Efficient Panelised Façade System for Geometrically Complex Buildings

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Overview | In the built environment there is increasing interest in free-form building design, these buildings spark the interest and imagination of their users. Their geometry is complex often leading to an inefficient conservative facade system design, due to a lack of accurate analysis within time constraints of the design stage. A greater understanding of emerging facade materials and technologies is needed, to allow system designs to be formed according the strengths of the technologies used. Ultra-high performance concrete (UHPC) is an emerging material technology which shows great potential for use in panelized facade systems. Due to its high durability and flexural strength, components made from UHPC have a longer design life, as well as using less material in their initial design. However, there is a lack of clarity surrounding the specific behaviour of the material particularly in response to stress concentrations.

Outcomes and Impact | In panel systems connections are a critical area due to the concentration of stresses and the safety implications should they fail. Knowledge of the behaviour of emerging materials is crucial in creating efficient panelised facade systems which enable complex buildings to be realized, with reduced material usage and efficient manufacture and assembly process. The aim of this work is to understand how emerging façade panel materials, such as UHPC, respond to the stress concentrations at connections and define a method for which these can be accurately predicted and designed.

Work Involved | The project will focus on several areas:

- Providing an overview of existing and emerging façade technologies for complex geometries, identifying technologies which can be developed to improve the efficiency of a panelised façade system.

- Characterising the behaviour of UHPC under stress concentrations formed and embedded connections and develop an accurate method for predicting these, which can be used to design efficient panels and connections for complex geometry projects.