



The Plaza Shopping Centre at Palmerston North is one of the first projects in NZ to use 5D BIM Modelling

## The Plaza Shopping Centre

Client: Kiwi Income Property Trust

Contractor: Lockwood Naylor

Architect: Ignite Architects

BIM Modeller: Predefine

Publication Date: November 2008

Region: Palmerston North

Sector: Retail

Total Project Value: \$60m Construction Cost

Project Timescale: March 2008 to March 2010

Current Stage: Partway through first stage

Form of Contract: Contractor NZS3910

## BUILDING INFORMATION MODELLING (BIM) MOVES TO 5D

One of New Zealand's first BIM 5D projects kicks off in Palmerston North. BIM was chosen in order to ensure that the project is delivered on time, at cost, to quality and to help resolve inefficiencies generally experienced in fast-track construction. Six months into the project the team is already experiencing the benefits of greater certainty, coordination and innovative practice directly as a result of the benefits that the BIM model can deliver.

### Background

BIM or Building Information Modelling has been around for a number of years albeit not widely used in NZ. BIM enables projects to be viewed as a virtual 3D model of the building.

A more recent innovation has been to link the model to the programme (4D) and to the cost plan (5D). These additional dimensions enable the project team to track the project 'virtually' forwards and backwards in time, play out 'what-if' scenarios and get to grips with complex logistics and buildability issues.

The Plaza Shopping Centre in Palmerston North is a \$60M project that started construction earlier this year. It involves a revamp of The Plaza Shopping Centre with the addition of a 3 storey carpark and a new strip mall with links to the new 3 storey building that combines retail space and carparking.

The Contractor decided to introduce BIM to The Plaza as there were concerns about the complexities of the project in a fast track environment. These were further exacerbated by the nature of retail projects where internal fitouts are in continuous motion throughout the construction period.

The contractor was keen to trial new ways of achieving cost & time certainty and saw the benefits that BIM could provide in realising this ambition.

With the full support of the Client, acknowledged by their financial contribution towards the creation of a virtual 3D model, a specialist modeller was employed to develop a model in parallel to the commencement of construction.

Six months into the project and the Contractor is already seeing the advantages of being able to 'prototype' the building prior to construction. This case study examines what has been achieved to date and also looks to the future and the possibilities this way of working can bring to the realisation of architecture.

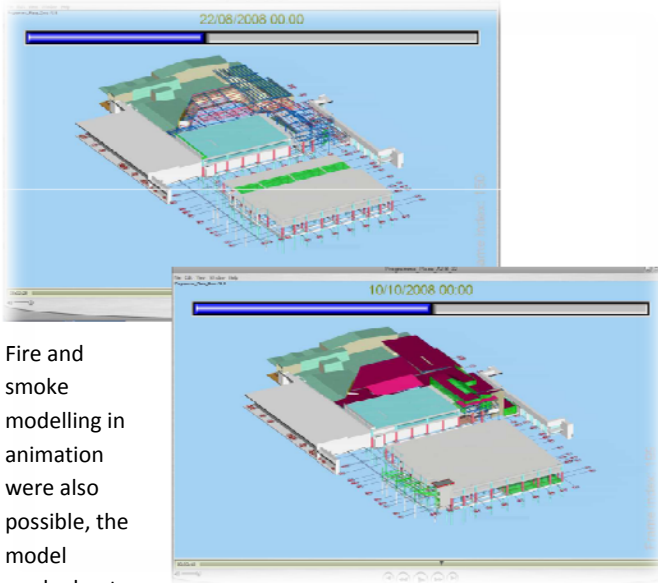
### Successful Outcomes

Although the project is in its early stages, there are already a number of outcomes worthy of note. These are described below.

#### Visual communication tool

During this initial stage, the Contractor has recognised the value of BIM as a communication tool. *"It brings the project to life, a plumber doesn't look at the structural drawings, and only has a vague knowledge of them, by seeing the building in 3D it incorporates their trade into the whole process and helps everyone understand the project. Then they can see why they need to do something in a particular order"* Pete Lockhart, Contractor.

Movies were created to show where the building was at any given day. This was possible though the programmes ability to link the time package to the model.



Fire and smoke modelling in animation were also possible, the model worked out how people would move through the building in an emergency.

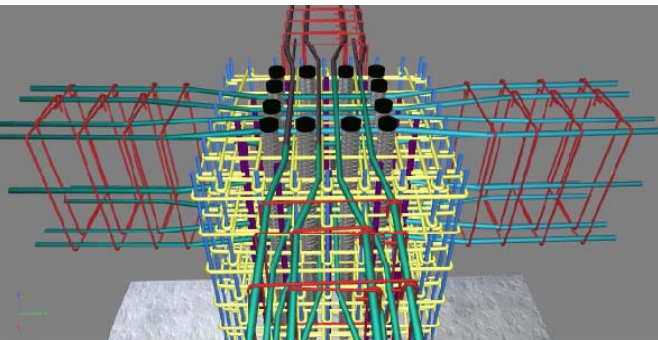
**Time**

Through the use of the model, coordination issues are identified way ahead of construction on site which significantly minimises delays and the cost of rework. This is helping to keep the project on time as it decreases the downtime experienced when problems are identified for the first time on site and the work is delayed.

**Performance simulation**

The integration of time scheduling to the visual model has helped the supply chain understand the different sequence of events required and the implications behind certain requests. Time sequences based on the model were created over the last 6 months, and proved very useful.

For example, the design of the pile/beam/columns junction throughout the shopping centre had to be constructed with a 3-5mm tolerance between all reinforcing. Due to such a minimal tolerance the Contractors introduced the time package to the model to see how the columns could best be constructed. It took two weeks of planning to get this right, but the result has been a "right first time" outcome, i.e. zero rework across the 40 columns built.



This is a significant achievement and one that clearly shows the benefit of investing in forward planning.

**Last Planner™**

The team also adopted the Lean Construction tool, Last Planner™. This is an approach which integrates the client, the design team, the main and the specialist contractors into a collaborative planning exercise which produces a jointly owned and agreed programme. Because the programme is agreed in detail in advance with the whole team, it is de-risked to a much greater extent than is the case with a normal programme produced by a single planner.

Key to the approach is a weekly, collaborative 'Production meeting' where the team would normally use the drawings to plan in detail the activities for the coming week and check for any constraints that may have not yet become apparent. With the BIM model, the team is able to see the areas they are going to work on in 3, 4 and 5D. "The model helps to reduce the time taken to examine the detail of the project in the meetings and makes it easier for the whole team to really understand how the project needs to come together" Paul Booth, Contract Manager, Lockwood Naylor.

**Cost**

The Contractor's risk is being minimised as the modelling identifies the potential conflicts prior to building. The costs of correcting them at this earlier stage are significantly lower.

The cost savings created by modelling the building outweigh the initial financial cost of creating it. "We believe that the savings we get out of using BIM will result in no additional costs overall, because of the savings we are gaining by using it" Pete Lockhart, Contractor.

The Contractor decided to introduce the 5D integrated costing package at a later stage due to the tight delivery of 2D documentation running in line with the construction. To fully implement this package they will need to reload information from their existing cost package.

**Quality**

Identifying the inconsistencies across consultants, contractors, specialists and manufacturers information prior to construction is helping to realise a better quality outcome. "BIM ensures better quality by creating consistency in the documentation and the timely resolution of problems which results in less rework" Zolna Murray, Specialist Modeller.

When the client requests a variation, the team can immediately identify any potential impact that decision makes on clashes of services and structures, the programme and the budget.

The ease of the visual 3D tool is also helping the Client understand the end product. This ensures there are no surprises, which ultimately is helping client satisfaction with the finished outcome and therefore the overall quality of the work.

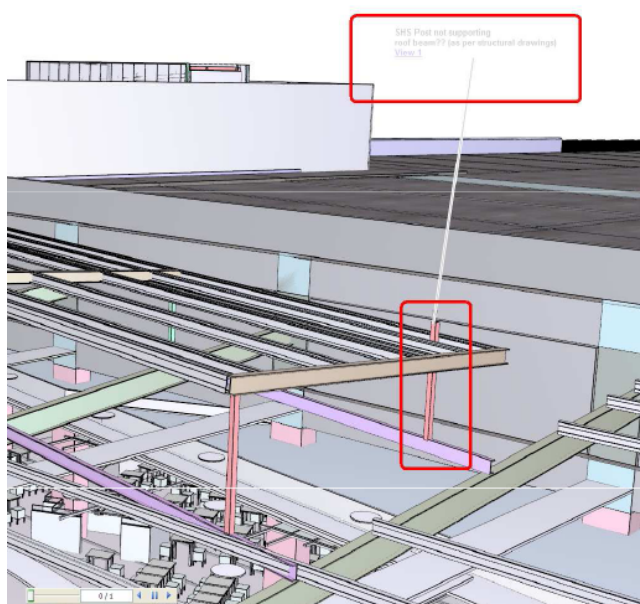
*The BIM showing the Pile/Beam/Column configuration and same on site, 40 Columns completed 'right first time'.*

## Summary of Benefits

- The 3D model is providing visible and accessible information to all team members in a way that, they can not only understand their part in the project but also, its interrelation to others in both space and time. This has brought more certainty to the project.
- A key outcome is the reduced re-work, which is saving money, time and the frustration experienced when rework is only discovered on site due to insufficient documentation.
- During this fast-track process it is typical that the various consultants are issuing drawings on the same day that construction is scheduled. Along with the Last Planner process of '5 week look-aheads', BIM is assisting with the information flow by identifying the gaps and coordination issues between the team prior to the scheduled construction.

## Lessons learned

- As with all new tools, it takes time to fully integrate new practice. When things get busy it is easy to revert to business as usual. It is therefore important to be aware of the need to balance the management of a new process with the day-to-day pressures.
- Adoption of BIM demands a team who are enthusiastic about the tool and realise its potential. Only then will they invest in R&D, except the time and effort it takes to change the way they work to gain the benefits in the future.
- The fast track process is not necessarily the most efficient way to build and the limitations of this process should be recognised and minimised where possible.
- The decision to only partially use the BIM system at the first stage of construction helped the team to understand the tool and prepare them to incorporate more of the 4D (time) package and the 5D cost package in the second stage of the work.



The BIM model helps to identify issues with coordination prior to construction.

## Conclusion

This project is a first foray for NZ into the 5D world and it did not start its life in an ideal position. Ideally, the design team would develop the project in 3D, preferably each working on the same model. The Contractor would add information on programme and cost in addition to factory designed items. However all agree the advantages of having the model outweigh any challenges and the Contractor views the additional training and adoption of new systems as an investment. *"I do see it as the way of the future – it is the next step in bringing the industry up to standard"* Pete Lockhart, Contractor.

The team is to be applauded for putting a first foot on the 5D technology ladder and the lessons learned will be invaluable. Once started down this path the rewards are there and the opportunities are only just being realised.



Viewing the project from all angles helps different disciplines understand the implications of their design and its' buildability

## Key principles for repetition

- The adoption of BIM
- Using BIM as a communication tool with the design team and the supply chain
- Integrating the time package to the model to understand sequence of events to help build complex or difficult junctions
- Taking the time to forward plan and understand aspects of the building prior to starting on site
- The Contractor identified the best attributes of BIM for The Plaza given the conditions and concentrated on those initially to get the maximum benefit from it.

## Possible improvements

- The adoption of the BIM system for The Plaza is an interim measure in that the documentation is being produced independently of the model. Ideally, BIM is introduced at the beginning of the design stage, preferably with the project team working on the same model.
- Contractors, manufacturers and suppliers need to be included in the design stage to gain maximum benefit. Once the drawings are complete, the Contractor's contribution is minimised. *"If we can be involved in the design with our construction knowledge we can be of value right from the beginning"* Pete Lockhart, Contractor.
- Working on one model at design stage aids efficiency as it prevents information being reprocessed. *"What you aim for is to have one virtual model that everyone works on together. Creating robust management tools and having someone responsible to manage the information flow and the model can manage risk. As a result you create trust between parties as they are able to rely on the information that comes from the model. BIM also supports innovation as it frees up people from doing repetitive documentation, and allows them instead 'optioneer'"* Zolna Murray, Specialist Modeller.
- Incorporate the 5D integrated costing package into the 3D and 4D package at the design stage.
- BIM enables the team to easily measure the life-cycle of a building. As an industry, we need to take full advantage of the tool and start addressing the bigger picture of sustainability.
- BIM is a collection of "intelligent elements". Everything that is modelled can be measured. To help realise sustainable architecture a model can assess whole life costs, embedded energy, CO<sup>2</sup> calculations of materials, solar shading studies, the air quality and thermal performance.
- TA's can check code compliance on submitted documentation and can monitor changes to the documentation.

## Key Client Actions

This project demonstrates a number of areas where the client directly and positively affected the outcome of the project **for all**, by adopting specific Collaborative Working practices. These included:

- **Full Support** provided to the Contractor in their proposal to introduce BIM.
- **Financially contributed** to the creation of the model
- **Open** to the possibility of new tools provided that they bring benefits to the project

## Why is the industry slow to adopt BIM?

The industry has shown reluctance towards the uptake of the BIM system even with all these advantages. It is important therefore to explore why.

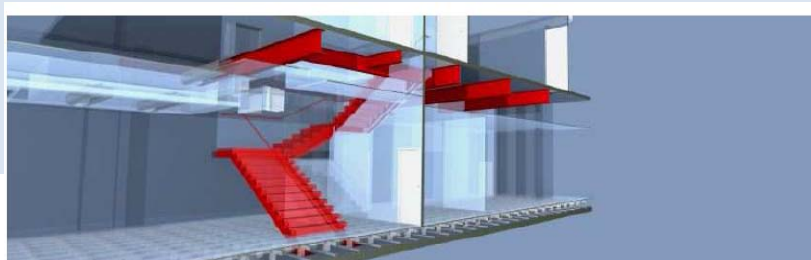
**Interoperability:** Firstly, this is partly due to the initial limitations of the technology, particularly cross platform compatibility between the different programmes. Many of these problems are being addressed as software companies are developing packages that can talk to one another without losing the intelligence of the model. The creation of a new team member - an Interoperability Manager, is also advisable to oversee and coordinate the model's information.

**Liability:** A second issue is around liability, particularly under the traditional procurement process. Questions are being raised as to who owns the model and the legal standing of the model. The result of this is that consultants and manufacturers are each drawing their own 'models' as they cannot rely on what others have drawn. In this case study the 3D model was used in a low risk way. The modeller is not accepting the liability for other people's work, rather, they identify the issues and the Contractor requests information from the various consultants. This is contrary to the model's inherent nature of integration and cross over between the disciplines.

**Front End Loading:** Thirdly, the BIM approach skews the work to the front end of the project and a shift in the fee structure will be required to reflect this. To date, this has not affected the overall fees but the loading of fees and the implications this has to the client need to be understood.

**Revolution:** And finally, it is around people's resistance to change. To adopt the BIM system in its entirety will demand that the industry revolutionise how it works. Issues around current practice and the impact of an integrated practice culture will need to be examined.

*Everything modelled can be measured*



- Soon technology will enable the model to inform building management systems. This will mean the end user can use the model to manage the building through its life. The model can monitor things such as energy efficiency, the WOF of the building, maintenance and leasing.

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