

Building Information Modelling (BIM) pilot project

Meadow Road affordable housing scheme

Interim report March 2015



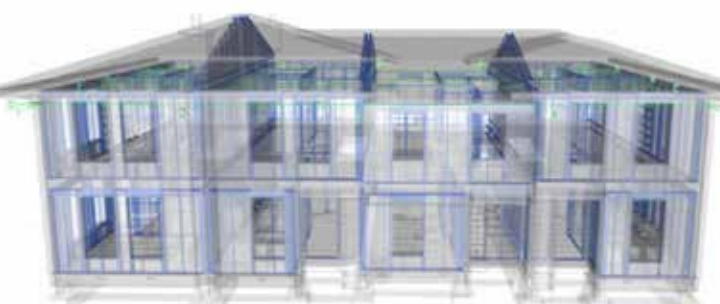
Worthing
HOMES



Why this project is special

By implementing a full 6D level 2 BIM on a £1.5 million project, the team can evaluate the benefits and challenges of using BIM on an 'average value' contract.

Most of the government's BIM pilot projects have a value of £10+ million whereas according to a 2013 report by the Department of Business, Innovation and Skills, the mean value of central government projects is closer to £2.5 million.



Meadow Road is a design and build scheme for 12 houses in three blocks and host to a research project funded by Innovate UK (formerly the Technology Strategy Board).

The primary objective of the research project is to explore the changes in dynamics and behaviours across the construction supply chain, required to ensure that Building Information Modelling (BIM) delivers a more efficient and collaborative way of working.

The research project is being led by The Clarkson Alliance, working alongside software partner Clearbox. The host project – Meadow Road – is being provided by the third collaboration partner, Worthing Homes. The construction is being managed by the main contractor PMC Construction alongside structural engineer HOP and designer ECE Architecture.

The impact on the tendering process

The tendering process used a federated BIM model*, integrating the design via Clearbox's central BIMXtra platform.

This approach gives the team access to powerful visualisation and clash detection tools within Autodesk Navisworks – allowing design issues to be quickly and easily identified and resolved.

*The design is being developed by the architect, structural engineer and a number of sub contractors who have design responsibility in authoring tools such as Autodesk Revit. These details are then imported into a central middleware platform to create a single federated Level 2 BIM model.

This has significantly changed the usual dynamics and behaviours at tender stage – leading to a move away from a single stage design and build tender to a two stage tender.

In design and build contracts clients often seek to transfer the design risk to the winning bidder. However with the ability to identify and resolve design issues using the visualisation software, this means there's far less inherent design risk in a BIM project and hence little point in paying the contractor a risk premium to transfer it.

A further important change has been an early focus on the asset information model (AIM) – the information needed to efficiently and effectively operate and maintain the finished building – which ensures the client's requirements are captured early on in the process and written into the Employer's Information Requirements (EIR).

At Meadow Road we have focused on building an AIM that will deliver:

- A Health and Safety File containing 'passive' project data
- A federated model in IFC file format containing 'passive' system data
- A spreadsheet containing 'active' system data

Step two in the tendering process included issuing the EIR with the usual employer's requirements and supporting the bidders, their consultants and contractors through the process, in particular with their pre-contract award BIM Execution Plans and associated capability assessments.

We are already gathering insight into how BIM can change the tender process and how vital it is to ensure the client's needs are incorporated. We will be actively sharing our findings as we uncover more changes in process and behaviours in future updates as we develop further understanding of how BIM works in a live project environment.

Getting the basics right

An early focus was on developing a BIM protocol and an asset information model to allow Worthing Homes to effectively operate and maintain the finished building. Worthing Homes collated a set of employer's information requirements (EIR) based on the publicly available standard (PAS) 1192-2:2013 for BIM projects.

PAS 1192-2 is set as a standard for all BIM projects, however we found we needed to substantially tailor the approach to fit the needs of this smaller contract, where there are fewer people and less data than would be typical in a major government scheme.

"PAS 1192-2 is a very difficult document to read, I've heard SMEs use words like 'impenetrable,'" acknowledges Julian Bullen, project director at the Clarkson Alliance. *"However, it provided us with a framework to work within, we selected the parts relevant to us and translated them into our own documentation to make it more accessible and easy to read."*

"We found it vital to use PAS terminology consistently, so that everyone is speaking in a common language, for example they know the difference between a BIM Information Manager and a BIM Coordinator and their responsibilities."

Where the PAS assumes a single stage tender process, Meadow Road in fact went through a two-stage process.

The design was at first developed in 2D CAD and tendered in the traditional manner. After the contractor and design team were appointed, a BIM execution plan and related assessments were then carried out before developing the design and moving on to the second stage tender.

BIM's powerful 3D visualisations and clash detection features helped to resolve design issues quickly, resulting in reduced design risk for the contractor compared with a traditional design and build contract. This allowed the contract to be priced without the normal risk premium.

Software compatibility

Several software tools are being used by the project team and supply chain. Data is originated in Autodesk Revit which interfaces with BIMXtra, a cloud-based data hub that consolidates the information and coordinates the construction schedule, cost planning, asset information as well as other functions.

BIMXtra is currently used by a range of construction businesses and has performed well. However, some members of the supply chain have yet to access BIM enabled solutions within their own spheres of operation. For instance timber frame suppliers use autocad software such as Consultec for their panelisation drawings. This is compatible with BIM projects as we have proved and we created a converter that enabled this sub contractor to be included in the BIM process. Without this, alternative work arounds would have needed to be found.

Another issue has been insufficient access to reliable BIM object data on products from certain manufacturers and suppliers, which has forced the designers to draw up the objects themselves from scratch. BIMXtra has nevertheless helped to expose the maturity of the BIM information and helped many in the team avoid the complexity of the traditional BIM authoring tools.

It turns out that products initially specified by the architect, and their attendant BIM objects, were abandoned by the contractor during detailed design in favour of cheaper or higher quality alternatives, which sometimes lacked BIM object data.

"We have been through four different windows suppliers and the current one doesn't have windows available as BIM objects. It means we lose the advantage of having that level of detail in the model and being able to see how it interfaces with other components," says Bullen.

"There's a massive push to get manufacturers to update their BIM libraries, the penny is dropping with many of them, but if you're a small window manufacturer just coming out of the recession you may not have all of your products in CAD yet, let alone BIM software."

This also raised concerns in relation to contractual responsibility and BIM information: with the windows, for instance, the contractor is providing a component that is compliant with the employer's specification requirements, but not necessarily with its EIR.

"This is where someone has to make a judgement call in terms of whether they have complied with the contract because they haven't provided the BIM information component when it was available, albeit for an alternative product," says Bullen.

Behavioural and cultural change

The biggest challenges have related to the training required to upskill contributors, alongside the process, behavioural and cultural changes needed to work collaboratively in a BIM environment. In addition to regular training in BIMXtra, the Innovate UK funding is being used to run several workshops and analysis on behavioural change.

"The biggest challenge is not the tools and processes, but the people. Individuals need to have a level of trust and confidence in one another to work collaboratively using BIM as well as embrace technological change. You have to work very hard to win people over to the concept of change being a good thing, neuroscience shows us that brains are pre-wired to go into flight, fight or freeze mode when confronted by things they are not familiar with. We've had to work very hard to win people over to the concept of change being a good thing," concludes Bullen.



Benefits and challenges

At the time of compiling this interim report The Clarkson Alliance captured the benefits and challenges so far encountered.

BIM housing positives

- Great potential for off-site manufacturing processes.
- Early use of modelling tools will provide improved layouts which consider topography and site constraints at development appraisal stage.
- Possible to generate good asset information that will provide benefits to maintenance teams.
- Ability to remodel very quickly when changes occur without having to change numerous drawings.
- Ability to quantify and schedule quantities from the model, thereby reducing waste and monitor more closely use of materials by labour only sub-contractors.

BIM challenges

- Current smaller supply chain contractors undertaking limited design do not have the BIM capabilities.
- Manufacturing software does not easily link with design authoring software e.g. timber frame required some coding from software engineers to Clearbox to generate a file converter to ensure all project data could be included.
- Lots to learn on 'first' projects.
- Not used to providing more detailed information earlier which enables design issues to be resolved.
- Procurement needs to be reviewed to engage teams earlier in the process.
- Not all families of objects available.

Meadow Road project targets

- 10% reduction in design costs measured at end of design and on completion
- 20% reduction in construction costs measured on completion
- 75% reduction in post-contract change measured on completion
- 10% reduction in time on-site measured on completion
- 25% reduction in notified defects measured at end of defects liability period
- 25% reduction in construction waste measured on completion

Worthing Homes
Host project
and research partner

**Helmsley Orrall
Partnership**
Structural engineer

The Clarkson Alliance
Research partner

AD Mechanical
Mechanical engineer

PMC Construction
Main contractor

MR Electrical Services
Electrical engineer

ECE Architecture
Designer

Rund Partnership
Employer's agent

Clearbox Limited
Innovate Research Partner

Allwood Timber
Timber frames

Innovation in Practice



**CONSTRUCTING
EXCELLENCE**
in the built environment

