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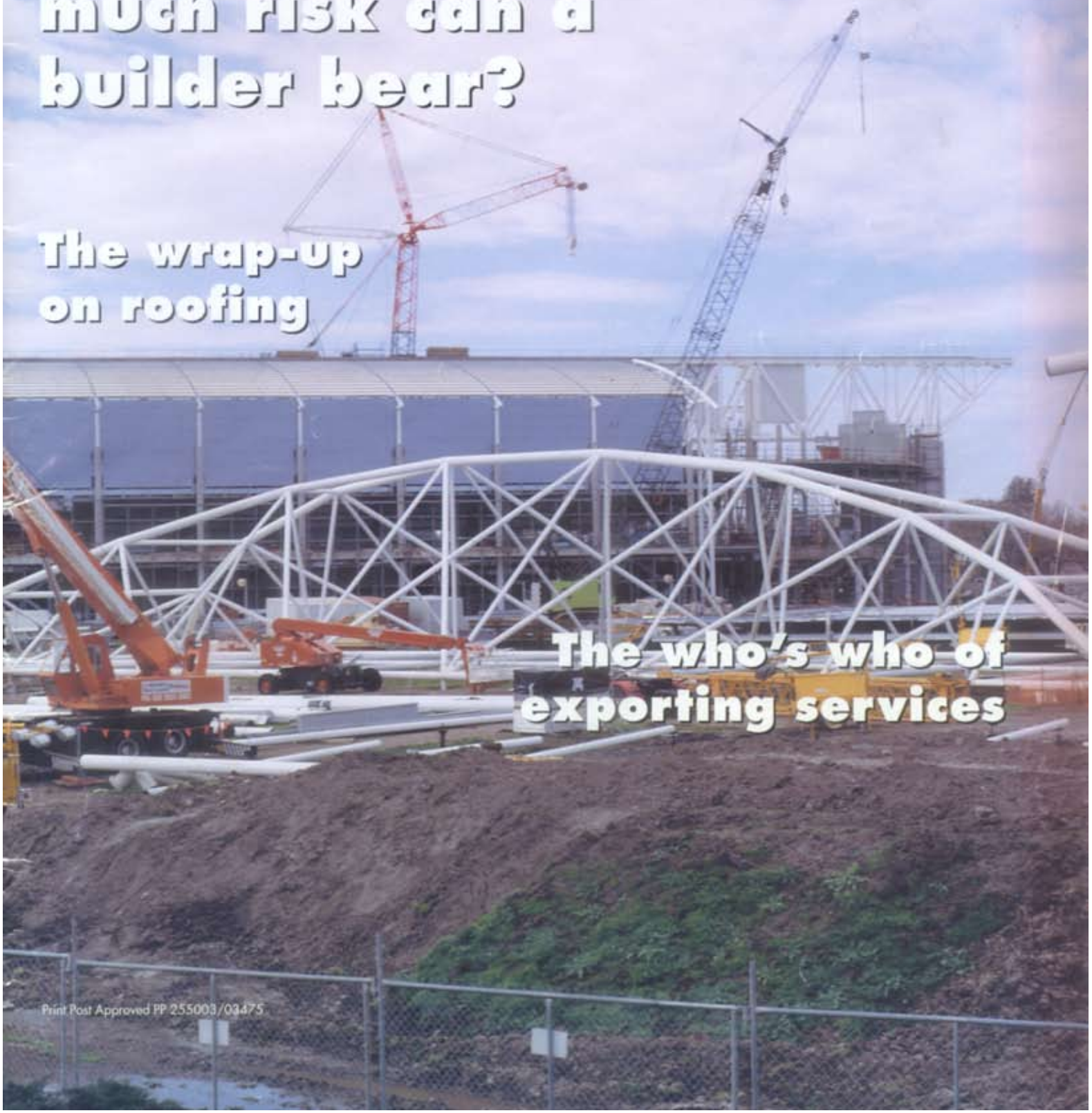

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The multi-purpose venue, Melbourne

With what began as impromptu scribbles on a white board at the urging of the client, has led to the ultimately complicated and unique design of the new multi-purpose venue in Melbourne. Currently under construction, architect Peter Brooks of Peddle Thorp Architects says the main problem encountered in the initial design stages was how to accommodate four different sporting functions under just one roof - and be a cost-effective structure. By **Juliet Pratley**

According to principal of Connell Wagner, Brian Dean, although the venue looks simple, it is deceptively complex and a very unique design.

"Peter came up with this clever idea which was essentially to wrap the velodrome track around a centre court and he rang me to see if it was feasible," said Mr Dean.

"I couldn't see any reason why not, having already worked on the Docklands Stadium I knew the moving roof spans were adequate for example and I was satisfied that the raiseable seating concept to accommodate the velodrome track was also possible.

"Having said that, I believe it is one of the most complex jobs we've ever been involved in," said Mr Dean.

Mr Brook said the main problem encountered in the initial design stages was how to accommodate the four different sporting activities under one roof as individual venues for the individual sports would not be financially feasible.

"The design is something that has not been done before; I don't know why because it doesn't seem like a very complicated idea when you scribble it down on a white board,' said Mr Brook.

Client: Melbourne Olympic Park Trust

Architect: Peddle Thorp Architects

Head contractor: Thiess Contractors Pty Ltd

Structural, civil, mechanical and electrical engineers: Connell Wagner Pty Ltd

Cost: $65 million

Completion: End of 1999 for Australia Tennis Open

Velodrome, February 2000



"There was a need to replace the existing basketball venue, the government had committed money to build a velodrome and also had a commitment with Tennis Australia to increase capacity for the Melbourne Open by an extra 10,000 seats.

"Additionally, a smaller entertainment venue was required to support Melbourne Park," he said.

Mr Brook said the key to the whole project was basically a simple idea and one of those ideas which evolves from 'someone throwing you up a challenge.'

"It's pretty incredible value getting four venues in one for approximately $65 million," he said.

"Its multi-purpose use is an important principle for sports buildings in the future; you can't expect to build a venue such as this and only dedicate it to one use," said Mr Brook.

Whilst the venue has been designed to look like a member of the 'family of buildings' in Melbourne Park, its structure is vastly different in terms of the engineering undertaken to achieve the project's very specific functions.

The venue can be changed to the following modes; tennis (10,000 seats), basketball (10,000), entertainment (12,000) and the velodrome mode (6000).

The most simplistic explanation of achieving these varying modes is the use of 'raiseable and moveable' seating whereby the stadium is reconfigured by, as the description suggests, raising portions of the seating up into the moveable roof structure.

"The trick was that the velodrome track is larger than the tennis courts and therefore how do you get the seating over the top of that for the tennis mode," said Mr Dean.

"That was achieved by using raiseable seating and it is a major innovation in the design.

"I'm almost 100% sure that it is a unique facility worldwide, in using raiseable and moveable seating to quickly change the venue's functions."

Mr Dean said the main engineering challenge lay in designing a cost-effective structure which had a roof which could be opened, was virtually column-free for an 80m x 60m area. Simultaneously the structure had to be able to support very heavy loads including the raiseable seats and the large stage equipment loads from the roof. For example, from each half of the roof, 50 tonnes of equipment has to be supported.

The roofing, the structure of which was constrained to the depth adopted by the sight lines and shadow lines, consists of two primary box trusses supported on the four major service cores. There are also secondary support trusses to provide the required stiffness and for the service walkways. These trusses not only support the north and south pitch roofs but also form the support for the raiseable seating.

A number of alternatives were examined for the roof geometry which whilst being sympathetic to the adjacent Tennis Centre had to make its own statement in terms of aesthetics. For example, spans are shortened and allowed for lighter panels and enhanced buildability.

Alternatives examined early in the design process included a cantilever roof structure with moveable roof trusses spanning the full width of the stadium or a cable stay structure. For various reasons, these systems were not adopted as in some cases the raiseable seating would require additional support or extra steel would be required.

The flooring for most of the structure is fairly conventional comprising a post-tensioned band beam system and Bondek slabs or steel beams and Bondek slabs. Thiess senior civil and structural engineer David Chiang said Lysaght Bondek structural steel formwork was the most effective solution for the project, which had to accommodate larger than normal heights between levels.

"One level is at a height of seven metres in the backstage area, and Bondek steel offered speedier erection times and greater ease of construction than other methods,' said Mr Chiang.

"By doing away with propping for such heights we saved time and money."

The fixed seating elements comprise raking steel beams with precast concrete plats. The moveable roofing is stored to the underside of the moveable roof whilst the removable seating is stored in basement areas when not required.

For the moveable roof structure, the main trusses span 63 metres onto the bogies with two roof panels supported on four bogies each. Connell Wagner undertook this sophisticated engineering for the moving bogey systems which run on crane rails.

"One of the challenges was not only minimising the weight of the roof structure but having good control of the system to prevent them skewing as well as occupational health and safety issues,' said Mr Dean.

"Each roof panel on the bogey system has bearings which allow for rotational movements, with the lateral loads taken by the trolley which has horizontal wheels.

"It is all computer controlled and linked by electronics," said Mr Dean.

Another innovative aspect of the project is the use of the Easiboard ceiling panel system manufactured by Ortech Industries Pty Ltd which the company says will 'revolutionise' similar stadium construction in Australia. One of the major drawbacks and time constraints in such projects tends to be overcoming the problems inherent with working at heights for the installation of steelwork, ceilings and roofing. The Ortech building system components are delivered to site ready for assembly into large ceiling modules. These modules consist of Easibeam high span purlins, Easibeam cross runner supports and Easiboard acoustic ceiling panels, pre-finished and powdercoated. The onsite assembly of the system is completed on a reusable jig at ground level with a purpose made lifting frame supplied with the system which is connected to the completed Easiboard ceiling module. The completed unit is then lifted into position by crane and connected to the building structure through a standard purlin cleat system. Once the module is bolted into position, the lifting frame is released and returns to the jig area at ground level to pick up the next completed Easiboard module.

Overall stability to the project is provided by the four concrete cores with uplift on the cores resultant from roof truss continuity resisted by the self-weight for the static loads. Ground anchors have also been included to provide additional capacity to resist wind and earthquake loadings. Corners of the main truss support section of the core is stitched together with insitu concrete with tension stress taken up by ordinary reinforcement.

The multi-purpose venue is scheduled to open in January 2000 for international cycling, tennis, basketball and entertainment events, with the official opening in April 2000.

The project once again demonstrates the extent of expertise available in Australia's construction industry and what can be achieved with smart ideas and great teamwork. **BA**