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LEEDer of the pack

A Sydney stadium impresses.

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LEEDer of the pack

As well as boasting a design that places sports fans closer to the action, **Bankwest Stadium** in Parramatta is the first sports stadium in the world to announce LEED v4 Gold sustainability certification from the US Green Building Council. **Sean McGowan** reports.

Images courtesy of A.G. Coombs/The Moment it Clicks

Bankwest Stadium is the first stadium in the world to achieve LEED v4 Gold certification and the first building in Australia to do so.

In seeking to improve the sporting infrastructure across the state, the New South Wales government prioritised the construction of a new rectangular Western Sydney Stadium in Parramatta.

The new $360 million stadium – now known under a naming rights partnership as Bankwest Stadium – replaces the former Parramatta Stadium. Spectator capacity has increased to 30,000 seats in the new venue.

Led by design and construct (D&C) head constructor Lendlease, project team members include architects Populous, and engineers and sustainability consultants Aurecon.

Bankwest Stadium offers modern corporate hospitality facilities including Australia's first, continuous suite deck and a new conference and banquet centre.

> It also features the steepest grandstands in the country – designed to bring sports fans closer

It also features the steepest grandstands in the country – designed to bring sports fans closer to the on-field action while amplifying the noise of the crowd. The venue's acoustics are further enhanced by the roof design.

In April 2019, the stadium hosted its first major sporting event: a sold-out Easter Monday clash between NRL rivals the Parramatta Eels and Wests Tigers.

EARLY ENGAGEMENT

A key member of the Lendlease bid team, Aurecon provided multi-disciplinary engineering services to the project. The offering included structural and civil engineering, building services, wind and fire engineering, security, and sustainable design.


Two energy efficient 505kW gas-fired condensing hot water generators provide heating hot water to AHUs and FCUs.

According to Aurecon built environment associate Olivier Loyez, the bid phase and associated design work spanned several months before a final proposal was presented to iNSW (Infrastructure NSW).

During this time, Aurecon brought in the group's in-house experience from similar projects, including Perth Stadium.

"The knowledge acquired on the Perth Stadium project allowed us to question the brief, identify opportunities and focus on the key issues at hand at an early stage," says Loyez.

"A number of design alternatives were proposed to get the design across the line, and a lot of those would have not been identified without prior experience on similar projects."

The early engagement of A.G. Coombs as a full D&C mechanical services specialist contractor in mid-2016 afforded the bid team the opportunity to explore a range of solutions, as well as influence final architectural and structural design decisions.

By exploring alternative mechanical services design paths, the aesthetic of the stadium's architectural design was able to be maintained. It also provided the opportunity to ensure the final services was brief-compliant and delivered efficiently.

"A.G. Coombs and Aurecon reviewed the brief and options leading to the final design," says Loyez. "We were able to get some cost certainty using A.G. Coombs' experience as D&C contractors."

Although Loyez says there were diverging views at times, these resulted in a balanced design. The clear objectives from the NSW government combined with the expertise of the project team enabled the stadium to be delivered on time and on budget.

WORLD-LEADING DESIGN

Ambitions of achieving a Leadership in Energy and Environmental Design (LEED) v4 Gold certification underpinned many of the building and mechanical services design decisions.

Consequently, A.G. Coombs performed a number of life-cycle cost scenarios based on the solutions available.

"Life-cycle analysis and the sporadic use of the air conditioned corporate facilities within the stadium led to the adoption of two 1,150kW air-cooled chillers configured in a primary pumping arrangement," says A.G. Coombs senior project engineer Paul Archer.

"In conjunction with the selection of two 505kW gas-fired condensing hot water generators, they provide chilled water and heating hot water respectively to the air handling units (AHUs) and fan coil units (FCUs) serving the five

APPLYING DATA CENTRE EXPERIENCE

The A.G. Coombs Group's experience in data centre CFD (computational fluid dynamics) modelling was called on to determine the most effective and efficient mode of providing ventilation to the stadium's electrical substation.

This led to the performance of the stadium's electrical substation under natural ventilation being adopted as an alternative to the rigorous mechanical ventilation requirements set out by the energy provider, Endeavour Energy.

The outcomes of the modelling resulted in a design that was able to remove the need for mechanical ventilation systems within this high-risk environment.

floors of indoor conditioned spaces within the western stand."

Selected with 20 per cent spare capacity on the calculated design day load, the chiller plant was deemed to provide optimum performance over the stadium's 50-year life cycle.

High-efficiency variable-speed pumps with N+1 redundancy were also selected for both cooling and heating pumping systems.

The HVAC systems designed to serve the air conditioned spaces of the western stand consist largely of variable-flow AHUs serving a mixture of constant-volume and variable-air-volume (VAV) terminal units. These provide local temperature control and thermal zoning.

The use of larger AHUs provided benefits such as economy cycle and CO_2 control.

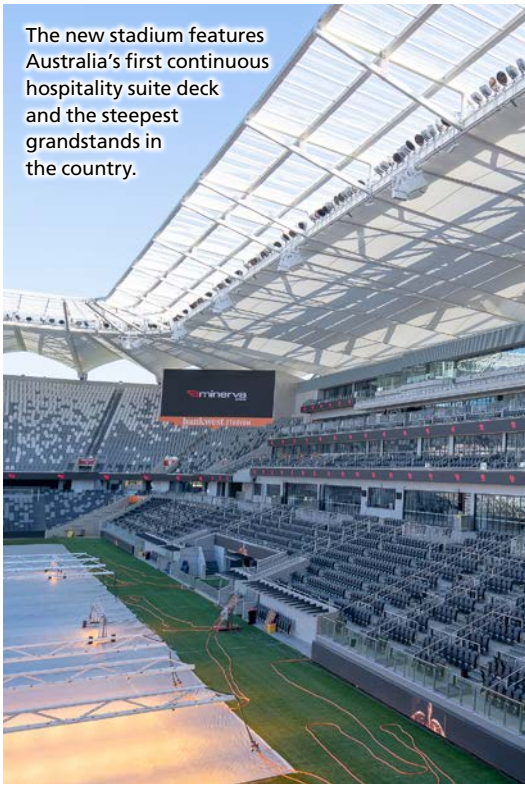
Corporate function suites are served by a VAV system, which can be disabled when these spaces are not occupied.

"On non-event days when the total demand for chilled water is low, the thermal inertia of the system is utilised to provide sufficient cooling to condition occupied spaces such as administration offices and preparation kitchens before the chiller plant is activated if required," says Archer.

By adopting the use of thermal inertia to provide this low-load cooling, any requirement for the addition of a low-load chiller was avoided.

Distributed FCUs serve a variety of other spaces within the western stand, many of which experience very different usage profiles, including satellite kitchens, stadium office spaces and the stand's atrium.

Where a number of smaller, self-contained spaces are located throughout the eastern, northern and southern stands, these are conditioned by a mix of packaged units, split systems and ventilation fans.



The new stadium features Australia's first continuous hospitality suite deck and the steepest grandstands in the country.

THE LEED IMPACT

According to Loyez, LEED is – at least on the surface – similar to other sustainability rating frameworks such as Green Star in the sense that it covers similar areas such as energy, water, transport and the like.

But as the project team would discover, becoming the first stadium in the world to announce LEED v4 Gold certification remained a challenge.

"There were a lot of discussions early on to decide which framework to use," Lopez says. "The brief was relatively open on that topic, and each would have significant impacts on the design as well as construction costs."

He says the choice to pursue LEED certification from the US Green Building Council (USGBC) meant that the design had to comply with a number of US-based requirements. These added quirks to the design and presented their own challenges.

"It was a very involved process, with many LEED credits based on American standards and available products," adds Loyez. "There was extensive work done at the beginning of the project to understand what credits would be applicable and what were simply not applicable to Australia."

As well as the energy-efficient, life-cycle-focused mechanical services design, Bankwest Stadium features a number of other sustainable initiatives.

These include a 100kW photovoltaic solar panel array, a rainwater capture system with 260,000L storage tank, and connectivity to public transport.

The construction methods also reduced the embodied carbon within the stadium through material selection. Meanwhile, the recycling of 700kg of soft plastics from new seat covers contributed to over 90 per cent of building waste being diverted from landfill.

To best manage the various stages of LEED certification, the project team submitted a LEED design review at the start of construction. This included energy modelling and a few other design-based credits. The result was that only a few commissioning credits needed to be submitted after practical completion.

"There is always a bit of a process to gather all the required information," Loyez says. "So, this typically takes a little longer than what some may think."

The LEED commissioning credit requires a review of building operations 10 months after practical completion, resulting in this not being submitted until late 2019.

STADIUM LESSONS

Aurecon built environment associate Olivier Loyez offers some of the key lessons from the Bankwest Stadium project.

It is all about the (sports) fans and their experience.

Conventional wisdom does not always apply – the return on investment calculations on a stadium project are based on a significantly lower number of running hours compared to, say, a commercial office building. Therefore, there are fewer hours to offset and recover an initial capital investment, and solutions that are often rejected on other projects on that basis can be acceptable on a stadium.

There are a number of key design challenges that all stadia face in one form or another. They need to be focused on and tackled early. Kitchen exhausts, façade code compliance, fire compartmentation and low-load scenarios are the main ones that spring to mind.

EXHAUST DISCHARGE

To cater for crowds of up to 30,000, modern facilities such as Bankwest Stadium typically feature many food and beverage retail outlets.

These retail outlets require a large number of kitchen exhausts. But the placement of exhausts – at the top of the stadium and away from the seating bowl – can become a practical challenge.

Leveraging its experience on the Perth Stadium, Aurecon proposed an alternative solution that not only met the design constraints but also overcame the onerous requirements associated with kitchens needing to be fire-rated to achieve code compliance.

A WORLD'S FIRST

In May 2020, Bankwest Stadium was the first stadium in the world to announce that it had received LEED v4 Gold certification for sustainability by the USGBC.

It was also Australia's first LEED v4 Gold building, and follows other Lendlease projects to achieve LEED Gold certification such as Margaret Court Arena in Melbourne, the International Convention Centre Sydney, and The Science Place at James Cook University in Townsville.

"By taking an innovative approach with our clients and design partners, Bankwest Stadium embodies what is possible when we collaborate towards achieving out sustainability goals," says Dale Connor, chief executive officer – building and engineering at Lendlease.

"This achievement – along with our other LEED-certified projects – is a testament to our commitment to creating the best places that balance our environmental obligations with community and economy."

Life cycle analysis and the sporadic use of air conditioned facilities led to the adoption of two 1,150Kw air-cooled chillers.

CLASH AND BANG

As the lead contractor for services coordination, A.G. Coombs took responsibility for services clash reporting and model management – including the application of BIM (building information modelling).

PROJECT AT A GLANCE

The personnel

- Architect: **Populous**
- Builder: **Lendlease**
- Building services engineer: **Aurecon**
- Client: **Infrastructure NSW, NSW government**
- Electrical contractor: **Stowe**
- ESD consultant: **Aurecon**
- Fire services contractor: **Base Fire**
- Hydraulics contractor: **John R Keith**
- Mechanical services D&C contractor: **A.G. Coombs**
- Structural engineer: **Aurecon**

The equipment

- AHUs: **York**
- BMS: **Johnson Controls**
- Chillers: **PowerPax**
- Condensing hot water heaters: **Simons Boilers**
- Diffusers: **Trox, QAE**
- Fans: **Pacific HVAC**
- FCUs: **York**
- Grilles: **QAE**
- Pumps: **Wilo**
- Sensors: **Johnson Controls**
- VAV units: **Johnson Controls**

(Source: Aurecon & A.G. Coombs)