



**UNIVERSITY OF  
CAMBRIDGE**

Department of Engineering

## **CONSTRUCTION ENGINEERING MASTERS DISSERTATION ABSTRACT**

### **Feeling the Heat? : The Design of Precast Concrete Facades to Meet UK Energy Efficiency Requirements**

Precast concrete panels have been commonly used in UK construction for building facades for many years. More recently, the design and manufacture of these products have had to comply with onerous energy efficiency standards. Since 2005, and most recently in 2013, Part L Building Regulations in England and Wales have been progressively updated in order to satisfy the EU Energy Performance of Buildings Directive, to aid in the reduction of carbon dioxide emissions. This has a significant impact for developers and facade designers through the incorporation of increased thermal insulation and improved air tightness criteria. This well-intentioned measure can have adverse effects, such as increasing the depth of the concrete panels, which in turn can increase the overall facade zone and reduce the usable floor space. Some buildings are also experiencing negative consequences of better performing envelopes, including overheating, poor air quality and condensation.

The aim of this study is to examine the energy efficiency regulations which precast concrete facade design has to comply with, understand the impact for key stakeholders involved in the design and construction process, and determine how the issues raised can be addressed. The paper focuses on the residential sector, as this is the area where building occupants are being most affected by the issues raised.

A literature review is undertaken to understand the background to the relevant building regulations, in particular Part L, examine the main effects of energy regulations on building designs, and consider the implications for precast concrete cladding design. The application and performance of precast concrete as a facade solution is also examined.

A questionnaire is completed by key stakeholders involved in the construction process, followed by structured interviews with a selected pool of experts, in order to examine the main factors affecting facade design and performance, and investigate how problems could be overcome. A relevant project case study is also examined to demonstrate the potential issues when things go wrong, and provide lessons learnt for future schemes.

The results of the study indicate that an increase in insulation thickness resulting from compliance with Part L Building Regulations has had the most significant impact on precast concrete facade designs, and the regulations have contributed to an increase in facade costs. Further training and guidance was identified as beneficial for stakeholders to improve their knowledge and application of the regulations. Improved air tightness of facades was considered to have the potential to create buildings which are subject to overheating, and incur problems with air quality and condensation, if adequate ventilation measures are not considered.

Recommendations are put forward for ensuring how precast facade designs can be developed to comply with energy efficiency regulations. These include early consideration of thermal aspects and greater coordination between stakeholders through the design process. The study also includes the production of a guidance document as a companion to the regulations, to identify potential issues and offer best practice and accepted design solutions. A review of the actual performance of buildings designed to current regulations is recommended before any further changes are made.

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