

Ara Institute of Canterbury Kahukura Block

BIM as a collaborative Quantity Surveying tool

The project

Ara Institute of Canterbury (Ara) is creating learning spaces aligned to its core values, including sustainability. Ara wanted a new building to house its Architecture and Engineering students at its inner city campus. The result will be the Kahukura Block – a flagship building marking the entrance to the southern gateway of the campus.



The \$34 million building is currently under construction.

The client and all of the design team saw the potential of BIM to add value to this project.

Ara engaged AECOM to provide quantity surveying (QS) services, including cost plans for each stage of design, collaboration with the early contractor involvement (ECI) contractor, a schedule of quantities and administration of construction costs.

The design brief was that the spaces within the three-level 6,690m² building were to be as open as possible to show off its structure so students could use it as a learning tool. Ara wanted to have as sustainable a building as possible.

Initially, the design was to use a steel and concrete structure. As a result of the QS process, AECOM recommended that a timber gravity structure be considered. The end result was a hybrid solution of timber, concrete and steel that uses the best of all of these materials to achieve a very efficient and more sustainable build. The building is being constructed on a deep soil cement mix and reinforced concrete raft. It has a laminated veneer lumber column and beam system with steel cross-braces and two, in-situ-cast concrete cores.

This case study explains how AECOM used 5D BIM on this project to assist with cost estimation as part of a collaborative process. 5D BIM is quantity surveying in a collaborative digital environment; it involves extracting data from models to create cost plans.

What is BIM?

BIM is the digital representation of the complete physical and functional characteristics of a built asset – everything from bridges to buildings.

It involves creating a model with real life attributes within a computer and sharing that information to optimise the design, construction and operation of that asset.

Used well, BIM can add value over the whole life of a built asset.

“5D BIM enabled AECOM to provide a quick and accurate cost estimate of the detailed design for the Kahukura project.”

Jon Bruwer
Capital Works Programme Manager, Ara

AECOM

Duration

Design of the Kahukura Block started in March 2014. The building is expected to be complete in early 2017, in time for the commencement of the academic year.

Project partners

Client:	Ara Institute of Canterbury (Ara)
Quantity Surveyor:	AECOM
ECI & Main Contractor:	Hawkins Construction
Architect:	Jasmax
Project Manager:	Inovo Projects
Structure:	Powell Fenwick Consultants
Fire, MEP, Hydraulics, Civil	Powell Fenwick Consultants
Fire Sprinkler Modelling	Protech
Geotechnical	Tonkin & Taylor

BIM Uses

The New Zealand BIM Handbook Appendix D defines 21 distinct BIM Uses. To date, this project has used BIM for:

- Cost estimation
- Design authoring
- Design review
- Engineering analysis
- 3D coordination.

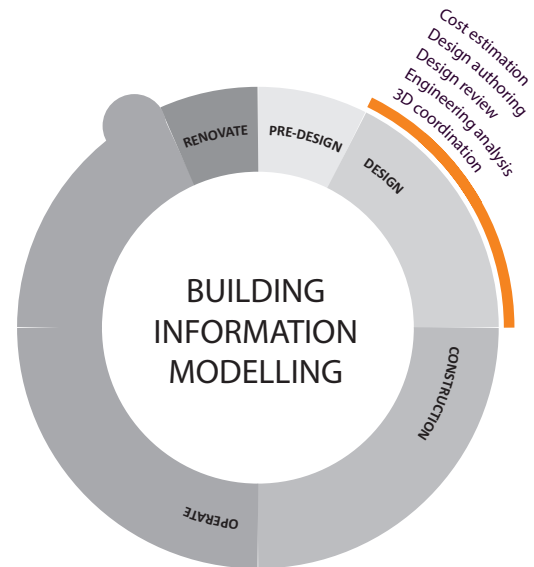
Process

At the kick-off meeting AECOM sat down with the whole design team including Jasmax and Powell Fenwick Consultants (PFC) to agree the ground rules for the BIM Execution Plan (BEP). This live document captured details on how the team was going to operate in a digital environment, covering everything from the software and file types to be used, down to data storage, the QA process, and the level of detail (LOD) required at design stages. (See BIM Handbook Appendix C - Levels of Development definitions.) This was integral to interoperability, enabling data and models to be shared seamlessly across the team. There was no independent BIM Manager.

AECOM brought their model content plan (MCP) to the table. The MCP performs a similar function to model element authoring but has been specifically developed by AECOM for QS modelling.

What is a BIM Use?

BIM Use – a unique task or procedure on a project which can benefit from the application and integration of BIM into that process.



This case study highlights the value of using 5D BIM in the design stage of the project life cycle.

“BIM was a design requirement from the get-go. We added BIM as a QS tool as AECOM’s protocol documents clearly showed what they wanted from the model and how they would use it as a communication tool to request the required data for cost plans.”

Rachel Bowen-Price
Project Manager, Inovo Projects

This collaborative BIM tool enabled the team to discuss how AECOM was going to measure the building and populate the cost plan. Using this text document, responsibilities for maintaining quality data on various building components were assigned to different project team members. This gave all team members a comprehensive picture of the project and what was needed. The MCP allowed AECOM to request data required to inform estimates. It also showed where the responsibility for modelling the components lay so the right design team member provided that detail in their model.

Importantly, the MCP gave everyone the opportunity to talk about their components of the design before moving ahead to finalise them.

“BIM has the potential to enable better design because everyone is on the same page; it facilitates communication, collaboration and contribution.”

Keeley Pomeroy
Senior Quantity Surveyor, AECOM

AECOM attended fortnightly BIM coordination meetings to provide input during the critical design stages. This helped provide for the most efficient construction process, along with ‘Safety in Design’ inputs.

The design team from Jasmax and Powell Fenwick Consultants produced 3D information models and 2D drawings for each design stage for AECOM to prepare a cost plan. AECOM was able to use the models within their cost planning software. These included architectural, structural, mechanical, hydraulic and electrical models. As the project’s quantity surveyor, AECOM used individual models to measure raw data and the federated model, which brought all of the plans together, to visualise the whole building.

At the end of each design phase milestone, AECOM prepared a cost plan based on that documentation. AECOM then met with the client and design team to discuss the estimated costings. Client feedback was used to modify the design and budget, as required. AECOM’s last estimate was based on 70% detailed design.

Ara wanted to ensure that its flagship project was built and delivered on time and to budget. To assist with this, Hawkins Construction was brought in as an early contractor involvement partner at developed design stage. Hawkins collaborated with AECOM and extracted quantities from the cost plan for market testing, and gave independent advice on construction costs and risks. AECOM checked the market estimates obtained by Hawkins against the model. This quickly identified any mismatches and highlighted potential risk areas that could impact on the budget. It also highlighted information gaps or issues with quantities or measures in the model which could be rectified in the next stage of design so tenders for subcontractors were accurate.

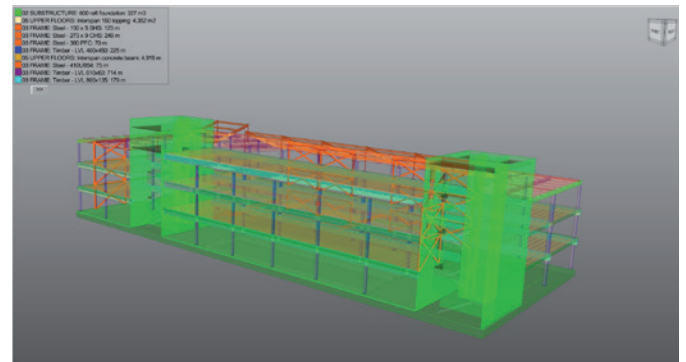
AECOM’s estimates were revised accordingly, based on agreed risk and market feedback, providing Ara with a firmer price to budget on. Hawkins was then asked to provide a lump sum tender for the building. A limited trade schedule of quantities was produced to assist Hawkins in getting the most competitive pricing from selected trades.

Challenges and constraints

Ara requested that AECOM produce a cost plan within three days of the completion of the developed design documentation, presenting one of the biggest challenges for the team. Normally, this would not be possible on a project of this scale but, with a BIM-focused project, the level of detail within the model was appropriate to drive the quantities for the cost plan. This meant AECOM was able to deliver the cost plan in 20 work hours, in time for the client to sign off. Without BIM, this task would have taken up to two weeks.

There was a perceived risk in relying on a digital model to drive quantities; investment in internal systems was required to ensure AECOM’s quality assurance systems were BIM appropriate. 5D BIM enables best design practice but it does not reduce project risk in itself; it’s always down to the people who use it.

The quality of the cost estimate is related to the quality of the design documentation provided to the quantity surveyor.



Data extracted from the PFC structural model ready for cost planning

Policing of the BIM Execution Plan is crucial to a project’s success; a key learning for all the project team. Furthermore, the process would have been assisted greatly by an independent BIM Manager. The client needs to be assured their consultants will be held accountable if BEP criteria are not met, so they deliver against Construction Industry Council guidelines at each design stage.

As the 3D documentation was not part of the contract documents, AECOM could not use the models for producing schedules of quantities for contractor pricing.

The construction industry needs an approved BIM method of measurement to realise these time and cost efficiencies.

Results and benefits

5D BIM enabled AECOM to use intelligent data to provide Ara with accurate quantities and costings, fast. Information could be harvested from the models to drive precise measurement of different building components.

The speed with which cost plans could be prepared freed up AECOM to concentrate on obtaining specialist market cost information to further increase the robustness of the pricing.

“5D BIM (digital QS) enables a quantity surveyor to work very fast because you can rely on the data.”

Keeley Pomeroy
Senior Quantity Surveyor, AECOM

Hawkins was able to use AECOM’s cost plan as the basis for conversations with subcontractors and engaging with specialists, while remaining focused on buildability and construction cost savings.

Having a proactive construction team on board early greatly assisted the QS process. AECOM was in constant communication with Hawkins so their costing was “live”. This was very powerful, enabling AECOM to quickly inform the client and project managers of the impact on cost of any changes or design development options.

“The speed and efficiency with which AECOM could check the accuracy of contractors’ quotes were greatly assisted by BIM.”

Rachel Bowen-Price
Project Manager, Inovo Projects

Working on a BIM-led project meant that the quantity surveyors were part of the design team and could contribute in a sense that wasn’t purely traditional.

A critical success factor was client support; Ara understood the value of using BIM and saw that it enabled a process to achieve excellence from their consultant team. Importantly, the client endorsed this sharing of information, recognising that collaboration was essential to successful delivery.

Cost considerations

Using BIM saved time, therefore, money throughout the design stages of this complex project. For example, it enabled production of the developed design cost plan in 20 hours instead of the usual one to two weeks required for a traditional, non-digital process. All time and fees saved on cost planning were directed into engaging with the market to confirm specialist pricing or achieving further savings through value engineering workshops and meetings. Consequently, the timeframe for the programme was reduced.

“5D BIM definitely helped us reach our budget targets.”

Jon Bruwer
Capital Works Programme Manager, Ara

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Further information on BIM in New Zealand
www.building.govt.nz/bim-in-nz