UNIVERSITY OF CAMBRIDGE
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CONSTRUCTION ENGINEERING MASTERS DISSERTATION ABSTRACT

Use of Large Design for Manufacture and Assembly Concrete Components in Nuclear Construction

This research investigates the benefits of adopting a large Design for Manufacture and Assembly (DfMA) component approach to nuclear building construction, thereby reducing the number and duration of site operations and improving build quality.

A new era of nuclear plant construction is creating pressure to improve build times in an effort to bring down the high cost of nuclear power. Presently, large and complex concrete structures such as those required at nuclear installations are generally constructed using traditional in-situ methods, resulting in lengthy programmes and allowing latent design problems to persist unidentified. When problems surface, delays often arise, affecting programme-critical tasks.

The DfMA method addresses these issues, however, in order to adopt this approach, there is the need to resolve several aspects of the construction:-
1. Decomposing a large building into suitable elements for manufacture.
2. Re-connecting the elements on site to meet the structural performance criteria.
3. Achieving precise construction tolerances and understanding the implications tolerances have on manufacture and assembly.

This study examines these three aspects and an experimental trial has been undertaken to develop a DfMA design solution and obtain field measurements of quality and build-time performance of the approach. These are compared with measurements from traditional construction in a previous trial and analysed to determine as-built accuracy.

Findings from the study indicate that the DfMA method can generate substantial time savings on site, albeit at the expense of increased complexity and overall labour. The approach could nevertheless be a valuable step in reducing high financing costs. The experimental trial demonstrates that complex building geometry can be decomposed into elements for manufacture, with satisfactory connections between parts. Analysis of achieved manufacturing and assembly tolerances has shown that the required level of overall accuracy is achievable, whilst also identifying significant difficulty in procuring reinforcement to meet specifications.

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