UNIVERSITY OF CAMBRIDGE
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CONSTRUCTION ENGINEERING MASTERS DISSERTATION ABSTRACT

A comparison of the embodied carbon of prefabricated bathroom pods and site-built bathrooms

Global warming is one of the greatest challenges facing humankind today. The construction industry is responsible for a significant proportion of greenhouse gas emissions which are leading to unprecedented climate change. Efforts are being made to reduce operational impacts but significant emissions arise from material processing and construction. The uptake of prefabrication in the industry is increasing and can affect these embodied emissions, yet its impact is not fully understood. Previous studies have compared the embodied carbon of different forms of prefabrication to conventional construction with the exception of volumetric pods, and generally using narrow assessment boundaries.

This dissertation compares the embodied carbon of a single prefabricated bathroom pod to an equivalent conventionally constructed bathroom through a quantitative lifecycle assessment. A hybrid approach combining process-based and input-output calculations has been adopted. Any type of embodied carbon calculation is subject to uncertainty from the range of available data, boundaries and assumptions which must be made. Furthermore, due to variation across projects, each set of circumstances or scenarios will lead to different quantities of embodied carbon, even for the same type of prefabrication. Unlike the existing research in this field, this study aims to account for both uncertainty and scenario variability.

The results show that whilst the initial embodied carbon of the bathroom pod is 34% higher than that of an equivalent site-built bathroom, the whole-life embodied carbon is 6% less. The uncertainty surrounding both of these figures is significant. The scenario analysis shows that if a pod is not carefully designed, its embodied carbon could be far higher than that of a site-built bathroom. This is in contrast to other studies which mostly report that prefabrication reduces carbon emissions if materials remain constant, albeit only marginally. In light of the significance of uncertainty found in this study, it is likely that for most forms of construction, the act of prefabrication alone will not provide the carbon step-change required. Factors such as material choice are far more significant. Whole-life carbon should therefore be reduced in the design stage of every project, regardless of the construction method adopted.

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