

CONSTRUCTION ENGINEERING MASTERS DISSERTATION ABSTRACT

Applying the principles of design for manufacture and assembly (DfMA) to the design of bridge construction projects

Design for Manufacture and Assembly has been proven in the manufacturing industry as a method of improving productivity by integrating knowledge of downstream processes with the design. In comparison to manufacturing, productivity in the construction industry is poor. Construction industry literature promotes DfMA as a route to achieving the productivity gains that have been enjoyed in manufacturing, and major construction industry players agree, proposing a shift towards off-site manufacture and a reduction of on-site activity. However, there is an apparent divergence between the construction industry's perception of DfMA as a prefabrication concept and the manufacturing industry's application as a systematic design optimisation process. Prefabrication is only one of several capabilities that DfMA has to offer, and the literature is skewed towards a prefabrication focus. Designers have a substantial influence over the application of DfMA during the design stage, yet designers' perceptions of DfMA and the state of practice regarding the application of DfMA principles by designers present a gap in knowledge. Qualitative research has been conducted taking a case-study approach. The case selected was a portfolio of bridge design projects selected from the AECOM RBS project portfolio. Semi-formal interviews were conducted with individuals each representing one of the projects in the sample. Thematic analysis of the results identified five primary themes: (1) DfMA is perceived as a prefabrication concept, (2) designers are already applying the principles of DfMA, (3) designers strive for design optimisation based on experience, (4) behaviours are key for collaborative relationships, and (5) 3D modelling is helpful when the project team is allowed to use it to suit their cause. It was found that the term 'DfMA' is misleading and has connotations of a factory setting, and a new title 'Integrated Design for Optimised Construction' is proposed. The construction industry needs to address the problem that designers are becoming remote from the construction process, and improved opportunities for site experience for designers are needed if a skills gap is to be avoided. Finally, clients should be clear on their intentions for BIM when defining the scope of design contracts, and formal BIM requirements should not be specified if the client and contractor are not in a position to leverage the benefits of BIM.

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