BROADMOOR HOSPITAL REDEVELOPMENT

PROJECT VALUE - £242M
CLIENT - WEST LONDON NHS TRUST
COST CONSULTANT - RIDGE & PARTNERS
MAIN CONTRACTOR - KIER CONSTRUCTION
ARCHITECT - GILLING DODD
STRUCTURAL ENGINEER - WSP
M&E ENGINEER - WSP
PCE SCOPE OF WORKS -
- DESIGN AND BUILD
- COMPOSITE BASEMENT LINER WALLS
- HYBRID CONCRETE SUPERSTRUCTURE
- STRUCTURAL INTEGRATED ARCHITECTURAL PRECAST FAÇADE

PCE CONTRACT VALUE - £16M
**PCE DESIGN** - CURTINS CONSULTING

Introduction

The Broadmoor Hospital Redevelopment Project involved the construction of three new accommodation blocks housing 234-beds across 16 wards, along with a new Entrance Building housing administration and visitor facilities along with the site security control room. The unique accommodation layout was designed to enable greater levels of patient independence, reducing the need for long periods of observation and ushering by staff. This in turn allowed greater focus on therapeutic activities, providing a boost to patient recovery and well-being. Kier having worked with PCE on other large scale DfMA Projects, were determined that Broadmoor maximised the opportunities that offsite solutions can offer, and therefore selected PCE's HybriDfMA Frame and Secure system with an integrated structural façade.

The complex geometry of the ward buildings coupled with the challenging site topography made this a unique challenge. Each ward building was cut into the site with the wards sitting over a semi-basement which housed plant, storage and archiving. The same geometric intent for the wards was adopted across all three buildings with two buildings having two storeys of accommodation and one building have a single storey of accommodation.

Hybrid Frame Structure

PCE's developed an alternative solution to the insitu concrete tender design using a combination of our hybriDfMA frame and secure systems. It was vital that the bedrooms be constructed from concrete due to its inherent robustness and fire resistance and Kier were keen to avoid the use of expensive finishes in these areas due to the complication and cost with ongoing maintenance and repair. Fair faced precast concrete walls which could be directly decorated and floor slabs which had floor finishes directly applied were configured as a bedroom module and were used structurally to support themselves along with the roof. The external façade was configured as a sandwich wall construction with an insulative core and through colour reconstructed stone textured concrete. Building services were integrated within the precast elements and modular risers installed within each bedroom module.
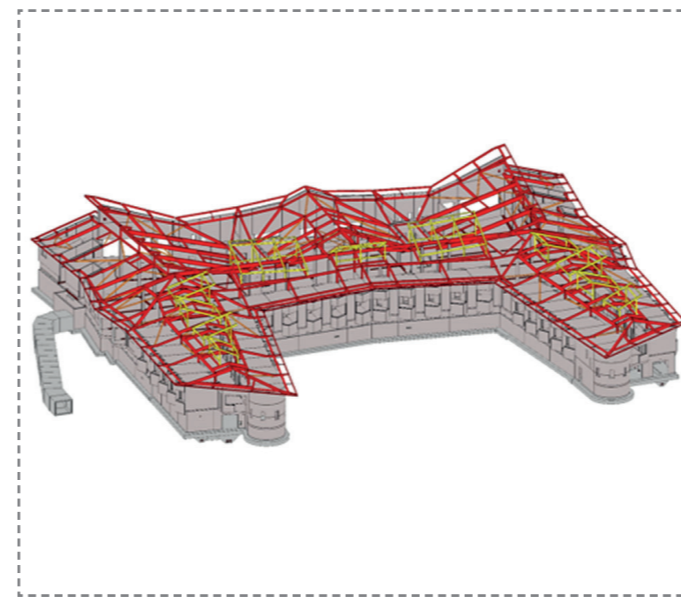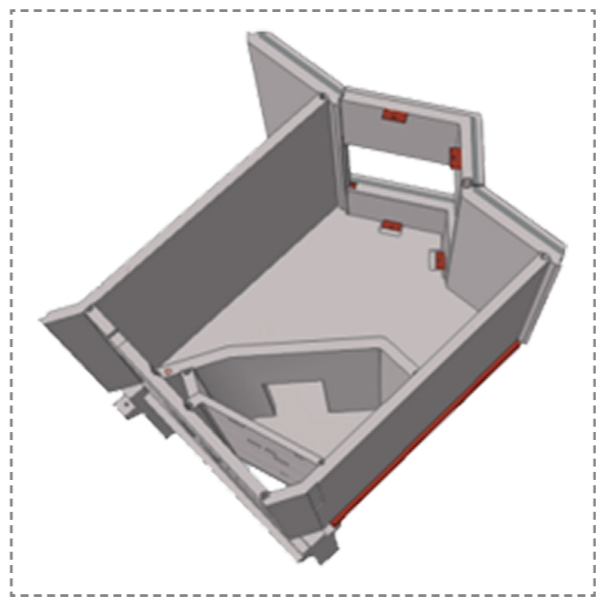

Project Features

The unique roof geometry was extremely complex due to the shape of the ward buildings, but also due to the incorporation of alternating roof lights to provide natural light and ventilation to the wards and treatment areas. The roof was supported directly on the precast concrete structure which involved setting out and casting in of several thousand connections. Within the frame areas of the building precast columns had steel fabrications embedded within them to connect to the streel framing and the pitched and profiled, saw-tooth facades were designed to follow the complex geometric line of the eaves.

Another key component of the DfMA delivery strategy was to integrate the façade with the superstructure and to remove the need for any further decorative treatment to the façade. The original design intent of rendering the façade panels was replaced with a high quality reconstructed stone finish which would not require any long term maintenance. A palette of project specific, 'warm pastel' tones was developed with our supply chain partner Techrete to match the architectural intent. This approach was designed to give a seasonal feel to the facades which would be calming for the patients.

The bedroom façade panels was constructed from a serious of cranked spandrels forming the head and sill of the windows, restrained by double storey mullions. Cranked spandrels hung from a 'saw tooth' precast concrete bedroom slab with mullions sitting on the basement twin walls.

Key Facts

When compared against the tender scheme:

- Site Man Hours reduced by **150,000**
- Site Deliveries reduced by over **750**
- Programme reduction of **12** weeks
- Removal of Scaffolding
- Reduction in H&S risks with **0** RIDDOR incidents
- Significant reduction in waste and rework
- **234** specialists secure bedrooms with directly decorated precast concrete walls
- Over **1500** integrated M&E components
- Multiple trades and H&S risks removed through an integrated structural façade solution
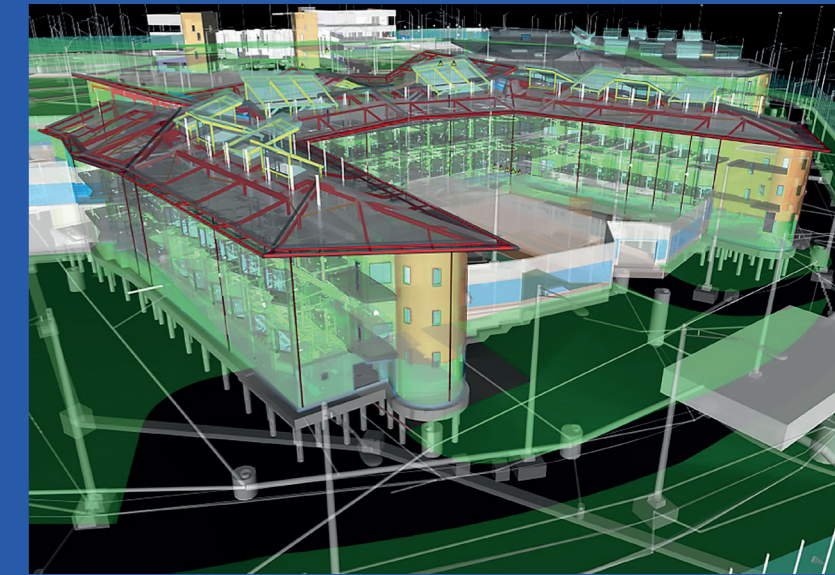
- Hybrid construction solution with over **6000** structural steel and concrete components
- **234** prefabricated M&E modules installed with the superstructure
- BIM Excellence Project through integrated partnering approach
- Innovative precast concrete basement construction

Project Delivery

With 6 offsite factories supplying over 6,150no. Structural components to the project, the 3 ward buildings and Entrance Building were constructed in 30 weeks with just 60 specialist site operatives. The semi-basement was constructed using a twin wall system infilled with a Xypex water resisting concrete to create the internal line of defence against water ingress. The remainder of the basement was constructed as frame with the bedrooms above being supported by a series of precast columns and a grillage of steel and precast concrete beams internally and precast concrete wall panels externally.

Once the lower level of the structure was complete, the bedroom modules could be installed along with the circular stair cores and hybrid frame to the rear of the buildings. The integrated façade was constructed progressively to create a weathertight structure and a structural topping was applied to long span composite slabs to the areas outside of the bedrooms to create flexible, open plan spaces. Riser modules were then lifted into place before the roof was constructed.

On average, 60 structural components equating to approximately 400t of concrete were assembled every day to form the 20,000m2 facility.