

INTERDISCIPLINARY BIOMEDICAL RESEARCH BUILDING, UNIVERSITY OF WARWICK

PROJECT VALUE - £54.3M
 CLIENT – UNIVERSITY OF WARWICK
 COST CONSULTANT – MACE
 PROJECT MANAGERS – TURNER & TOWNSEND
 MAIN CONTRACTOR – WILLMOTT DIXON
 SCHEME ARCHITECT – HAWKINS BROWN
 PROJECT ARCHITECT – FAIRHURSTS DESIGN GROUP
 STRUCTURAL ENGINEER – PETER BRETT ASSOCIATES
 M&E ENGINEER – HOARE LEA & PARTNERS
 PCE SCOPE OF WORKS – HYBRID CONCRETE SUPERSTRUCTURE FRAME
 PCE CONTRACT VALUE - £3.2M



Introduction

The IBRB laboratory was commissioned by the University of Warwick in order to unite the previously separate schools of life sciences and medicine under one roof, creating a collaborative work environment that emphasises innovation through interaction. Located on the University's Gibbert Hill Campus the scheme was delivered whilst maintaining functional operation of all the other campus facilities.

The University had set a target to achieve 50% pre-manufactured value and so having worked with PCE Ltd on other large schemes and taking advantage of PCE's recent experience in delivering multiple laboratory facilities Willmott Dixon selected PCE's HybriDfma Frame System as their chosen superstructure solution.

With contrasting façades of dark bronze and white concrete, IBRB is designed to reflect both the interdisciplinary research happening within the building and the quality of the work it produces. The 7,060 sqm building is immediately recognisable and creates a strong visual link to the main University of Warwick campus to the north.

The 5 storey superstructure including a partial basement is recti-linear in plan, with a repeating floor plate on level's 2, 3 and 4. Level 1 is dissected by a double height auditorium and cafe and the level 5 roof is home to the major plant and specialist M&E equipment.

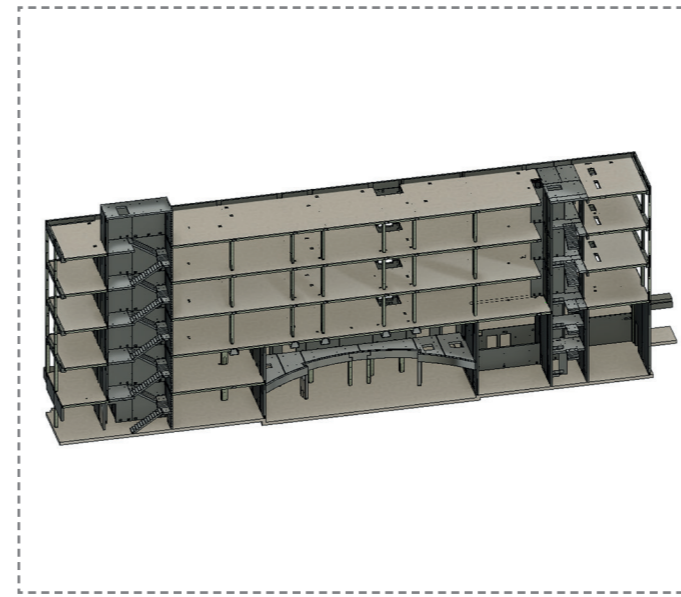
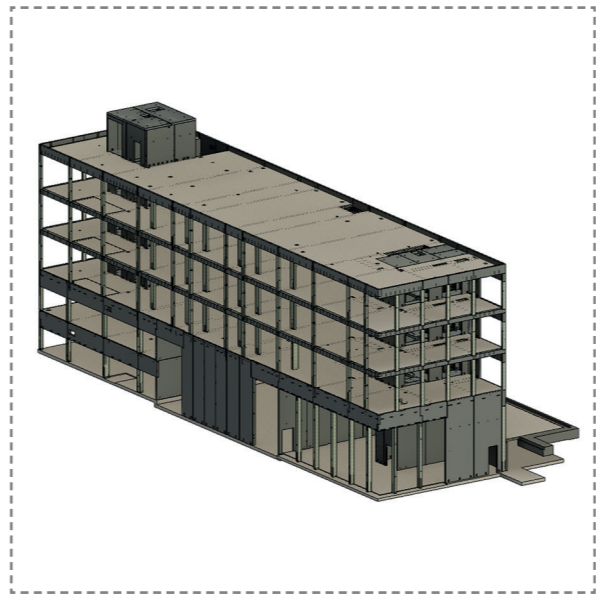
Key performance requirements for the structure included the floor plates having significantly high levels of vibration resistance and flexibility in terms of services distribution and routing throughout the structure.



Hybrid Frame Structure

PCE's hybriDfMA frame system was chosen due to 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 Warwick University 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 Features

The quality of the exposed finishes that form an important architectural feature in various areas within the building including the café area, the auditorium and around the cores were formed by formliners placed into bespoke mouldage within the factory. Co-ordination of the interfacing timber structure was managed through the design team and by control of quality and tolerances within off-site production facilities. All concrete products were manufactured within a 70 mile radius of the site. The structural design solution for the building developed by PCE included for some of the most heavily loaded Deltabeams to be produced and at 16 metres long with a delivered structural steel weight of 18 tonnes they are also the heaviest ever to be manufactured. The 4 composite action steel/concrete beams each required 12m³ of on-site insitu concrete to complete them, bringing the final weight of each beam element to approximately 48 tonnes. Holding down bolts for the columns connected to the beams, which support the 3 storeys of Offsite manufactured frame structure above, were also prefabricated onto the Deltabeams during their manufacture.



Key Metrics

- The HybriDfMA solution required 630m³ of reinforced insitu concrete
- 23,000 man hours accident free
- 13 months from Design commencement to on-site completion
- Digitally designed and detailed
- Delivered through Stages A1-A5 using just 244Kg/m² of Embodied Carbon. A reduction of 15% below the LETI target of 288Kg/m²
- 150 vehicle deliveries saved from a comparable on-site insitu solution
- Over 1,400 individual structural elements were manufactured offsite and delivered on just 208 delivery vehicles
- Offsite Awards 'Best use of concrete technology' 2021 winner

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.

Project Delivery

The 6,220m² hybriDfma superstructure frame was constructed in only 26 weeks. Structural stability for the frames was provided by precast concrete core and shear walls. Precast concrete stair and landing units were installed within the cores progressively to provide safe access for the construction works.

The superstructure frame was formed of precast concrete columns and perimeter edge beams with structural steel Deltabeams providing the internal support for the suspended floor plates, which comprised a composition of precast prestressed concrete floor units with a reinforced structural concrete topping.

The auditorium clear spans were created with 16m long structural steel Deltabeams weighing 48 tonne in their composite form.

The 9m high precast concrete shear walls to the café, auditorium and write up spaces were provided with formed ribbed or boardmark finish to provide an architectural accent to the concrete.

Over 1,400 individual structural elements were assembled by just 18 of PCE's multi-disciplined construction operatives having been delivered on just 208 delivery vehicle movements into the live campus facility.



To ensure the exceptionally low vibration design criteria was met PCE engaged with Curtins Consulting vibrations experts. 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.

