variable, it changes the geometry very quickly," Arup lead structural draftsman John Legge-Wilkinson said. This allowed the designers to test 24 different models and come up with an optimal design for the roof.

Arup also imported data from the analysis model into Bentley Structural software to create a 3D version of the stadium and produce design documentation. A model of roof steelwork and geometry was also given to the steel fabricator.

The $268 million stadium is being developed for Major Projects Victoria, Sport and Recreation Victoria, and the Melbourne and Olympic Parks Trust. Grocon is the construction contractor. Norman Disney & Young is the engineering services consultant.

When completed next year, the stadium will be able to accommodate some 31,000 spectators of soccer and rugby matches. ■

Modelling wind loads on Kuala Lumpur towers

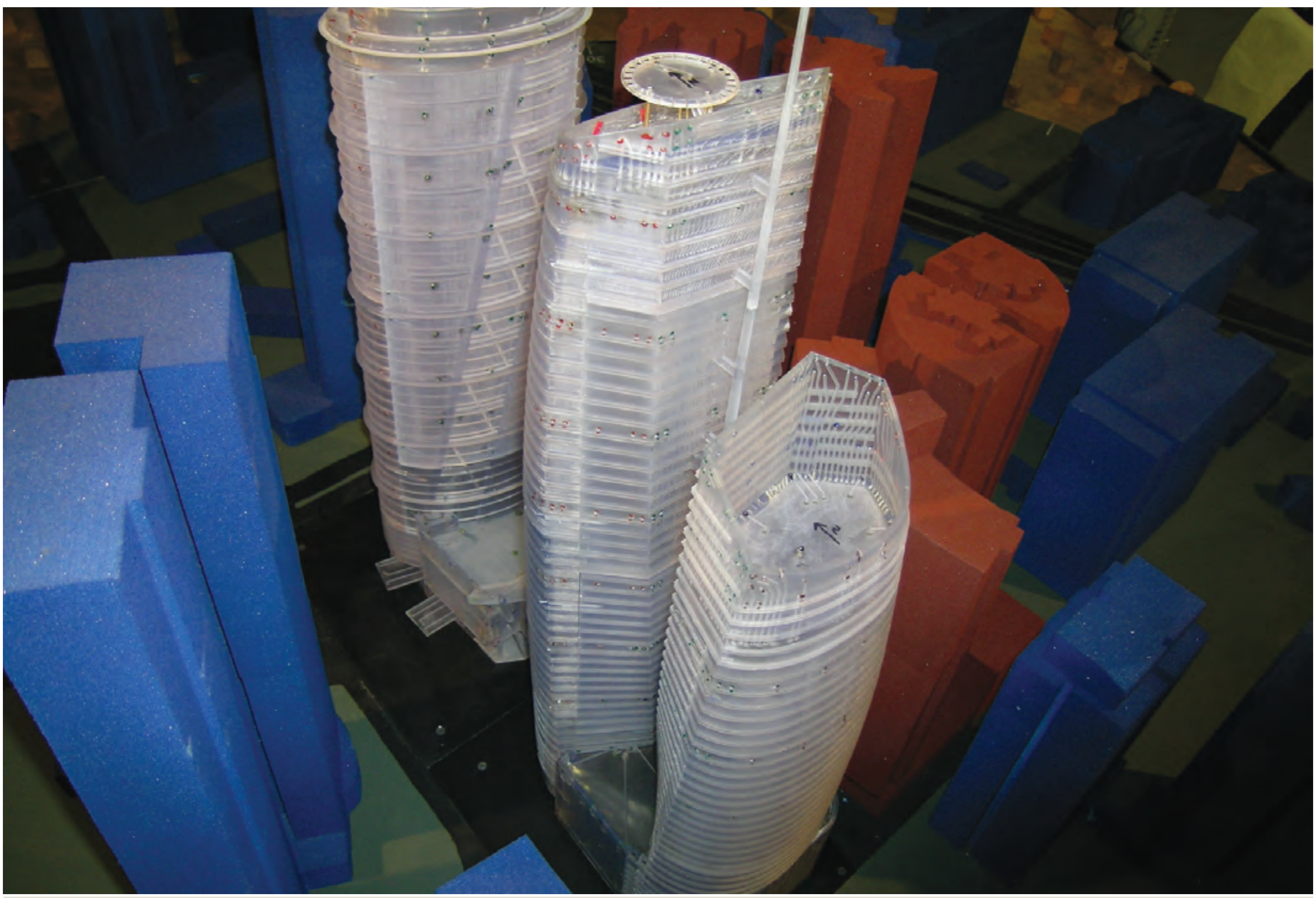
The Sydney branch of the international wind engineering consultancy CPP has been testing the cladding design of the Platinum Park, a set of eight commercial and residential towers to be built in Kuala Lumpur.

According to CPP director Dr Matt Glanville, most areas of the façade typically experience lower wind loads than those predicted by the design wind codes. But pressures are higher on some parts of the building and, as a result, cladding can break off in some places. "By correctly mapping design pressures over the entire façade via wind tunnel testing, a safer and more economical façade design was realised than would have been predicted using wind codes," he said.

Project architect RSP Architects provided 2D design drawings of the towers which CPP drafters and engineers turned into virtual 3D models. CPP's project manager Yarrow Fewless oversaw this process. CPP then "printed out" the models using the technique of stereolithography.

Each stereolithographic tower had an intricate system of some 600 "taps" to measure wind pressure. A tap is a hole about 1mm-wide with a tube that leads to a pressure transducer under the model. The towers were placed in a 1:300 scale model of all the buildings within a 450m radius of Platinum Park.

CPP tested the model in its boundary layer wind tunnel in Sydney. Roughness elements – trip boards and spires in the tunnel – created the required turbulence and velocity. Mounted on a turntable, the



A model of the Platinum Park towers in Kuala Lumpur showing minute "taps" used to measure wind pressure in a boundary layer tunnel.

model rotated in 10° increments to simulate wind coming from different directions.

Engineers used reference wind conditions to calculate the wind pressure at different spots on the buildings. Expressed as a coefficient, these figures were then applied to a 1-in-50 year return period wind based on climate data for Kuala Lumpur. After factoring in the pressure inside the buildings, CPP produced diagrams and tables showing net wind pressures on different parts of each tower's façade.

Aside from structural engineers and architects, this data is also useful for building services engineers who need to find the best places to put air conditioners and other equipment, Glanville said.

CPP is also using the tunnel to test the effect of wind on the structures and foundation of the Platinum Park towers, including measuring winds at ground level.

Platinum Park is being developed by Malaysian property company Naza TTDI. ■

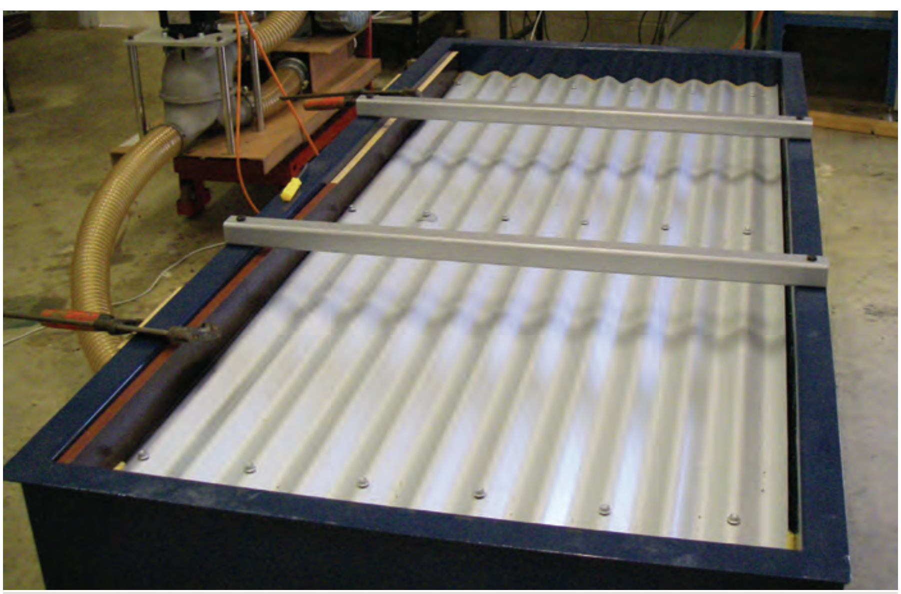
CPP director Dr Matt Glanville in the company's boundary layer tunnel in Sydney. Behind him is a scale model of an area of Kuala Lumpur used to test the Platinum Park towers. Roughness elements such as raised blocks and spires can also be seen in the tunnel. PHOTO: KIRILL REZTSOV

Testing roof cladding for cyclone areas

Researchers at James Cook University's Cyclone Testing Station are studying how roof cladding fails and cracks in changing wind conditions.

What sets this project apart from the station's previous research into roof cladding is the pressure load actuator (PLA) which the station obtained in 2007. "This is the only one in Australia," the station's research director Dr John Ginger said.

The PLA is a high-volume blower fan with a computer-controlled valve. By quickly switching between blowing and suction, it can simulate the fluctuating wind pressures of cyclones. According to Ginger, this produces more accurate results than traditional methods.



A pressure load actuator and airbox being used to test roof cladding at James Cook University's Cyclone Testing Station. PHOTO: CYCLONE TESTING STATION

The PLA is on loan from the University of Western Ontario in Canada. The station's former manager David Henderson has specialised in programming and using the machine. He is involved in the project as a PhD student. "David is the only guy here who can run it," Ginger said.

The project, which started in 2006, is due to finish in the second half of this year.

Ginger said the findings could eventually be incorporated into building designs and codes for regions where cyclones are common.

The project received over $90,000 in grants from the Australian Research Council.

Building materials company Stramit Corporation is involved in the project as an industry partner.

Although the researchers are using Stramit's cladding in their tests, Ginger said the results would be applicable to cladding from other manufacturers.

The Cyclone Testing Station has been operating in Townsville since 1977. It recently published a brochure explaining how people can prepare their houses for cyclones. ■