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Ecolibrium

Rise and shine

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100 YEARS AS THE VOICE OF HVAC&R
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Centre of creation

A city's outer suburbs are not often immediately associated with the cultivation of the arts. However, a new $125 million multi-use building in the City of Casey in Melbourne's south-east is changing that perception. As **Sean McGowan** reports, Bunjil Place redefines what we have traditionally expected from civic centres.

Both the name and impressive architecture of the City of Casey's Bunjil Place were inspired by stories of Bunjil (or Bundjil) by the area's First Nation's peoples – the Boon Wurrung, Bunurong and Wurundjeri people.

Each group has its own special relationship with the stories of Bunjil the "creator", and these themes weave through the design of this first-of-a-kind facility, which brings together creativity, entertainment and community to Melbourne's outer south-eastern suburbs.

"It is a place to be inspired by the innovative, experience the new, rediscover the past, be entertained by talent, feel challenged by different ideas and engage in culture and community," says the City of Casey.

Designed by architectural firm Francis-Jones Morehen Thorp (FJMT) and built by Multiplex, Bunjil Place is located in Narre Warren, adjacent to Westfield Fountain Gate shopping centre.

Encompassing 24,500m², the facility encompasses 12 community spaces including an 800-seat performing arts theatre, an art gallery, performing arts studio, public library, function centre, plaza, and cafe. It also accommodates the City of Casey's offices, including the council's customer service centre.

"Our vision for Bunjil Place is to create an inviting central heart for the community that celebrates participation, belonging and civic pride," says the City of Casey.

> "The displacement ventilation principle is ideal for spaces like the performing arts theatre"

SERVING MULTIPLE SPACES

Ground works had already begun on site when mechanical services design-and-construct contractor, Ellis Air, was engaged in January 2016 to carry out the mechanical services work at Bunjil Place.

According to project manager Karl Kristoffersen, the project brief was to create a modern, multi-purpose space for the City of Casey. The design had to

The performing arts space uses CO_2-controlled outside-air systems.
Image: Courtesy John Gollings Photography.

showcase innovative environmentally sustainable design that emphasised passive energy use.

Working from a preliminary design by mechanical services consultant Murchie Consulting (now Meinhardt), Ellis Air was able to "value engineer" the systems while still maintaining the project brief intent.

This led to reduced operating costs for the end user.

One way this was achieved was through the use of CO_2 controlled, outside-air systems within the performing arts theatre, art gallery and function space air conditioning systems.

"These spaces are designed to cater for large numbers of occupants during peak periods, but for most of the time the spaces are minimally populated," says Ellis Air's Gary Ward, M.AIRAH. "Our design meant that during the off-peak periods we could recirculate the air from the space rather than having to condition mostly fresh air all of the time."

A low-temperature, variable-air-volume (VAV) system was prescribed for use across the majority of the site, including the City of Casey's office, the library and back-of-house areas.

A common solution for office-type environments, this system enables savings to be made in fan energy over constant-volume systems.


A prefabricated riser is lowered into place.

But in spaces such as the art gallery and gallery workshop, close temperature and humidity control that met the National Gallery of Australia design standards had to be achieved.

To dehumidify the air serving these spaces, cooling and heating coils were sufficiently oversized. This allows for the air to be overcooled to remove moisture before the air is re-heated to the appropriate temperature to maintain space conditions. Humidification is achieved by an electric steam generator with duct-mounted injector, with humidity monitored in the duct and room, and controlled accordingly.

"In ordinary air conditioning systems, we don't typically do this because of its high capital and running costs," Ward says.

RISER CHALLENGES

Taking up the role of lead services contractor during the construction phase, Ellis Air worked closely with project stakeholders. Representatives from the firm attended regular design team meetings, where it coordinated requirements with that of the architect and other services trades.

Early on in the project, it was advised that the construction method of the building cores (which housed the services risers) would be precast concrete panels.

A subsequent request to have access holes cut into the risers to allow a traditional installation of services was rejected by the structural engineer due to the shafts forming the core strength of the building.

This led to a prefabricated approach.

Ellis Air prefabricates as much of its installations as possible, but it had not previously prefabricated risers.

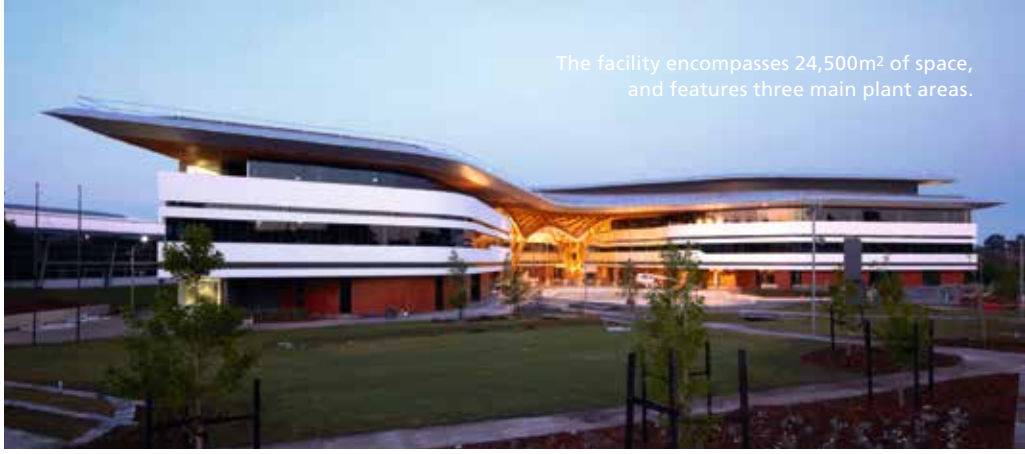
It was proposed to assemble the risers horizontally in an offsite workshop. They would then be transported to site, where two tower cranes would lift them off the transport, right them, and lower them into the concrete shafts. The concept was agreed upon by all stakeholders.

"The riser modules needed to be structurally engineered – not only for their final position, but also for the lifting operation," says Kristoffersen. "For this engineering certification, we employed the services of Gamcorp engineers."

A proprietary product for the riser frame construction was used rather than a fully welded frame design. This offers greater flexibility and has many brackets and fittings already designed and in stock.

"It also allowed for changes to be made easily," Kristofferson says, "because it all bolted together."


The risers were assembled horizontally in an offsite workshop.



The facility encompasses 24,500m² of space, and features three main plant areas.

THE POWER OF THREE

Bunjil Place features three main HVAC plant areas, all serving different spaces within the building.

The Level 2 West plant room is a double-height space containing most of the water-side plant. It also houses the air-side plant serving the library, art gallery, foyer and various back-of-house areas.

The Level 4 West plant room contains the air-handling units (AHUs) serving the performing arts theatre.

An external plant compound below the roof level accommodates the cooling towers. This also houses computer room air conditioning (CRAC) units, which serve the facility's main communications room in an N+1 configuration.

In accordance with the acoustic brief, ductwork within these West plant rooms was acoustically isolated from the structure.

On the eastern side of the building, the Level 3 East plant room contains the AHUs serving the City of Casey's offices in the east wing of the building.

This plant room also contains smoke-exhaust systems serving the foyer and performing arts theatre.

LOW NOISE

Long before any other contractor was engaged on the project, acoustic consultant Acoustic Studio had been engaged by the City of Casey.

The brief? Develop an acoustic brief for Bunjil Place's 800-seat performing arts theatre and studio.

This brief specified that noise within these spaces must be below NR20 and NR25, respectively, while the mechanical plant operated at full capacity.

To achieve these acoustic requirements, a number of structural, architectural and mechanical services philosophies were employed to isolate the space from the rest of the building.

From a mechanical services perspective, a displacement ventilation solution was adopted for the theatre. This introduces conditioned air at low velocity via in-floor diffusers from an underfloor plenum.

"The displacement ventilation principle is ideal for spaces like the performing arts theatre," says Kristoffersen.

PROJECT AT A GLANCE

The personnel

- **Architect:** Francis-Jones Morehen Thorp (FJMT)
- **Builder:** Multiplex
- **Building services engineer:** Meinhardt (Murchie Consulting)
- **Client:** City of Casey
- **ESD engineer:** Meinhardt (Murchie Consulting)
- **Façade engineer:** Taylor Thomson Whitting (TTW)
- **Mechanical services contractor:** Ellis Air
- **Structural engineer:** Taylor Thomson Whitting (TTW)

The equipment

- **AHUs:** GJ Walker
- **Attenuators:** Australian Silencer Company
- **BMS:** Schneider
- **Boilers:** Automatic Heating
- **Chillers:** Carrier
- **Convectors (in-floor):** Air Solutions
- **Cooling Towers:** Pacific Heat + BAC
- **CRAC units:** Emerson (now Vertiv)
- **Dampers:** Celmec
- **Diffusers/Grilles:** Grilletech + Holyoake
- **Duct:** Celsius Sheet Metal, Ductform
- **Fans:** Fantech
- **FCUs:** GJ Walker
- **Filters:** Airepure
- **Heat exchangers:** Teralba
- **Humidifiers:** Air Solutions + Carel
- **Kitchen exhaust filter:** Airepure
- **Pumps:** BKB + Grundfos
- **Riser frame:** Flexistrut
- **Sensors:** Schneider
- **VAV boxes:** Celmec
- **VSDs:** HTC + ABB

(Source: Ellis Air)

"Such spaces require a large amount of fresh air to be delivered at low velocity because of the acoustic requirements. It would be no good having jet diffusers at high level jetting air down to the occupied zone, because these types of systems are inherently noisy, relatively speaking."

The acoustic requirements of these spaces also influenced the selection of the HVAC plant – the thinking was that if noisy plant was the starting point, more effort would be required at a later date to reduce the noise.

Once low-noise plant and equipment was selected, Ellis Air then began to incorporate primary, secondary and tertiary attenuation into the duct design and installation.

A primary silencer was used close to the plant to perform the bulk of noise reduction; it interestingly caused regenerated noise downstream within the duct. Secondary silencers were then used further down the duct (sometimes in several branches) to remove the bulk of the regenerated noise from the primary silencers.

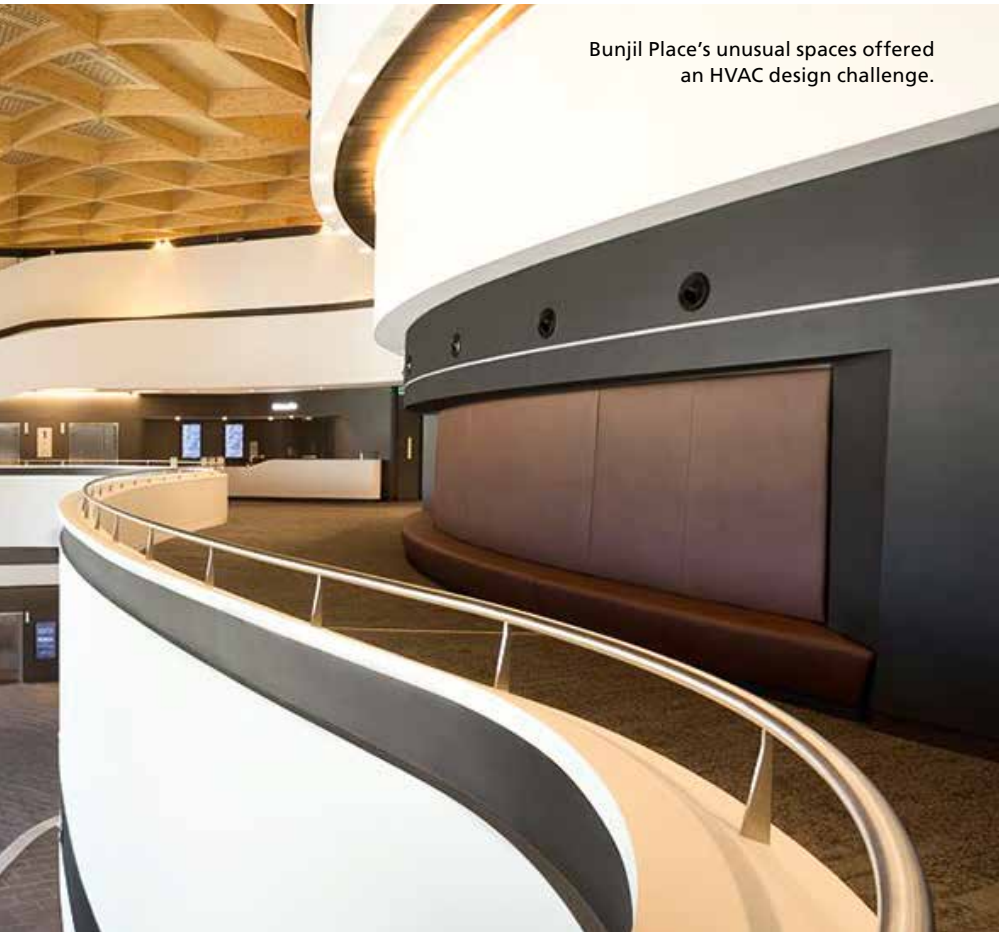
The third stage of attenuation consisted of internally insulated ductwork "straights and bends" that removed the regenerated noise from the secondary silencers.

"The acoustic tests performed after project completion indicated that we had achieved NR18 in the theatre and NR22 in the studio, with all plant running at full capacity," says Kristoffersen. "This was a great result."

LARGE VOLUME HEATING

Bunjil Place's welcome foyer is an impressive double-height space featuring a long, curved glazed façade. This architecture proved challenging both in the design of the HVAC solution to serve this space, as well as the installation of services.

"One of the best ways to overcome heat loss from a glass facade is to use fan-forced perimeter convector heaters," says Kristoffersen. "These provide a curtain of air against the glass to keep the remainder of the space comfortable."



Bunjil Place's unusual spaces offered an HVAC design challenge.

It was a requirement of the job that all services needed to blend in with the design.

This led Ellis Air to adopt trench heaters that were custom-made to a specific radius to match the curve of the façade, and installed beneath the glazing.

"The remainder of the space heating is taken care of with a central plant constant-volume air handling unit," Ward says.

THE MEETING PLACE

Bunjil Place opened to the community in October 2017.

In the months since, it has already found its place within Australia's arts and entertainment discourse. In an Australian first, the Bunjil Place art gallery is exhibiting a collection of Arthur Boyd's famous landscapes, and the Australian Ballet will present Coppélia in late July.

To be hosting such highly regarded events is testament to a project well delivered.

"The Bunjil Place project went smoothly from start to finish, with minimal mechanical services problems," says Kristoffersen.

> "The Bunjil Place project went smoothly from start to finish, with minimal mechanical services problems"

"The builder had the foresight to bring the services trades on board seven months before we started our installations. This allowed us to iron out most of the problems and finalise our construction documentation in good time."

Since opening, two tuning meetings have identified and implemented fine-tuning of the central plant to further improve energy efficiency and space temperature control.