



# Steel in smart high-rise construction

Steel solutions form an integral part of the construction of tall towers, high-rise commercial and residential structures which are increasingly dominating Australian cities' skylines. With an estimated 272 additional towers proposed and underway across the country, innovative use of steel allows the construction of superior tall buildings incorporating green design elements and sustainable features. As high-rise infrastructure looks to greener and smarter design, it is crucial that the steel sector stays informed of the latest advancements.

While China and the Middle East are the current hot spots in high-rise construction, according to **Peter A Weismantle**, Director of Supertall Building Technology at Adrian Smith + Gordon Gill Architecture (AS+GG), Australia is coming on strong. Weismantle, along with a wide array of speakers from structural and industrial fields will contribute to the Smart Skyscrapers Summit which makes its Australian debut in Melbourne on 28 and 29 March.

A diverse range of high-rise building case studies will be presented at the event, including some of Australia's most impressive supertall designs. It will profile some of the most innovative and benchmark high-rise projects built in Australia to date such as Sydney's 6-Star Green Star buildings, 1 Bligh Street and One Central Park. The tallest prefabricated building in Australia, Melbourne's 323 La Trobe Street will also be featured on the Summit agenda presented by Hickory's Director, **George Argyrou**.

Principal Engineer, **Peter Lalas** at Façade Systems expects time and labour reductions onsite from prefabrication as well as the environmental performance aspects of façades that reduce the running cost of buildings to be in high demand for skyscraper developments in Australia.

PTW Architects Senior Associate, **Mark Giles** brings 25 years' experience in the built environment to some of Australia's major high-rise projects including Sydney's One Central Park. Receiving over 30 international design awards, Giles has worked on a broad range of mixed-use, residential, public, transportation and educational projects.

Sydney's One Central Park, housing the world's tallest vertical garden and Australia's first residential heliostat, is a major project from PTW Architects. The mixed-use tower demonstrates the imperative of steel design solutions in realising the innovative features of high-rise green construction. Mr Giles will profile the use of steel in the construction of the 117-metre high project based in the Sydney inner-city suburb of Chippendale.



Mark Giles

The construction of One Central Park produced a cantilevered structure that defies gravity, said Mr Giles. One Central Park's cantilevered Sky Garden extending 25 metres beyond the east tower façade is easily its most eye-catching feature. The underside of the structure houses an array of reflector panels that direct more sunlight to the piazza area at the base of the building. Innovative use of structural steel managed by engineering firm, Robert Bird Group realised the architectural intent of the high-rise structure.



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The process avoided the use of formwork or excessive scaffolding in employing bridge building techniques of the 200-tonne cantilevered section which was constructed in three prefabricated boxes.

Stressing the important role of steel in the construction of the One Central Park cantilever structure, Mr Giles identified steel as the material of choice in the efficient use of trusses due to its tensile and compressive capacities. The use of steel allowed for the elements to be slender, facilitating the effect of weightlessness in the design of the reflector frame.

The steel perimeter beams could be designed as porous and castellated, reducing wind pressures and creating a lighter looking structure.

Grade 400 steel was chosen for most of the truss and reflector structure due to its high yield strength, adaptability to welding work and ductility. Bisalloy steel up to grade 800 was used for some of the high stress components to work within geometrical requirements. The steel trusses were manufactured off-site and match-fitted to within millimetre tolerances before being taken to site. Finally, the steel was profiled to the shapes required to ensure access to connections and ensure safe erection.

The structural shop detailer used Tekla to complete its 3D shop detailing. Robert Bird Group converted and imported the Level of Detail (LOD) 500 Tekla model into a combined Revit and Navisworks structural model which was then integrated into the architectural

model to complete all clash detection and meet all exacting service coordination and finish requirements. This project enabled all parties to assist in developing the Tekla/Revit interface set to become critical in all modern steel dominated structures, according to Giles.

The back span of the steel cantilever trusses which run through the tower to the eastern face is an often-overlooked feature, Giles observed. These two-storey, seven-metre high trusses are significant pieces of engineering, concealed within the apartments, the lift cores and plant areas. At the eastern face of the tower, the trusses connect to tension columns to resist the uplift and consequential sail-like reflector frame movement. The tower experiences effects that are more common on buildings twice its height.

Mr Giles will further profile One Central Park's structural features at the Australian Smart Skyscrapers Summit this March. Façade Systems' Janus Façade Principal Engineer, **Peter Lalas** will be discussing the importance of performance testing the consistency and reliability of building façades in skyscraper construction. Australia 108, which is set to overtake the Eureka Tower as Australia's tallest at 100 stories, will be profiled by Fender Katsalidis Architects' Managing Principal, **Karl Fender**. 3XN Architect and Partner, **Fred Holt** will deconstruct the future of high-rise design through a case study of Sydney's Quay Quarter Tower at the Summit.

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