CAPELLA – JEFFREY CHEAH BUILDING, CAMBRIDGE UNIVERSITY

PROJECT VALUE - £96M
CLIENT - CAMBRIDGE UNIVERSITY
COST CONSULTANT - AECOM
MAIN CONTRACTOR - KIER CONSTRUCTION
ARCHITECT - FAIRHURSTS GROUP
STRUCTURAL ENGINEER - ARUP
M&E ENGINEER - ARUP
PCE'S SCOPE OF WORKS -

- DESIGN AND BUILD
- COMPOSITE BASEMENT LINER WALLS
- HYBRID CONCRETE SUPERSTRUCTURE
- ARCHITECTURAL PRECAST FAÇADE
- ROOF LEVEL PLANT ROOM FRAMING

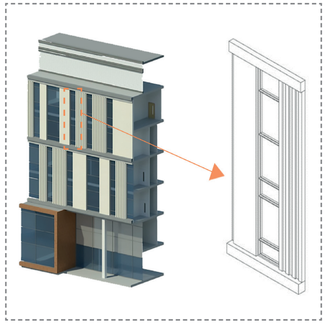
PCE CONTRACT VALUE - £9M

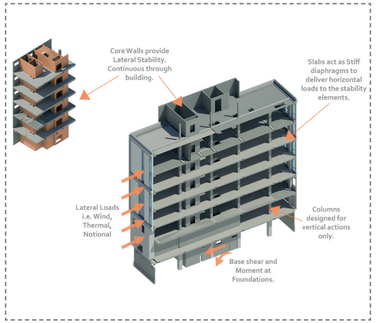
Introduction

The Capella Laboratory, later named the Jeffrey Cheah Building, was commissioned by Cambridge University to provide a world-class Bioscience Research and Development facility constructed to accommodate a diverse group of the world's leading medical research organizations. Located at the heart of the Cambridge Biomedical campus, the scheme was delivered whilst maintaining functional operation of Addenbrookes Hospital other campus facilities.
Kier were determined that the Capella project maximised the opportunities that offsite construction solutions offer and having worked with PCE Ltd on other large scale DfMA Projects selected PCE's HybriDfMA Frame system approach with integrated façade as their chosen superstructure solution.
The 7 storey superstructure was assembled over a 5.0m deep basement, is recti-linear in plan, with a repeating floor plate above level 2. The basement contains major plant and specialist research equipment. Social, hospitality and presentational spaces are at ground and 1st floor, with levels 2 to 6 being laboratories and 'write-up' spaces. At roof level there is a large steel framed plantroom housing specialist extraction plant.
Key performance requirements for the structure included the floor plates to have significantly high levels of vibration resistance flexibility in terms of service distribution and routing throughout the structure.

Hybrid Frame Structure

PCE's hybriDfMA frame system was chosen due its inherent structural performance, flexibility and speed of construction. The Digital design process enables the superstructure to be componentized into a 'kit of parts' which are manufactured offsite under factory controlled conditions prior to delivery to site and assembled, quickly and efficiently by PCE's 'in-house' specialist construction operatives.
The 'kit of parts' for Capella were obtained from PCE's in-house library of standard components and connections and then 'bespoked' to meet the performance and geometric requirements necessary.



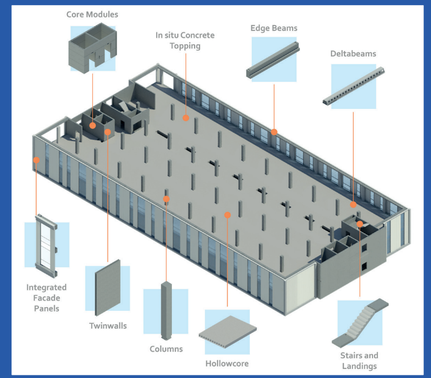


Project Delivery

The 3,500m2 basement was initially constructed in only 6 weeks, followed by the 16,000m2 superstructure frame which took just a further 26 weeks. Structural stability for the frame was provided by a hybrid construction of precast and insitu concrete core and shear walls. Precast concrete stair flights and landings were installed within the cores progressively to enable safe access for the construction works.

The superstructure frame was formed of precast concrete columns and structural steel Deltabeams providing support for the suspended floor plates, which were a composite of precast prestressed concrete floor units with a deep reinforced structural concrete topping. 350no. structural steel members were assembled at roof level to create the 2,500m2 plantroom. In total nearly 4,500 structural elements for the basement and superstructure were assembled by just 22 of PCE specialist multi-disciplined construction operatives.

It took just 4 weeks for 8 PCE specialist operatives using two cranes to install the 195 architectural precast concrete cladding panels which form over 4,000m2 of the structures façade. These pre glazed panels generally spanned two floor levels with vertical loads also being transferred at the intermediate floors.

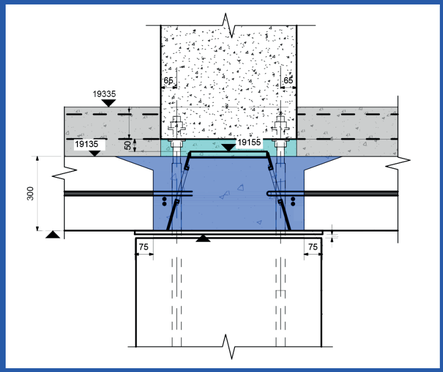


Key Metrics

- **200,000** man hours RIDDOR free
- Net usable space increased by **8%**
- Embodied Carbon reduced
- New BIM Standards for the University

Comparison with equivalent insitu concrete and traditional façade solution:

- Reduction in concrete of **3,500**tonnes
- Site Man Hours reduced by over **100,000**
- Site Deliveries reduced by over **900** lorry loads
- Programme reduction of **15** weeks for the frame and **8** weeks for the Façade
- No external scaffolding requirement
- Reduction in Health &Safety risks
- Reduction in waste and reworking



**To enable flexibility for services design and distribution, PCE used the flat, no downstands, composite construction floor system which provided a highly efficient solution to sustain the high imposed loads and providing the required vibration resistance.
To ensure the exceptionally low vibration design criteria was met PCE engaged with Exeter University's Engineering excellence team. Specialist FEA (Finite Element Analysis) modelling was undertaken to determine the optimum floor construction in terms of stiffness and depth to achieve the VC-A requirements. Onsite testing validated the FEA analysis and proved that the finished structure not only achieved the VC-A requirement but exceed it by at least one VC increment.**

Project Features

The architectural intent required a high quality architectural concrete façade solution using a double storey perspective as the Architect was keen to descale the building due to its close proximity to other buildings.

A key requirement of Kier's project strategy was to integrate the façade with the superstructure to ensuring the glazing was preinstalled within the façade components offsite to avoid and any external access scaffolding onsite.

To achieve the above a modular panellised solution resulted with single panel components up to 9m x 3.6m in area containing different colours of concrete and textures and being fully glazed at the manufacturing factory prior to delivery.

Panels were manufactured in Scunthorpe, transported to Cambridge and turned through 90 degrees on site before assembly into the structure.