied energy; Embodied carbon

1 Introduction

A growing population and a high demand for accessible accommodation have caused cities to grow vertically, whereby low-rise and medium-rise construction is no longer sufficient.

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