

Öppen IM&T & Medical Records Building RUH - Retrospective Case Study



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| Form of Procurement: | Cost Led Procurement (CLP) |
| Project Title: | Öppen IM&T & Medical Records Building RUH |
| Client department: | NHS Foundation Trust |
| Project Value: | £1.73m |
| Form of project: | New build - Adaptable offices |
| Main Contractor: | Pollard |
| Lead Designer: | SRA Architects |
| Key suppliers: | Mann Williams, Hulley & Kirkwood, Northcroft (QS), Steel Fabrications (Martock) Limited |
| Project timescales: | July 2011 – December 2014 |

Client satisfaction

"The contractor and the design team delivered a fantastic office building using the Öppen system. The project demonstrated construction innovation, teamwork and provided adaptability and value for money. The end users are really pleased with their new environment; it has improved working practices and created a real buzz. Even on this fast track programme the end users could fine-tune the design, e.g. server room and security. This is especially important as the medical records plan to change from hard copy files to digitized records with the introduction of a scanning bureau."

- Daniel Barnett, PM, Royal United Hospitals Bath, NHS Foundation Trust

Project Overview

To enable the Royal United Hospitals Bath, NHS Foundation Trust to rationalise their estate, they required a new building for their Medical Records and Information Management Technology Departments. The Trust has occupied many of its buildings since it moved to its current site in 1932. During that time the estate has seen almost continuous change, and this is unlikely to abate. Therefore, the client was clear that their new building had to be adaptable to new uses throughout its 60+ year life. In addition to this adaptability, the building also needed to be economical and durable: precisely the solution that Öppen offers.

The Öppen system was invented by SRA Architects, and it is a fusion of mass-customisation, Open Architecture, pre-fabrication and on-site assembly, lean construction, and open source materials. The two key points of innovation are: a) to separate the building shell from the fit-out; b) to make the building shell fast and economical to construct. SRA Architects worked with Pollard as the main contractor to deliver this project using Öppen, and as a result of this approach, the project achieved a 15% reduction on cost and 31% reduction on delivery time against a traditionally designed building.

Project Background

The Royal United Hospitals Bath, NHS Foundation Trust's full brief for this project was as follows

- Space that was easily adaptable
- Good working environment for up to 100 people
- Durable construction (60+ years) that will be low-maintenance
- Low energy consumption in use and naturally ventilated
- Then, lowest initial capital cost

In addition to this, speed of delivery was a critical factor as the accommodation where the IT department was located was substandard.

Procurement Route

Although the Estates Director wanted what an Öppen building had to offer, the hospital's procurement rules required an open competition. To achieve this, the RUH commissioned SRA Architects to design a building which was: adaptable, enjoyable, durable, economical. With planning consent secured, the project was tendered to D&B contractors without SRA being novated. Two tenderers offered the Öppen system and two offered a building constructed using traditional methods. Pollard's tender was selected. They offered the Öppen system. Compared with the best traditional construction offer, Pollard's offer was 15% lower cost and 31% faster programme.

Concept Design

At the outset, SRA Architects, Mann Williams (s/e) and Northcroft (QS) spent 12 months testing alternative construction strategies. Then Pollard (main contractor) and their key supply chain partners (steel frame, precast concrete planks, cross laminated timber panels) were introduced to the team. This was vital to the successful delivery of the project, for it is the specialist trade contractors who best understand their systems and their early involvement in the design process enabled economies in terms of cost and time to be achieved. It also helped them to uncover and address any potential pitfalls at an early stage. Furthermore, through on-site communication with operatives, assembly was further optimised.

During construction, through bi-weekly monitoring of the project while under construction, and conversations with the operatives, several potential improvements were identified. These have been captured and fed back in to the BIM model to improve the next Öppen project.

Innovation

There are many underlying problems with traditional construction techniques and processes, including

- Poor quality – every project is a prototype
- High cost – lack of buildability in the design
- Inefficiency – lack of learning curve project to project
- A widespread public dislike of industrialised buildings
- As a consequence clients receive poor value for money, this means
 - For publicly funded clients, fewer schools and hospitals;
 - For corporate clients, their products and services increase in cost;
 - For individuals, difficulty in being able to afford a better house.

Having built over £300m of IKEA stores, IKEA's focus on achieving economy through innovation and collaboration has become an integral part of SRA's DNA. SRA first applied IKEA's way of thinking to a non-IKEA project in 2004 when working with Oxford University on the design of a new research laboratory. The consequence was a reduction of 40% in construction cost. This led them to develop the Öppen system, and apply this innovative thinking to a wide range of everyday buildings, giving clients a solution that reduces cost and time, and also gives them a better quality product.

The innovative thinking and practices that enabled this project to deliver lower costs alongside higher quality really makes it stand out as an exemplar, as too often in construction projects we find that one is 'traded off' against the other.

Achieving a better outcome for clients

With Öppen, everything that the users see and touch is bespoke and customised to their needs. All the hidden parts are efficiently machine-made. Due to repetition, the designers and contractors can improve the design and assembly of the shell. By designing Öppen so that it can be efficiently prefabricated off-site, flat-packed, and assembled on site, they have reduced the need for skilled labour.

For all these reasons the clients get much better value for money, much better quality, lower running costs, and greater long-term adaptability.

"The nature of the project made for a smooth and simple design which allowed us to prepare for manufacture very quickly. The installation proved to be relatively simple due to the pre-construction forethought, and we have suggested some improvements for the next project."

- Daniel Saunders, Manager, Crendon Timber Engineering (Supplier/installer of CLT)



Öppen brings together five innovations

• Mass-Customisation

The same efficient, clever design of structure and skin is used in all Öppen projects: offices, residential or laboratories. The interior fit-out and exterior finish can be tailored to suit the specific use and context.

• Open Architecture

Öppen provides 15m wide column-free floor plates - all partitions are non-load bearing. All floors are provided with raised access floors so changing M&E installations is easy.

• Pre-Fabrication and On-Site Assembly

Öppen is designed for easy assembly; the components are accurately made and carefully packed. This reduces the skill level and time required on site.

• Lean Construction

Öppen is a 'design one, build many' system, so it has been worth investing time to make the design and construction lean. As we have seen in other sectors (automotive), this approach leads to increased productivity, together with 'right first time' quality outcomes.

• Open Source

Öppen is constructed entirely using easily available components all of which are available from multiple sources.

Integration & Collaborative Working

Design is an iterative process; decisions need to be made at the correct stage. At RIBA Stage 1 (Preparation & Brief) it is too early to decide whether the frame is steel or concrete; at RIBA Stage 5 (Construction) it is too late. Typically, during RIBA Stage 3 (Developed Design), the primary focuses are achieving the brief within the budget and securing planning consent. With planning consent secured, time to hand-over is usually fixed and as short as possible. This means that RIBA Stage 4 (Technical Design) is highly compressed: there is only time to make decisions once, little time to collaborate and improve the outcome.

However, with Öppen, years ahead of receiving any client's brief, SRA had identified the characteristics of an adaptable building. These characteristics were a 15m wide rectilinear footprint, exposed concrete soffits and multi-storey. This was their RIBA Stage 3. Without the pressure of a project programme, over two years of working with the engineers and quantity surveyor, SRA had time to integrate their iterative improvements while undertaking RIBA Stage 4 on a hypothetical project.

Some of the issues they faced included:

- Balancing cost/time between a steel and concrete frame
- Comparing precast floors (quicker, dryer) with in-situ (cheaper)
- Minimising waste material and time
- Optimising pre-fabrication and on-site assembly
- Progressing the fit-out with early enclosure
- Developing customisable elevations
- Achieving excellent air-tightness and insulation
- Making the M&E services installation easily adaptable
- Incorporating future flexibility for the client

Having established these principles, the ideas were reviewed with seven main contractors. Pollard was the most supportive and most willing to be the 'early adopter'. With Pollard in the team they could collaborate with their supply chain. As part of Pollard's commitment to Öppen, they introduced their preferred specialist trade contractors. Their involvement was invaluable. This is where the real understanding of construction exists.

Even having collaborated over Öppen's detailed design prior to commencing construction, it was on site that the most valuable lessons were learnt. Twice weekly site visits and communication directly with the operatives produced many incremental improvements to speed the construction process, for instance:

- The method of supporting, then fixing the CLT to the frame.
- The method of temporarily propping the steel frame.
- The method of speeding the waterproofing of the roof.

This project follows closely best practice guidelines set out by H.M.Treasury in its "achieving excellence", first published in 1999. (See "Constructing The Best Government Client"). As Öppen is a 'design one, build many' process, and everyone was aware that this was the first project, there was a common desire to improve and develop the system. This approach to continuous improvement is invaluable, as many projects within the sector are 'stand alone', and knowledge is lost when a team is disbanded.

"The close collaborative working allowed initial M&E services design concepts to be developed in an informed manner and as a consequence the later development of the design process was completed successfully in a clear, coordinated manner. A very enjoyable experience".

**- Nigel Yemm, Director, Hulley & Kirkwood
(Mechanical & Electrical Engineers)**

Value

This project realised great value for the client, not just in terms of the original requirements of reduced time and cost, but also in relation to the numerous other benefits achieved, as outlined below. Furthermore, the results to date indicate that with Lean philosophy being driven through continuous improvement techniques, greater savings can be realised on future projects.

Alignment with Construction 2025

• 33% reduction in cost.

Cost excluding fit-out, Cat A = £983/sqm, including fit-out = £1,504/sqm.

Öppen has achieved a 15% reduction on its first project.

Through data collection during construction SRA know further savings are achievable. Öppen is a 'design one, build many' process, therefore it is worth investing development time in improvements. Cost reductions have and will come from off-site prefabrication, simpler construction details, reduced time on site, reduced site waste and fewer defects therefore less reworking. All components are high quality and durable, designed to last 60+ years.

• 50% faster delivery.

12 weeks for groundworks, 20 weeks for envelope and fit-out.

Öppen has achieved a 31% reduction on its first project.

Having taken time lapse video of the entire construction process, SRA know that substantial further reductions in time are achievable. Öppen is designed so as to disentangle the trades: each one starts and finishes, with no need to return. This makes programming simpler.

Öppen utilises mass-customisation. This means that the structure and envelope always have the same detailed design. As construction time for each trade is now known, buffer time can be reduced.

• 50% lower emissions.

17.2kg/sqm/annum CO₂, less than 2.0cub.m air loss.

With accurate prefabrication of components and simple on-site assembly, low air loss is standard. Insulation can easily be increased. The high floor to ceiling heights and exposed thermal mass of the concrete soffit provide natural cooling. All this leads to very low energy consumption, helped by natural ventilation, local heating controls, and LED lighting.

• 50% improvement in exports.

SRA's work with IKEA has given them Europe-wide construction experience. Öppen is eminently exportable to Europe.

Additional client and end user benefits

- Long term adaptability
- Good working environment
- Good for the public purse

Health & Safety

The challenges were significant: the site is within an operational hospital; close to a residential area; with a nursery and primary school nearby.

Key issues included:

- A site bounded by adjacent buildings
- Delivery vehicles accessing the busy hospital site
- Very limited storage areas
- Noise/dust generation
- The use of large mobile cranes

This meant:

- Routes for deliveries were clearly marked and where possible segregated from those used by hospital staff and the public.
- All delivery drivers had to call the site in advance to ensure the delivery could be received and unloaded immediately.
- Keeping the site securely fenced with only one point of access. All visitors were required to undertake an induction process.

Building Safety Group undertook bi-weekly visits. A report was produced for Pollard's H&S Manager and Managing Director. BSG reviewed risk assessments and method statements. Evidence of their approach and commitment to Health & Safety was highlighted by the Considerate Constructor's Scheme monitor. The site scored 40 points and received a certificate of "Performance Beyond Compliance"

Regarding Health & Safety the monitor made the following comments:

- There is a full site specific safety plan.
- Visitors are being escorted and signed in and out; CSCS cards being noted.
- There is an appropriate traffic movement plan; all off site movements banked.
- Risk update information is provided to visitors and operatives via daily briefings.

"With the other designers we have produced a simple functional structure which minimises waste. The active engagement with the contractor and sub-contractors has both successfully realised the design and provided invaluable real time lessons to shape the next design iteration."

**- Spencer Fereday, Director, Mann Williams
(Civil & Structural Engineers)**

Sustainability

Economic:

In the NHS, capital is a finite resource. It is therefore imperative to secure best value. The Öppen-based solution was tendered against traditionally designed buildings: Öppen offered the lowest initial capital cost by 15% and shortest construction period by 31%.

- Öppen is constructed using heavy-weight, durable, long-lasting materials, and will be useful for 60+ years.
- Being well insulated, naturally ventilated and passively cooled, the building will have low running costs.
- With wide open floor plates and a raised access floor throughout, the building will be easy and economical to adapt.
- Local supply chain: 55% of all suppliers were sourced from within 20 miles.

The project achieved a construction cost of £1,533/sqm, including fit-out, except furniture.

Social:

- The users have noted that the building is a pleasure to work in.
- The building has ample daylight, high ceilings, natural ventilation and locally controllable heating which all contribute to improving the satisfaction of the occupants.
- The colour scheme has been developed with the Trust's own interior designer. It is bright and colourful – uplifting for the occupants.

Sustainability

Environmental:

- The calculated CO2 emission rate is 17.2kg/sqm/annum, better than that required by AD Part L.
- Embodied carbon – Öppen scores well: a recyclable steel frame; down-cyclable concrete floors; carbon-negative cross-laminated timber walls.
- Carbon in use – Öppen scores well: very low air-leakage (< 2.0 cub.m); high levels of insulation; natural ventilation; passive cooling; LED lighting.
- Carbon footprint – Öppen scores well because it is inherently durable and adaptable: its carbon footprint can be amortised over 60 years.

"This project has been an excellent example of teamwork and collaboration. We were introduced to Öppen during 2013 and worked with SRA Architects to develop the system. It was important that we fully understood the philosophy – the DNA that SRA refer to – this initial concept work enabled us to contribute buildability, programme and budget advice. The IM&T Building allowed us to translate this to a 'live' scheme and the opportunity to demonstrate its effectiveness in providing a quality building of outstanding value. The lessons learnt will help to develop and improve our delivery on future Öppen projects."

- Hugh Dalton, Director, Henry W Pollard & Sons Ltd (Main Contractor)



Summary

The benefits of adopting the Öppen system are numerous, and the project has delivered above and beyond the client's original requirements. Royal United Hospitals Bath, NHS Foundation Trust have achieved a fantastic office building, that is a great success with the users. This has all been achieved in a shorter timeframe and at a reduced cost compared to a traditionally designed building. Furthermore, this project is an excellent example of the benefits of teamwork and collaboration on a project. The whole team contributed to the development of the concept, eliminating waste, and ensuring the building progressed successfully.

As a project funded through the public procurement budget, Öppen is a significant example of what is possible, as an ongoing working building providing a modern working environment at lower cost. It clearly demonstrates that the 1990's target of 30% real cost reduction, outlined by Sir Michael Latham in his government report, is achievable. It is clear that the Öppen project addresses directly many of the issues identified in his report (such as poor leadership, risk adverse culture, lack of integration) that still hinder the sector today. More importantly, these outcomes have been verified by the data that is available. Key areas for concern (standardisation, integration, etc.) have been addressed, and levels of standardisation as well as product and process interface integration have been key to the success of the project. These practices will lead to significant repeatable activities for the build of future Öppen buildings, with a greater focus on the value of design and integration to meet the client requirements. This project clearly leads the way in developing an integrated building solution for the 21st century.

"We have worked with Pollard for 15 years and were pleased to have been selected by them for this project. Having been involved in its development and learnt lessons on site, we look forward to being involved in the next Öppen."

**- Andy Allman, Manager, Steel Fabrications
(Martock) (Supplier/erector of the frame)**

"SRA Architects designed Öppen to provide our clients with both fast construction and long-term adaptability, economy and durability, bespoke appearance and pre-designed structure. Öppen is a pre-fabricated system but does not need a factory. Öppen owns the intellectual property behind the patented design. Öppen is open-source, open-architecture. 'Öppen' is Swedish for 'open': in recognition of our 25 years' experience of working with IKEA."

- John Rich, Partner, SRA Architects – Öppen's inventor

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