CONSTRUCTING EXCELLENCE
in the built environment



demonstration project

Oriel School

Project Name:	Oriel School
Project Location:	South East
Themes:	Building Information Modelling, Integration and Collaborative Working
Project team:	West Sussex County Council / BAM Construct / BAM Design / Nick Hare / Feilden Clegg Bradley
Contract Value:	£60m
Type of Work:	Newbuild PFI

The Crawley Schools PFI project consisted of the design and construction of four schools in West Sussex plus a 30 year maintenance contract. The consortium led by BAM PPP provided the Design, Construction, financial planning and Facilities Management.

The new Oriel School was one of the four and aimed to provide 1,450 places for the children from the local Maidenbower neighbourhood. The concept design was developed by Feilden Clegg Bradley with BAM Design providing the interior design and FF and E. BAM Design wanted to utilise new technology to take partnering arrangements to a new level and felt that Building Information Modelling (BIM) could provide cost benefits, communication and coordination advantages.

Business Case

The team hoped that using a BIM would assist with the following:

- Cost effective and timely delivery of design information.
- Avoidance of duplicated effort.
- Integrated coordinated services information.
- Visual clash detection.
- Economies through purchasing fixtures, fittings and equipment.
- Consistency in fixtures, fittings and equipment specification and quality across all schools.
- Provision of an asset register for on-going maintenance, which could be utilised by the BAM team.

Use of BIM

The 3D model and database were developed within the CAD design programme.

The team used a Revit programme to provide BIM outputs, providing room layouts populated with all associated equipment and services as well as conventional outputs of room plans and elevations. Specific Family libraries were developed with additional data fields added to the BIM database to encompass schedule formatting for both numbers and costs to individual rooms or for the total project.

Structural elements, architectural building materials and environmental services components were created as objects and placed in the model. These were accessible by different disciplines through layers or work sets. The layers were similar to those used in traditional 2D working in paper drawings and schedules. The aim of this approach was to assist with form massing and spatial awareness and ultimately create design drawings that assist the designers, the client team, the contractor and supply chain to understand the scope of work in a fully coordinated three dimensional environment.

They saw the advantages that the BIM could have when procuring furniture and fixtures and fittings and used it in the preparation of schedules linked to a cost database. Each piece of furniture was assigned a code and then an automatic schedule and costings were created.

Procurement and Implementation

The BIM was first used at the prequalification stage and then later at the preferred bidder stage to verify that the contractors' proposals met the requirements of the client brief and complied with exemplar education standards. The client team, design team, construction team and supply chain were brought together at an early stage and they felt that the BIM helped to aid cultural integration within the team. It improved interface detailing between design disciplines and the automatic updating of schedules streamlined the process with the supply chain. Within the model, details were "owned" by the Architects and Interior Designers whilst the commercial teams were more interested in areas and quantities. The team experimented with developing the model further by adding product fact sheets linked to the furniture, however many items could be procured from many different suppliers which would make this difficult for generic items.

The fully coordinated visual references improved awareness and understanding of what was included within their scope of work as the 3D model provided a realistic picture of the final school which could be viewed from different angles. This helped to manage the client's expectations and assisted in the decision making process. The BAM team also used the BIM to demonstrate design proposals. For instance, they suggested that pop up computer screens would save space in the I.T suites and were then able to demonstrate this using the model.

Key Performance Indicators

The focus for the contractor and supply chain was on cost, time and quality and demonstration of best value. A tight timeframe of just 54 weeks meant that information release schedules were crucial to ensure project delivery. The

contractor felt that the quality of information produced by the BIM assisted them to achieve the target programme. It was suggested that savings in design time in the region of 15% were achieved through efficient delivery and Revit's ability to accommodate changes, although this was difficult to quantify.

Benefits

Clearly there is a benefit in terms of bringing the team quickly to a common level of understanding and the time reduction associated in reviewing and interpreting design information. This is particularly useful to customers less familiar with 2D drawings and permits timely and informed decisions to be taken.

Also, the team felt that the 3d model assisted in verifying the client's requirements and when these were validated within the contractors proposals which was crucial to the success of the project. The single model environment made it easier to coordinate different disciplines, schedules, areas and quantities which were automatically updated. This also provided efficient delivery of updated information and costs whilst maintaining an audit trail.

Barriers

The only barrier to this approach in the project was the reluctance from some of the supply chain to embrace new technology. Some individuals were reticent to try new ways of working and did not believe that the technology would provide significant benefits to the project. Education is necessary if the supply chain is to embrace the long term benefits and commit to the time investment needed to understand and use BIM.

For wholesale adoption of BIM it should be promoted by the client.

Reluctance in terms of consultants to use BIM technology is primarily driven by ownership (where the model sits) access and liability issues. The Revit system allows permissions to be set so that certain layers could only be changed by certain team members. As BAM were delivering the design, construction and maintaining the building it was in their interest to promote a collaborative approach.

The development of BIM could be hindered by the variety of software providers. Software packages from different providers do not always interface with each other which can lead to information exchange problems so interoperability and connectivity should be agreed as early as possible.

Conclusions

The client was extremely pleased with the final building and the building was delivered to the tight timescale of 54 weeks. The BAM team felt that the building could not have been completed using the new technology without the commitment to a new way of working. The achievement of the fast programme was greatly assisted by the BIM as many problems were resolved in the virtual environment before work began on site.

As this project used BIM at an early stage of its development it was not handed over to the client or FM team to use in the maintenance of the building. BIM has the potential to be used as a fully automated asset management system but this would require the a supply chain able to produce and deliver standardised products in BIM compliant models. The BIM also has the potential to be linked to whole life cycle cost modelling software but this would have incurred some initial cost and depreciated over the building life. The drawings and schedules however have been, and are, continually used by Oriel school for ongoing maintenance.

The BIM has helped generate closer working relationships with structural and services engineers and cost consultants. On future projects the team would integrate cost schedules, quantity extraction, structural and engineering services within the same model and produce time evented/construction sequence models. Since the completion of the project, BAM have now developed their own fixtures, fittings and equipment cost scheduling database. In future, they could also provide a full database for the FM Service providers which could be used for maintenance renovation or even demolition.

Future Steps

BAM have used BIM in many subsequent projects. They have developed the use of the BIM to include structural engineering, and engineering services have continued to develop their own library components. They feel that BIM has potential to be developed even further and could permit fast assessment of structural design and environmental services which could help improve the sustainability of future buildings. The project team feel that the use of BIM will greatly increase if clients begin to specify its use at tender stage.

Head Teacher and Principal Bill Lind commented in regard to the PFI schemes:

"I've been proud to be part of the PFI process, Its been a brilliant experience from the schools point of view. From day one I was impressed with BAM and had confidence in the delivery of the schools."

"They enjoyed and have been part of the conversations listening carefully to what the schools wanted and come up with some brilliant solutions. It's been a revelation what the children can achieve in a school where they have the facilities."

"Once I met the contractors team and the project team I had every faith that they would deliver on budget and on time – something they did and something you don't usually hear about in a construction company."

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Constructing Excellence
in the Built Environment
Warwick House,
25 Buckingham Palace Road,
London SW1W 0PP

T 020 7592 1100 **E** helpdesk@constructingexcellence.org.uk
W www.constructingexcellence.org.uk