DR CHAU CHAK WING BUILDING

SYDNEY, NEW SOUTH WALES

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SUMMARY

The Dr Chau Chak Wing building at UTS is the first building in Australia to be designed by renowned architect Frank Gehry, and has been hailed as the most remarkable construction in Sydney since the Opera House.

Instantly recognisable for its undulating brickwork facade, the building is the centrepiece of UTS's $1 billion master plan – a world-class educational facility.

The challenge for construction teams was to bring the unique geometry of Gehry's visionary design to life. The interior of the building contains only one vertical column from the bottom to the top with all others on angles. But the biggest test was the brick facade, according to Stewart Agus, Construction Manager at Lendlease. It required more than 320,000 bricks to be laid by hand, following an intricate design.

"I don't believe a facade of its nature has ever been done before," Stewart says. "How do you build something curved and three dimensional with bricks? Bricks aren't designed to bend."

"The geometry of the curves is not built on any mathematical formula," explains Stephen Giblett, AECOM. "This is an amorphous form. Without being able to take that form and model it and fabricate it, you could not have built this."

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BIM was the vital tool that helped the construction teams to take the design from concept to reality. With the modelling technology, the construction teams could break complex designs into constructible parts, achieve extreme degrees of accuracy when putting them together, and better detect potential clashes.

“We built one of the most complex buildings in Australia,” Stewart says. “That’s what I’m most proud of.”

REALISING A UNIQUE ARCHITECTURAL VISION

With BIM, the construction teams could track and control all location points, so anyone working on the project onsite could pick up the accurate data they needed, whenever they needed it. “Reproducing Gehry’s vision to the degree of accuracy needed would have been impossible without the 3D modelling software,” says Stewart.

The internal structure of the facade is formed by a layer of steel ‘membrane’, on top of which the bricks were laid following a series of contours. The shape for the bricklayers to follow was designed in Australia and Hong Kong, made in China, and brought to Australia to be assembled onsite using BIM.

“The architect could go into the model and pull up an area, and use a picture to explain how they wanted it to look,” says Brian Moore, Project Manager with UTS. “So you weren’t telling the bricklayer this is how it must be, but this is what we want to achieve. And the bricklayer would say, ‘Ah, got it’.”

The engineers were able to overcome the challenge of the curved surfaces using Gehry’s design program, Digital Project. With this software, they could create the complex shapes by taking the curved surfaces from the 3D model of Gehry’s design and rolling them out flat on a table, to be cut out and rolled back into shape. “It was like the ribs on the hull of a boat,” Stewart says. “Whatever shape that hull is, as long as you cut it in one plane, you can then put it back together and create a 3D surface that is replicated precisely.”

Using BIM to map out real coordinates and exact angles, the team was able to make sure every detail of the bricks was perfect, right through construction.

ENSURING ACCURACY OF DESIGN DETAILS

It isn't just the exterior that makes the Chau Chak building so impressive. The design of the interior is also architecturally complex, and includes an elaborate feature staircase fabricated by Urban Art Projects (UAP) resembling mirrors in a fun park.

By importing the Digital Project data into their own software, UAP created 3D image prints of 18 elements of the staircase, rolled out the curves, laid them flat and used them to laser cut the mirror finish stainless steel. The measuring and remeasuring process continued, with panel beaters welding the cut pieces together, using the model measurements to get accuracy to 5mm, on panels up to three metres long.

On a project where detail and accuracy are paramount, detecting clashes was more important than ever. "There were some parts in this building that were very hard to visualise in two dimensions, so the ability to use BIM for design consulting was very valuable," says Stewart. "It made it a lot easier to build, but we still had to do coordination at a shop drawing level. And we ran weekly model review meetings."

He acknowledges that when working with BIM, the time spent in the digital environment making sure all the parts go together can be lengthy. "But when you actually get onsite, as long as you translate those points using a surveyor, everything goes together as it does in the model. It just works."

FACILITATING COLLABORATION

Such a large and complex project involved many different teams: Lendlease, who had about ten staff onsite accessing BIM data, AECOM working on services, the local architects DJRW and Gehry's office in LA. The software was a powerful tool for collaboration and up-to-date information, syncing together and giving everyone access to live, accurate data. The services trades working onsite used Bentley ProjectWise, which also saved live revisions into the Lendlease cloud.

The senior engineer for the facade, Stuart Mackay, used a motion tablet onsite that ran the BIM software. Using it, he could stand with the surveyor checking the coordinates of a curtain wall being installed in the space, for example.

CREATING PROJECTS OF THE FUTURE

The great benefit of using BIM throughout the Chau Chak project was the ability to create and visualise an architect's vision, without constructability getting in the way. It was well suited to the specific complexities of Gehry's design – and it will be an essential tool for non-traditional designs in the future.

"With BIM, you can build curved surfaces where previous only square boxes were possible," explains Stewart.

It also offers the unprecedented ability to make design changes to model parts, save revisions to create narratives of the changes, compare new models with old models, and cross check everything during construction of different parts. And Stewart believes there is still a lot of untapped potential to be brought out through 3D modelling in the future, including after a project is completed.

"Three dimensional models can give a client so much more when it comes to facility management, for example," he says. "It can store information about the features of a building and a user can then fly through the model, click on the doorhandle of a particular office, and get that information back – about the manufacturer, the supplier, when it was installed. It is now very possible."

Stephen Gibblett sums up what was so brilliant about this project to him: "With Frank Gehry involved, and bearing in mind the importance of this building to UTS, there was a freedom. There was a freedom to go beyond the boundaries."

DID YOU KNOW?

Throughout construction of the facade, Lendlease had two people on the ground who counted every one of the 320,000 bricks laid.