UNIVERSITY OF CAMBRIDGE
Department of Engineering

## CONSTRUCTION ENGINEERING MASTERS DISSERTATION ABSTRACT

# Embodied carbon forecasting: A methodology for harnessing cost data to improve decision making


The UK construction industry accounts for approximately 25% of total UK greenhouse gas emissions, through its activities, supply chains and the assets it creates. The Government's commitment to reach net zero by 2050 has placed a spotlight for action on the UK construction industry. Government policy and industry focus over the past two decades has largely focused on operational generated carbon emissions. Standards, methodology and reporting frameworks are well established, although a route towards industry standardisation and transparency needed, is less clear. The assessment or control of the cost of embodied carbon is not a mandatory preconstruction deliverable required by current policy. Consultation on the implementation of mandatory requirements to undertake Lifecycle Assessments (LCA) for buildings and infrastructure at tender stage is currently being reviewed and piloted by Government as a mechanism to lower construction carbon emissions.

The potential change in strategy has seen an upward trend in both public and private sector clients requesting (LCA) as deliverables within tenders, and the introduction of scoring criteria levied against achieving the lowest (LCA). The introduction of tender assessment scoring incorporating technical, commercial and (LCA) embodied carbon criteria as a mechanism for assessing bidder returns has identified a need for a dynamic model to assess the carbon cost relationship to inform decision making at preconstruction stage.

The research utilises a case study approach to integrate embodied carbon data factors into the cost estimating process. The research applies design, quantities and construction methodology from a highway bridge structure project to generate resource loaded construction cost estimates. A methodology is developed to create linkages between embodied carbon factors and the cost estimate at a detailed resource level to enable industry standard reporting. The studies aim is to provide rapid quantifications of embodied carbon with linkages to cost data, improve data generation of BS EN 15978 TC350 A1 – A5 modules, develop a methodology and tool for projects to make optimised decisions to reduce embodied carbon.

The findings revealed, the creation of linkages between cost and carbon data sets, accelerated the ability to forecast embodied carbon in the preconstruction stage. The methodology offers several positive insights and potential for reducing embodied carbon through early evidence-based decision making. Challenges exist within the downstream supply chain, with focus on transparency of embodied carbon factors and maturity of available data. The scalability and application to other work packages outside of the civils sector presents an opportunity to industry to optimise designs to reduce embodied carbon and improve data transparency.



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