UNIVERSITY OF CAMBRIDGE
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CONSTRUCTION ENGINEERING MASTERS DISSERTATION ABSTRACT

Is DfMA Carbon Friendly?

There are two problems which combine to motivate this research; the need to unlock value in construction and the need to reduce carbon emissions. One of the attempts to solve the first problem is the use of Design for Manufacture and Assembly (DfMA) methodology in construction. However the effect of this and its impact on carbon emissions is not fully understood. As a result, the research question that this study seeks to answer is 'Is DfMA Carbon Friendly?'.The aim is to investigate what impact choosing DfMA methodology has on carbon emissions when compared to construction using traditional methodology.

Three case study projects were selected for investigation: Liverpool Street Crossrail Station Heathrow Terminal 2a and Farnham Road Hospital. These offered opportunities to compare DfMA and traditional methodology for different reinforced concrete elements: a wall, a retaining wall and a suspended slab respectively. Following guidance from recognised standards (ISO 14067:2013 and BS EN 15978:2011) a process based life cycle analysis was undertaken to allow relative comparisons to be made. The system boundary for the study was from cradle to the end of the construction phase, including: material extraction and processing, transportation and construction phases. Carbon emissions data was taken from the 'Inventory of Carbon and Energy' (2011) for building materials and DEFRA (2013) for transportation and energy.

At this stage only two of the three case study analyses have been completed as construction at Farnham Road Hospital is ongoing. The results to date suggest that overall DfMA methodology offers a carbon saving of 22% on average. However, DfMA carbon emissions for the transportation phase were greater by 60% on average. The main carbon saving from DfMA came from the construction phase due to reduced programme and site activities. This saving was approximately 75%.

The practical implications for the study are that it indicates that DfMA is carbon friendly as it reduces overall carbon emissions. Although it is important to identify that in all instances, for DfMA and traditional methodologies, around 80% of the carbon emissions were associated with carbon embodied in materials meaning that the savings made from the others phases are less significant in comparison.
However, the implications for construction contractors, whose material selection is often already made for them, DfMA offers an opportunity for them to reduce carbon emissions associated with their projects of around 60%.

It is also important to recognise that this study only investigates DfMA applied to reinforced concrete. DfMA can be applied to many other different areas in construction and it is recommended further research is carried out in these areas to conclude fully 'Is DfMA is carbon friendly?'.

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