BIMinNZ

CASESTUDY:

UNITEC's integrated information system

Unitec Institute of Technology
TE WHARE WĀNANGA O WAIRAKA

BIM ACCELERATION COMMITTEE

BRANZ Funded from the Building Research Levy

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

WHAT IS BIM:

Building Information Modelling (BIM) is a digital representation of physical and functional characteristics of a build asset – everything from bridges to buildings. A building information model is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition.

The key principle is that BIM is not any single act or process. It is not creating a 3D model in isolation from others or utilising computer-based fabrication. It is being aware of the information needs of others as you undertake your part of the process.

BIM as an information sharing resource for facilities management and operations.

Unitec Institute of Technology (Unitec) has created an information rich, digital model of its three campuses in Auckland and is using this live resource to support the planning, management and operation of its facilities for the whole of their life cycle. By integrating Building Information Modelling (BIM) with Unitec's facilities management system it's possible to track who is using what facilities for which activities at any time. This provides for the most efficient and cost effective use of resources. In the future, the BIM campus model will assist campus-wide development projects.

Unitec is New Zealand's largest institute of technology with three campuses across Auckland serving more than 20,000 students each year, employing around 800 staff members and offering over 150 employment-focused educational programmes. Its Facilities Management (FM) department operates from the main Mt Albert campus and is managed by the Strategic Property Development directorate, which is responsible for assets worth more than $400 million.

Prior to BIM adoption in 2008, facilities information at Unitec was managed using Aperture zone planning software, in conjunction with 2D drawings. The information was printed annually as an A3 sized "Plan Book". Unitec first considered using BIM in 2007 as part of a decision to develop a dedicated facilities management software application in-house to integrate digital building information with all facilities management and operation (FM&O) workflows to enable more efficient information sharing.

"BIM indicates a future where detailed information on buildings is available to consultants and clients alike, which will lead to greater accuracy of documentation and productivity gains, allowing higher levels of service."

GRAEME SCOTT, DIRECTOR, ASC ARCHITECTS

PROJECT DETAIL:

DURATION
The project took about four and a half years to complete:

Development of Unitec's FM system – May 2007 to January 2009

Building information modelling of Unitec campus – March 2008 to September 2011

BIM integration with FM system – October 2011 to January 2012.

PROJECT PARTNERS
The project was undertaken by Unitec in-house by a team of mainly part-time staff and contractors.

BIM USES
The New Zealand BIM Handbook Appendix D defines 21 distinct BIM Uses. On this project BIM was used for:

Existing condition modelling

Record modelling

Asset management

Building (preventative) maintenance scheduling

Space management tracking.

A key motivation was the lack of a suitable off-the-shelf product. Specifically, none of the available software products evaluated at the time allowed for integration with BIM.

The project consisted of three tasks:

1. Development of Unitec's FM system – a web based, integrated, information and asset management system.
2. Construction of Autodesk Revit models of all campus buildings in two stages, i.e., firstly the building shell then the interior layout and space objects including properties, fixtures and fittings.
3. Integration of BIM with Unitec's FM system.

A total of 191 buildings were successfully modelled in Revit and fully integrated into Unitec's FM system.

The Process

The process started with preparatory site surveys and assessment of space conditions. The site surveys provided a reference level and specific information for each building, such as window and door dimensions, opening direction of doors, exterior and interior surface finishes, etc.

This was followed by actual modelling of the buildings in Autodesk Revit software in two stages. The exterior of the buildings was modelled first, using existing 2D base drawings as overlays.

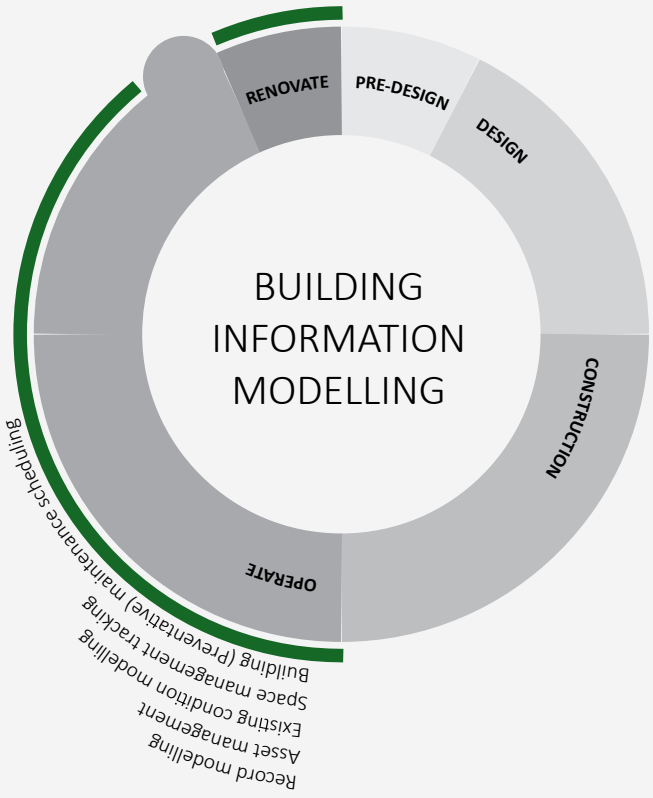
The interior of the buildings was then modelled including the layout and space objects as well as fixtures and fittings.

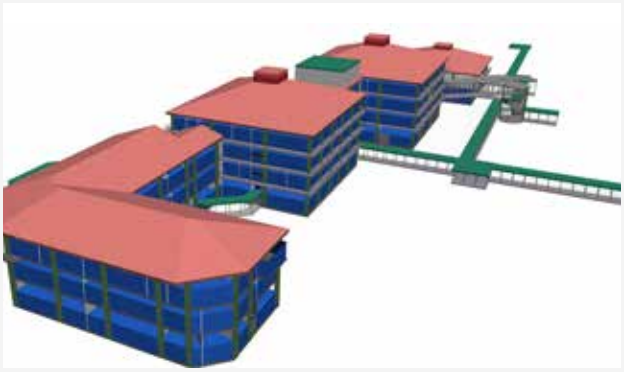
WHAT IS A BIM USE?

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

THE NEW ZEALAND BIM HANDBOOK.

THIS CASE STUDY HIGHLIGHTS THE VALUE OF USING BIM IN THE OPERATE AND RENOVATE STAGES OF THE PROJECT LIFE CYCLE.





An audit of the condition of all spaces (including the condition of walls, floors, ceilings, windows and blinds) was carried out and this information was added to the space objects of every model. Generating representations of space objects for each model was useful for post-processing by energy and engineering analysis software tools.

The next step was to integrate the models into Unitec's facilities management (FM) system. This was achieved with a software add-in using Revit's application programming developed specifically for this purpose.

Challenges and constraints

The project experienced a number of challenges including:

- Rapid technological changes in Revit's implementation of BIM during the initial stages. Unitec responded to this challenge by developing a formal modelling standard and conventions, based on the US BIM Standard, along with a training manual and adapting these as required.
- Backward incompatibility of Revit's application. This required Unitec to rewrite some of the add-in codes following each major Revit version upgrade.
- System performance and hardware limitations to keep working with complex models, and difficulties in modelling unconventional shapes and clusters of buildings in a single model.
- The effort required to obtain staff location data from a database managed by another department.

Results and benefits

The information generated by Unitec's BIM based, FM system is now being used by the Institute's teaching staff, security and compliance team, campus planning team, facilities management and operations team and contractors.

At the core of the Unitec's FM system is a centralised database that maintains a live link to every building model in the BIM repository. The centralised FM database feeds a suite of client/server web applications developed for specific FM&O tasks with various information and allows them to update the information, as shown in the following diagram (next page).

The integrated information system supports a comprehensive range of applications including:

- FM Help – a dedicated FM help-desk system used by the whole institution
- FM BIM – a user interface to the BIM database
- FM Space and FM Space View which provide facilities information for use by the whole institution

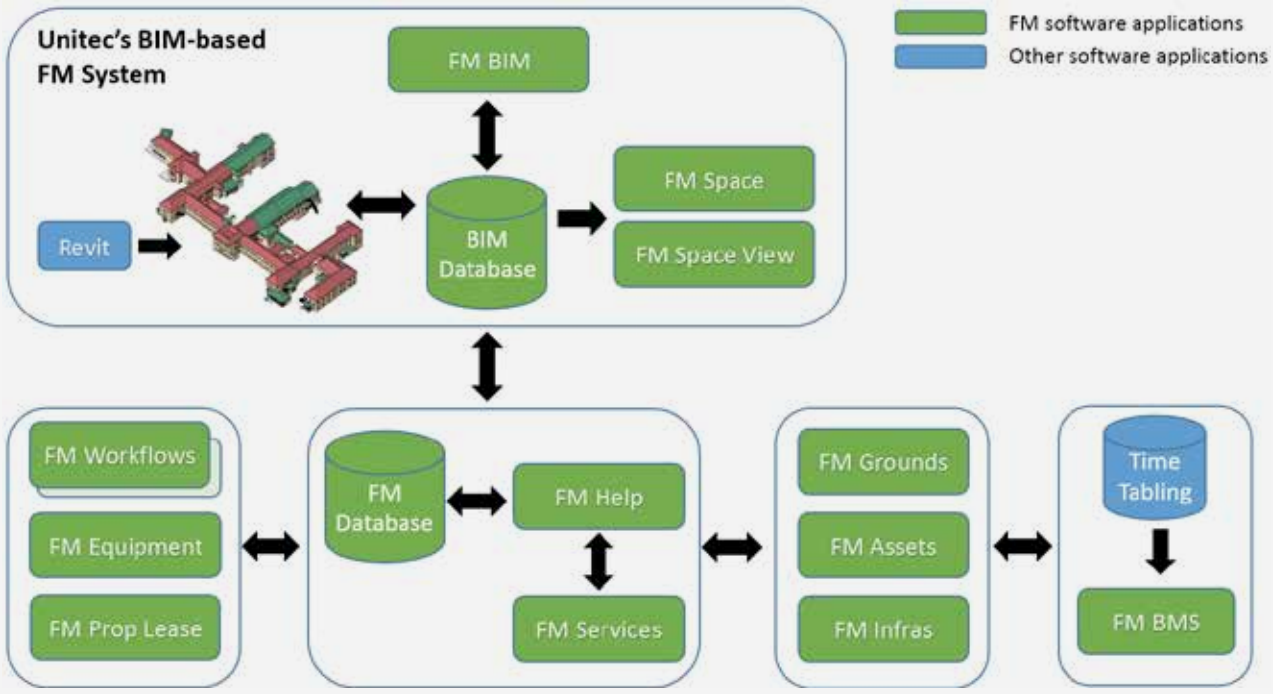
- FM Workflows (consisting of FM Actions, FM Compliance, FM Cleaning, FM Signage, FM Security, FM Grounds, FM Services)
- FM Projects – for managing capital projects
- FM Equipment – for managing equipment in teaching spaces
- FM BMS – for controlling heating, ventilation and air conditioning (HVAC) in teaching spaces using timetabling data
- FM Vehicles – for managing vehicle bookings and charges
- FM Maintenance – for automated generation and management of maintenance schedules and cost projections
- FM PropLease – for managing property and space leasing within Unitec campuses.

Unitec now has one source of building information that produces accurate and consistent data shared by all applications including space planning, room bookings, time-tabling, and its help-desk system. This improves workflow efficiency.

Unitec's integrated information system has delivered many benefits.

It provides instant access to accurate and up-to-date space information including automatically generated floor plans, space planning reports, maintenance schedules and long-term maintenance reports. Without BIM, most of this information would take days or weeks to produce.

Unitec now has one source of building information that produces accurate and consistent data shared by all applications including space planning, room bookings, time-tabling, and its help-desk system. This improves workflow efficiency. Prior to the use of BIM, facilities data was held in multiple places which made the compilation of reports time consuming and often resulted in discrepancies.



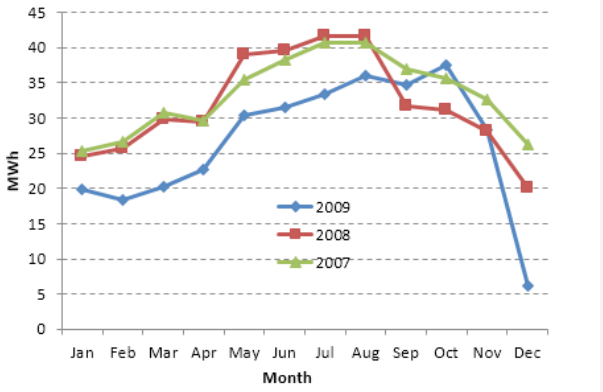
UNITEC'S BIM-enhanced FM system

Using time-tabling data to control heating, ventilation and air conditioning in teaching spaces has significantly reduced electricity consumption. Previously, they were controlled by fixed time schedules. The following graphs show an average 13 MWh reduction in electricity usage per month for two separate buildings after FM BMS's implementation in 2009, although this is only partially attributed to BIM. However, energy savings will increase as more buildings are controlled by FM BMS.

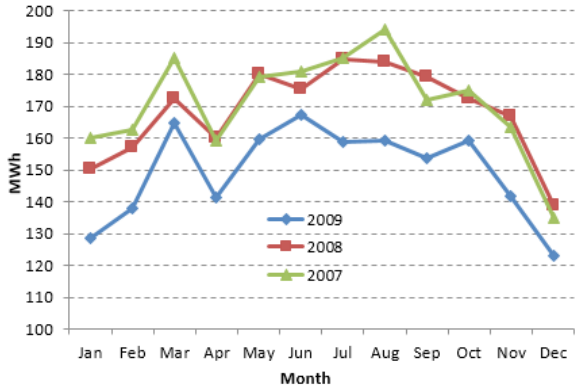
Online facilities information has reduced paper use and made it easy for maintenance staff and contractors to locate jobs accurately, leading to shorter response times and greater capacity to attend to required maintenance and repairs. Contractors' invoices are processed more efficiently due to the ability to quickly match them with job records held in the BIM database.

Generally, BIM has produced better quality information, boosted productivity, improved user satisfaction, increased FM&O workflow efficiency and driven opportunities for innovation.

Longer-term, the BIM campus model will facilitate campus planning and development projects, such as inter-departmental relocations and infrastructure upgrades. It can be used as an effective inventory system for tracking furniture movements and the condition of every major piece of equipment on campus. By using smart sensors and the building automation system, the model will enhance campus-wide security and energy management. More importantly, it will greatly assist risk and emergency management. For example, it can quickly locate faults in piped and wired services via augmented reality technology, avoiding potential disruption to business and associated costs.



Electricity consumption of two buildings



Estimated cost

The total cost of developing Unitec's BIM-driven FM System is estimated at $119,000 based on 3,300 hours of labour and initial computer system hardware and setup costs.

The ongoing cost of using BIM (model, system maintenance and hardware upgrade) is estimated at $19,500 per year. This is based on 94 hours per month and system upgrades at $1,000 per year. It excludes CAD/Revit software licensing of $1,800 per year. Note that the extent of BIM model and system maintenance is a function of Unitec's capital project activities, so it will vary from year to year.

This compares favourably with the average cost of completing FM&O tasks using and maintaining building information in the traditional way, prior to the BIM adoption, which added up to $27,000 per year. It amounts to an average saving of $7,200 per year.

Additionally, the availability of BIM models saves at least $5,000 on each BIM-based capital project at Unitec, as it eliminates the need to produce a base model of the building, every time. Improved collaboration among the project team in the initial planning and design stages provides for further savings. The FM BMS system also provides ongoing campus-wide energy savings in excess of $10,000 per year, based on current electricity charges.

Assuming an average of two BIM-based capital projects are undertaken each year in the shorter term, the total cost saving to Unitec will be around $27,000 per year, which represents an annual return on investment of approximately 23%.

Potential cost savings in the actual delivery of capital projects are beyond the scope of this study and have not been taken into account.

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