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# Ecolibrium

THE ECOLIBRIUM  
ANNUAL  
**AIRAH**  
AWARDS  
SPECIAL

## Law and order

Dramatically reimagining  
a heritage classic.



# Law and order

The University of Queensland's iconic Forgan Smith building has been home to the state's oldest law school since the end of World War II. As **Sean McGowan** reports, the Brisbane building's recent re-imagining only strengthens the TC Beirne School of Law's reputation within the Australian legal education landscape.



AIRAH  
2018  
AWARDS  
FINALIST



In 2015, The University of Queensland and the TC Beirne School of Law agreed to refurbish the west wing of the Forgan Smith building, which was originally constructed in the 1930s. The goal was to ensure that future generations of law students would continue to enjoy the highest quality and most relevant legal educational experience.

“The Forgan Smith building west wing has been re-imagined to suit contemporary needs of the TC Beirne School of Law and Walter Harrison Law Library,” says the project’s architect BVN.

“The adaptive re-use strategy transformed the restrictive central corridor and cellular room layout through strategic demolition and addition of new parts that support contemporary teaching and learning environments.”

BVN says the School of Law’s vision – to be inspirational, inquiring and international – underpinned the design approach. The resulting identity of the school is characterised by the historic building fabric and contemporary interiors.

Consulting engineer Aurecon was engaged by BVN to design all building services for the project including fire, hydraulic, electrical, communications and mechanical services.

“ The building occupants had often complained about feeling uncomfortable

Aurecon’s lead mechanical engineer on the project, Danni Roberts, M.AIRAH, says the team brainstormed and visualised design concepts early on in the design phase. The team then demonstrated some of the unique innovations to the university.

Working closely with BVN, the university and a heritage consultant, Aurecon modelled the project in 3D

and produced the mechanical services design documentation for tender. This, along with other consultant and services packages, was used to go to market to engage a managing contractor.

The result of the tender saw the contract awarded to Buildcorp, which worked with the consultant team to finalise the design for construction.

The proposed works included the demolition of the majority of the building internals including removal of all existing HVAC systems, controls and supporting building services. The building’s interior would be dramatically re-imagined into a space of light, learning and collaboration incorporating the latest technology.

“The building’s existing fitout had been refurbished over the previous years and was in need of modernisation,” says Roberts.

## AWARDS AND PLAUDITS

Aurecon has been recognised for its work on the TC Beirne School of Law building, with the project named as a finalist for the Best HVAC Retrofit or Upgrade category at the 2018 AIRAH Awards.

The project’s architect, BVN, was also recognised by the Australian Institute of Architects, winning the National Awards for Educational Architecture and Interior Architecture at the 2017 Awards, as well as a swathe of state and local chapter awards.

The existing mechanical services found in the building included a mixture of end-of-life multi-zone air-handling units (AHUs), redundant fans, retrofitted VAV systems, in-ceiling CHW ducted units and booster pumps.

“The building occupants had often complained about feeling uncomfortable, and of noisy plant – not ideal in a past or modern educational facility,” Roberts says.

The combination of the building’s heritage aspects, retained structural elements and re-imagined interior space created complexity in the design of a replacement system. This maximised usable floor space and delivered comfort conditions throughout.

## CAREFUL DESIGN

The project was designed over the course of six months from August 2015, before construction commenced onsite in January 2016.

The re-imagined interior of the Forgan Smith building’s west wing has included several new seminar and learning spaces, a moot court (simulation law courts), office areas and a new three-level central atrium that creates a new heart for the School of Law.

## HOLDING COURT

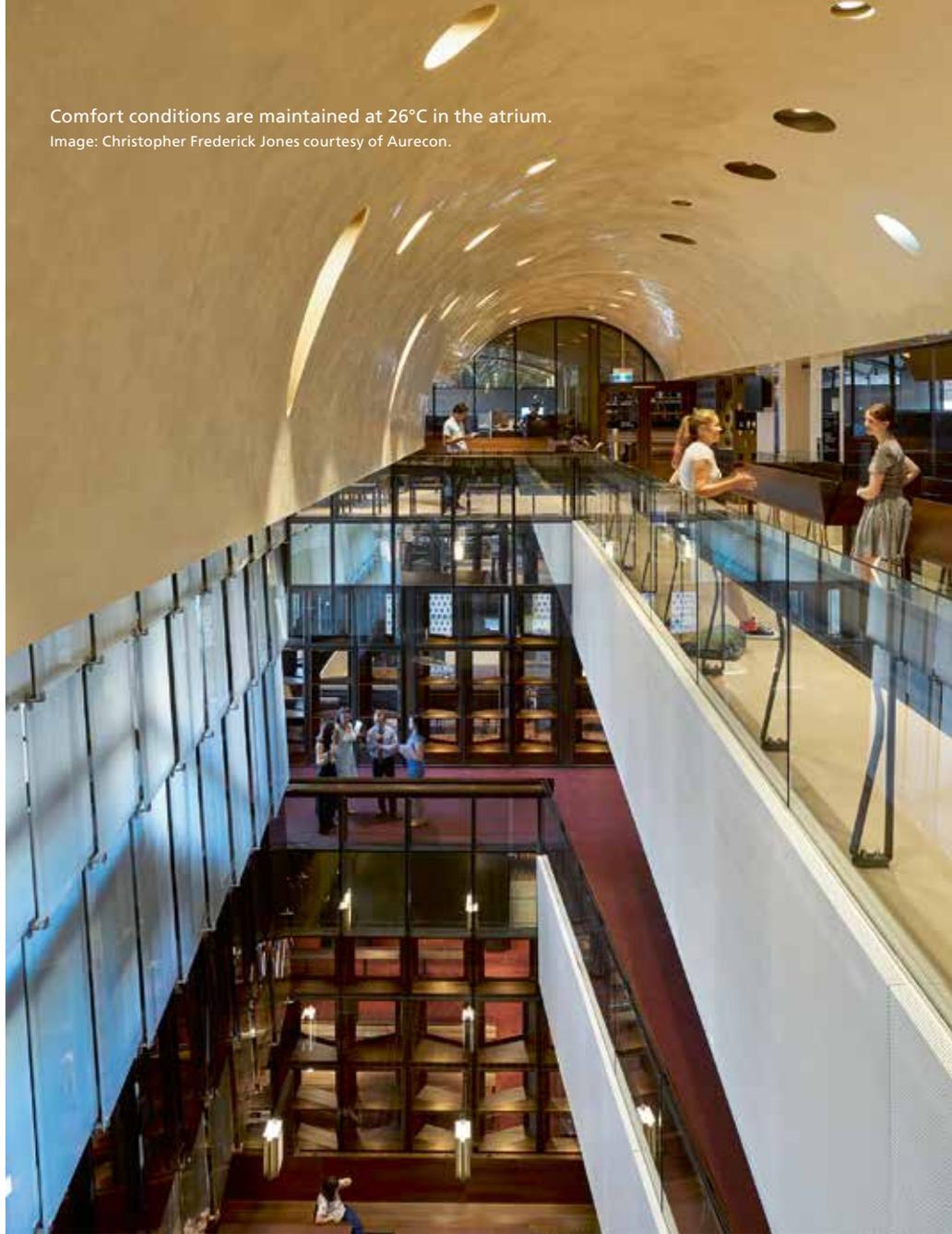
The central atrium is conditioned by utilising relief air from the adjacent conditioned spaces including a central stairwell, and areas for study, socialising and other university activities. The mechanical services design utilises a fan on a VSD controlled by temperature to maintain comfort conditions around 26°C.

This fan is located on the top floor, with air transfers out of each area into the atrium.

“This saved on energy use and simplified the cooling of an occupied open space with limited options for services reticulation,” says Aurecon’s Danni Roberts, M.AIRAH.

“During the recent site inspection, we found the atrium space to be densely populated by students, and a comfortable temperature and humidity being maintained.”

Comfort conditions are maintained at 26°C in the atrium.  
Image: Christopher Frederick Jones courtesy of Aurecon.



To condition these new spaces, Aurecon’s mechanical services design utilises a number of mechanical systems not historically applied to this type of building, nor found anywhere else on the university campus. These include the installation of motorised VAV diffusers, pressure-independent control valves on the chilled water system, bypass on booster-chilled water pumps, and a mixed-mode comfort cooling system for the atrium.

“The HVAC design captured new plant rooms in less desirable occupied spaces, with minimal ceiling space used to aid in improved maintenance and access,” says Roberts. “A reconfigured chilled water reticulation system improved energy efficiency and reduced plant room space.”

To preserve many aspects of the heritage-listed building, both the design and installation of new mechanical

services required detailed coordination and discussion with the client and BVN. The charm of its high ceilings was to be retained, as were internal timber finishes, including partitions and parquet flooring.

This nature of the building also impacted on the use of louvres or external intakes required for the HVAC services. These required careful consideration of placement to minimise the visual impact on the building’s sandstone façade.

“The mechanical services design was carefully worked through with the university’s facilities representatives – in particular the BMS system and the approach to the air distribution,” says Roberts.

To overcome the limited ceiling space available for ducting, Aurecon recommended the use of VAV air diffusers in offices and small enclosed spaces, served by a single AHU.



The central atrium is conditioned by utilising relief air from the adjacent conditioned spaces.  
Image: Christopher Frederick Jones courtesy of Aurecon.

Roberts says. “This provided the university with confidence that it was a good option for room-by-room control.”

Larger spaces, including lecture, tutorial and meeting spaces, were designed with a dedicated AHU located in a small, compact plant room (cupboard) backing onto the space to allow maintenance and access.

To minimise the impact of services, plant rooms were relocated to areas adjacent to fire stairs to house the main air-handling plant serving each floor. This relocation strategy also improved access and maintainability of equipment. Other plant rooms were positioned between spaces to minimise large duct runs and crosstalk noise.

There was some concern about the potential breakout noise generated from the localised plant rooms backing onto each of the lecture, tutorial and seminar spaces. But this was alleviated through careful acoustic design and mitigation measures completed in conjunction with the architect.

“We worked with the architect to ensure the plant room walls were full height and that the rooms could accommodate several bends in the ducting to remove the fan noise,” says Roberts.

The project’s acoustic consultant recommended the acoustic wall types and treatments to seal around the penetrations. This will maintain acoustic seals and therefore wall integrity.

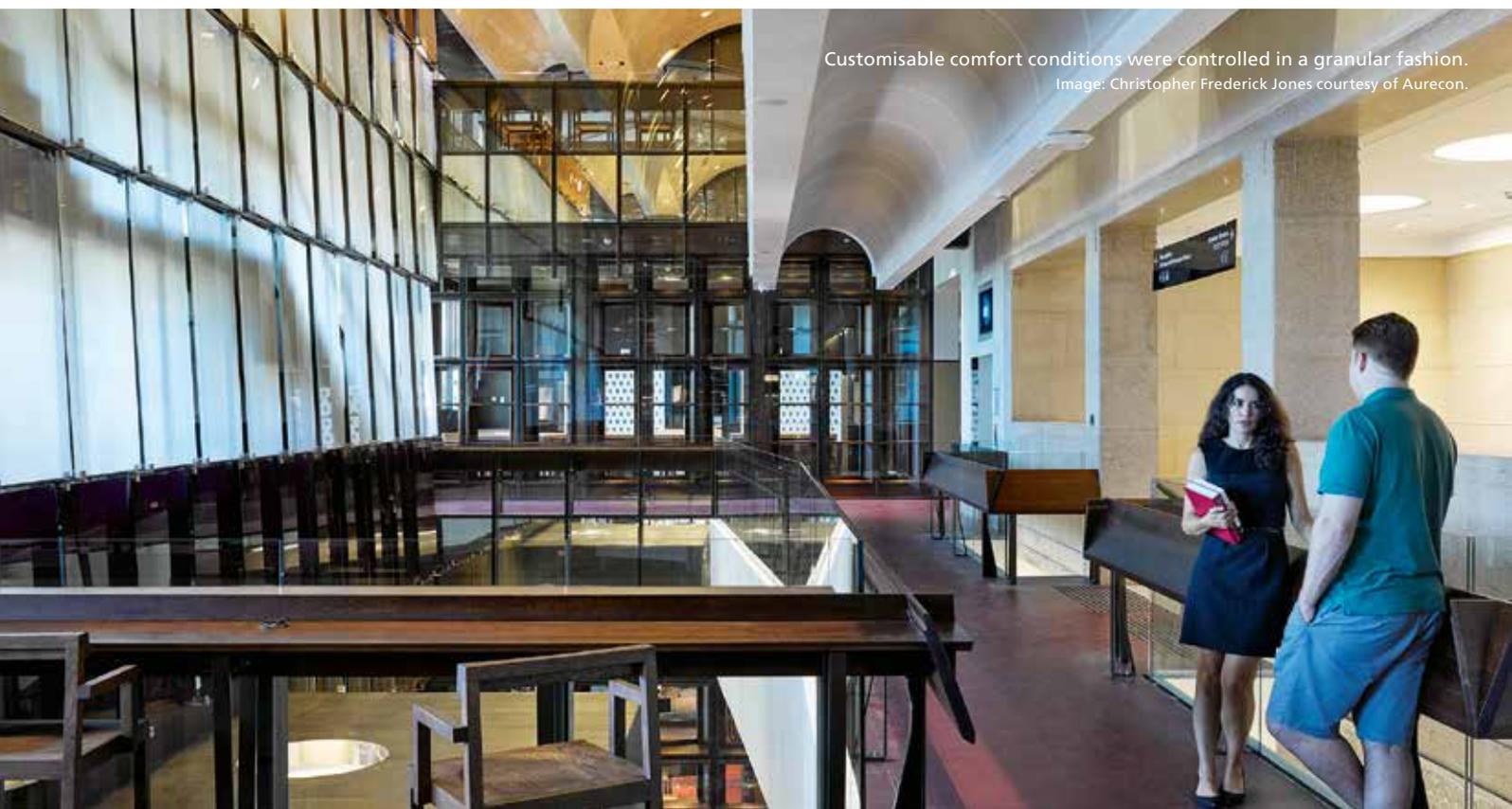
The university, however, was initially hesitant about this idea.

“They had previously had poor outcomes on VAV diffuser projects,” Roberts says of the university’s response. UQ had evidently experienced temperature fluctuations and a lack of individual space control with this type of design.

To mitigate this risk, Aurecon proposed the use of motorised VAV

air diffusers with local temperature sensors to ensure design airflows were met. Local, customisable comfort conditions are also controlled in a far more granular fashion than traditional VAV systems.

“We co-ordinated with the BMS provider, the VAV diffuser manufacturers and the mechanical services contractor to ensure we had all the required controls for successful commissioning.”



Customisable comfort conditions were controlled in a granular fashion.  
Image: Christopher Frederick Jones courtesy of Aurecon.

Larger spaces were designed with a dedicated AHU located in a small compact plant room.  
Image: Christopher Frederick Jones courtesy of Aurecon.



All grilles used on the project were powder-coated in colours to match the architectural finishes. Exposed painted ductwork in the two-level library was installed with side-blow diffusers.

Overall, plant maintenance has been simplified by locating all plant items – including AHUs, pumps, electric

duct heaters, outside-air fans and respective mechanical services electrical switchboards – within the contained, on-floor plant rooms.

“The project brief took away any requirement for access within ceiling voids, with the exception of duct cleaning,” Roberts says. “So, we expect

plant maintenance will be more efficient, safer and far more likely to occur, as all plant is accessible from floor level.”

## IN THE MAIN

The re-imagined TC Beirne School of Law building is served by the St Lucia Campus chilled water ring main, which runs under The Great Court.

All new air conditioning plant has been connected to the chilled water system, with the exception of the Communications Room’s back-up DX split system units.

Roberts says the Aurecon team designed the building to have a new duty stand-by pump system before deciding to add a bypass to be controlled by the building’s CHW pressure sensor.

“The bypass was included on review of the district chilled water system,” she says. “It was determined that the central energy chiller plant and pumps had sufficient capacity to supply the School of Law building for the majority of its operational hours.

## CONTROL FOR SAVINGS

According to Aurecon’s Danni Roberts, M.AIRAH, improvements in energy use on the project are the result of the use of relief air in the atrium, the sealing and double-glazing of existing windows, and the bypass control on the chilled water booster pumps.

But significant energy savings can also be attributed to changes in air conditioning controls across the building.

“Previously, all spaces were time-clock controlled, which resulted in spaces

not in use operating unnecessarily,” Roberts says.

As part of the design, wall-mounted two-hour run timers were provided to all lecture, tutorial and seminar spaces, so they would only operate as required. The switch also has a push-on/push-off function so that space AHUs can be switched off at the end of the session.

“While there are more complex systems in the marketplace,” Roberts says, “it’s important to keep things simple for users and maintainers.”



Plant maintenance has been simplified by locating all plant items within the contained, on-floor plant rooms.

Boosted water would only be required during peak site operation.”

This decision has contributed to an improvement in the building’s energy use, because the booster pumps would only operate when pressure from the CHW ring main was too low to serve the building – thus saving on pump energy use.

Aurecon also recommended the use of chilled-water pressure-independent control (PIC) valves in the design. Before approving their inclusion, the university required that two items be supplied as part of the design documentation: a list of projects where the valves had been installed, as well as a commissioning procedure.

## LESSONS FROM THE CONSULTANT

**Aurecon senior mechanical engineer, Danni Roberts, M.AIRAH, shares some of the key learnings from the re-imagining of the 1930s-era built Forgan Smith building at The University of Queensland.**

“The team really worked well together, and this came down to good communication,” says Roberts. “So a key lesson learnt here is to pick up the phone.”

She says co-ordination on the project was always a real challenge throughout the project, and making everything fit was tough – even with the help of Revit modelling.

“There was all the services, and the existing structure to consider – and limited space for mechanical ductwork reticulation. In one location, the ductwork was impossible to fit within the ceiling where it crossed a corridor, so the architect made this into a feature of the space.”

To this end, Roberts says working closely with the contractor is critical when dealing with complex ceiling profiles and finishes.

### PROJECT AT A GLANCE

#### The personnel

- Architect: **BVN**
- Client: **The University of Queensland (UQ)**
- Construction manager: **Buildcorp**
- Mechanical drafting: **Allied Drafting Services**
- Mechanical services consultant: **Aurecon**
- Mechanical services contractor: **Ascot Air and Electrical**
- Structural engineer: **Bligh Tanner**

#### The HVAC equipment

- ACs: **Mitsubishi Electric**
- AHUs: **Air Design**
- Controls: **Johnson Controls**
- Diffusers: **Acutherm**
- Fans: **All Vent**
- Pumps: **Wilo**
- Sensors: **Seimens Valves**

(Source: Aurecon)

### A NEW ORDER

The refurbishment of the TC Beirne School of Law building was completed in December 2016, in readiness for the commencement of The University of Queensland’s summer semester of 2017.

Since the refurbishment, Roberts says the building’s operators have experienced a considerable reduction in the number of mechanical maintenance items logged than was the case before the refurb.

“The project has met all the design objectives,” she says. “It has resulted in a considerably improved facility, both in terms of maintenance access and building functionality.”

The refurbishment of the Forgan Smith building is part of a wider re-imagining of the TC Beirne School of Law, which includes a revised curriculum, small group settings and low student-to-teacher ratios. Combined, these reforms will maintain the TC Beirne School of Law’s standing as an Australian leader in legal education for years to come. ■



The project has met all design objectives.