Combining timber and concrete for a sustainable future summary

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1. Introduction

The Julian Study Centre, also known as Building 57, is a world first. A truly unique combination of sustainable low-carbon ethos with innovative construction methods that has produced a building with an exceptionally low carbon footprint. It is an ambitious structure which provides creative solutions to some of the challenges faced by the modern construction industry. The main project motivation was the client who wished to produce one of the lowest carbon commercial style buildings in the United Kingdom.

Using a combination of prefabricated systems — CLT and precast hollowcore concrete planks — not only resulted in fewest lifecycle carbon emissions, but also provided a modern method of construction optimising safety, quality and speed of assembly. While satisfying the tough project brief, this particular juxtaposition of building construction types had yet to be attempted.

The 5 storey building incorporates two lecture theatres with high-specification audio-visual technology, seminar rooms, café and break-out spaces. The structure has a glazed steel entrance and façades of pink render, terracotta tiles and zinc cladding. The interior has TermoDeck floors, 200mm five-layer CLT walls and stairwells enhanced by the exposed timber surface of the CLT panels. It is the first BREEAM assessed building on the campus, achieving an ‘Excellent’ rating.

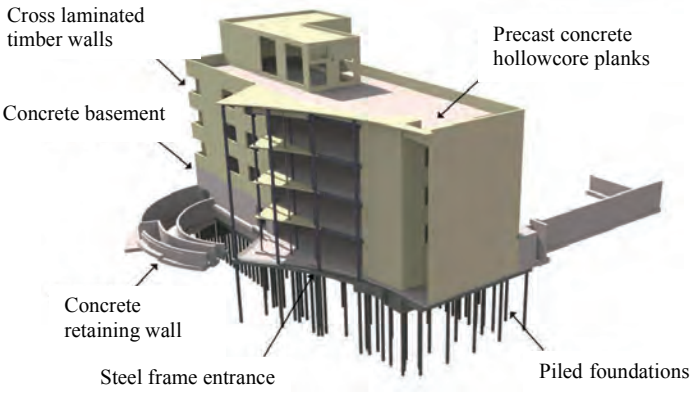

Figure 1: 3D render of The Julian Study Centre

2. Low carbon modelling

Modelling a range of possible construction methods allowed the optimum combination for the lifetime embodied and operational carbon implications of the building to be determined.

The client, as well as the mechanical and electrical engineer, was keen that a TermoDeck system was adopted as it had successfully been used on previous buildings on campus. The TermoDeck system uses the thermal mass of the floor planks to warm or cool the air passing through its hollow cores to reduce carbon emissions associated with heating and cooling.

Several structural options incorporating the TermoDeck system were considered, these included: A CLT frame with precast concrete hollowcore planks; An in-situ concrete frame with precast concrete hollowcore planks; A steel frame with precast concrete hollowcore planks; A CLT frame with a central steel spine.

An in depth study investigating the embodied and operational carbon aspects of each option was undertaken. The study revealed that CLT walls with precast concrete floors produced fewest carbon dioxide emissions and was the final structural solution adopted.

The final CLT and TermoDeck solution that was adopted saved approximately 2500 tCO_2 compared with a standard CLT frame option over the building's 50 year design life. The efficiency of the building is demonstrated in the fact that the entire building is heated by only three domestic boilers, one of which is a redundant back up.

3. Detailing

Integrating reinforced concrete, precast concrete, steel and CLT into one harmonious solution is challenging and could often be dismissed for that reason alone. Connecting these materials required very inventive bespoke connection detailing for both the permanent and construction phases.

4. Conclusion

The Julian Study Centre is a quality project that has exceeded expectations and demonstrated a sustainable approach that is scalable to other buildings. In the long term this building will provide a fully flexible space that continues to meet the needs of the client whilst also continuing to address the needs of society in relation to carbon dioxide emissions.

It can be seen that the combination of timber and concrete can provide a solution playing to each material's strengths to provide an elegant structure that makes a clear advance on sustainability.