Lucky Nº 8

8 Chifley in Sydney's CBD stands out from the crowd with its distinctive red steel bracing, transparent façade and prominent public space. But as Sean McGowan writes, this commercial building has substance to match its style.

Take just one glance at the 34-storey commercial office building at 8 Chifley Square, in the heart of Sydney's central business district, and it's obvious this is a building that offers something different.

But beyond its striking exterior – featuring extensive glazing, exposed external red-painted bracing, and a five-storey public space at its base – is a building designed for highly functional space planning and a flexible working environment.

Embodying the evolution of modern workplace design, 8 Chifley is the result of a global collaboration between owner/builder Mirvac, and UK architectural practice Rogers Stirk Harbour + Partners working in conjunction with Australia's Lippmann Partnership.

> "It was a balancing act to achieve the 6 star Green Star rating"

Made up of two stacked modules of 12 and nine floors respectively, the building's design champions the vertical village concept by offering seven unique villages spread over four floors ranging from 1,800 to 2,880 sq m.

Single floors have been strategically placed between each high-rise village to allow for flexibility and growth.

Successfully overcoming the limitations of the relatively small individual floor plates, a consequence of the 1,580 sq m site, villages and single floors can be vertically linked to provide connected workplaces of up to 10,670 sq m.

An additional benefit of this design is that a 45 per cent increase on perimeter space has been created (compared to traditional floor plates) in the larger villages to enhance natural light and provide flexibility to cater for different office layouts.

All workspaces are also linked to the building's central atria, while the building's sense of community is enhanced by two "sky gardens" on the 18th and 30th floors – both set within a three-storey void.

INTEGRATION

An integrated approach to the building's design was undertaken by key stakeholders: Mirvac, the architects, services and structural engineer Arup, and mechanical services contractor Triple M.

According to Arup associate engineer Cameron Dymond, this integrated approach as a multi-disciplinary team allowed for streamlined decision-making, and for design efficiencies to be recognised and implemented.

"This was made a lot easier by the in-house Arup team working on all key engineering disciplines, including the BIM management role," says Dymond.

"This project also represents my first experience working with a fully integrated Revit model on such a large scale, so it was a big step into the future of 3D-integrated building design."

As well as setting out to deliver a premium-grade office building to PCA (Property Council of Australia) standards, the project team was also set ambitious energy and sustainability targets.

These included satisfying the criteria for a 6 star Green Star Office Design v2 rating, and a 5 star NABERS Energy rating. (Mirvac is seeking a 6 star Green Star As-built rating and a 5.5 star NABERS Energy rating for the building after attaining the original targets).

Such targets naturally influenced the selection of the mechanical systems – which were also required to be robust and provide flexibility for the demands of the premium tenancy market.

"It was a balancing act to achieve the 6 star Green Star rating," says Dymond.

"For example, the reduction in carbon consumption from the use of trigeneration plant brought about an increase in water demand by the cooling towers, which then needed to be offset by recycled water from a blackwater treatment system, which in turn required more energy to operate."

Another key objective of the building services design was to successfully integrate services within the architectural structure, so as to uphold the project's architectural aims.

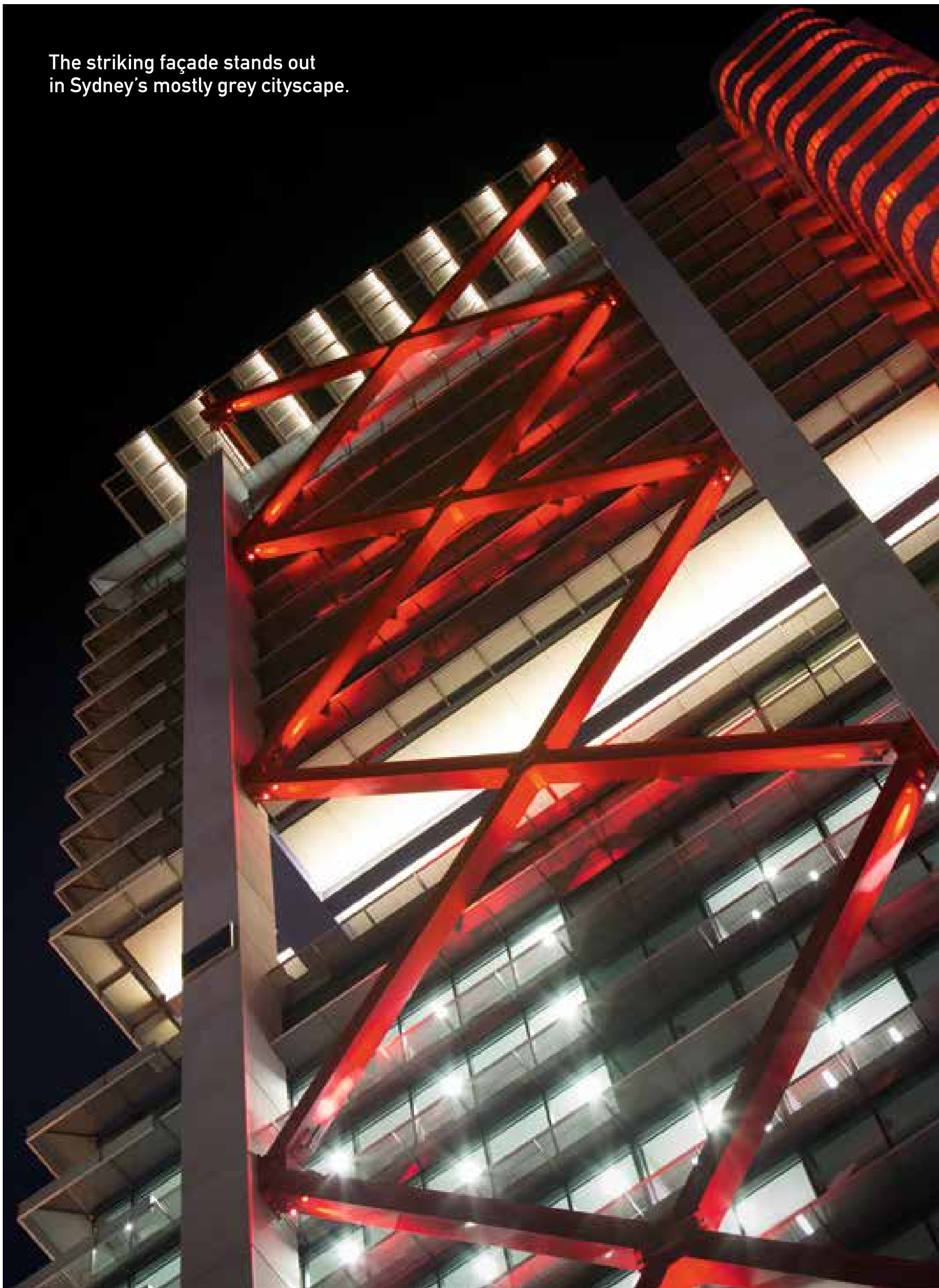
A good example of this is the discharge stack at the top of the building – a steel structure externally clad in expanded mesh in the distinct style of architect Richard Rogers.

Prefabricated offsite by Triple M, the stack houses flues and duct work for the building's kitchen, general exhaust systems and diesel and trigeneration generators. Rising 20m above the building, it weighs several tonnes.

"As it was to be installed on top of the building, the ability to safely build the stack onsite, with incorporated services within, would have been virtually impossible," says Mark Boyd, project manager for Triple M.

Just as the building's unique architecture offered up opportunities for innovation in the services design, so too did it create its own set of challenges, such as the location of fire stairs external to the building.

But it was the provision of the narrow, stacked plant rooms – designed to suit the



The striking façade stands out in Sydney's mostly grey cityscape.

An open floor-plate design meant very careful coordination was required to reticulate duct work.

single-sided core depth to maintain the backbone of the building – which posed the greatest challenge.

The limited size and positioning of these rooms was ultimately overcome by stacking mechanical plant over three-storeys on the roof, and over the three-storeys of the mid-rise terrace. This required careful staging and a planned installation sequence.

BRILLIANT BEAMS

Several HVAC option studies were undertaken during the design phase. Arup considered everything from floor-to-floor local plant providing displacement ventilation, to passive chilled beams – and every hybrid in between.

Active chilled beams were ultimately selected, owing to their inherent low-energy design, ability to achieve the desired comfort conditions, and provision for tenancy flexibility.

Following further refinement by Triple M, the final HVAC design has incorporated full active chilled beams on the perimeter, which are then teamed with variable air volume (VAV) to serve the village atria areas.

"The use of active chilled beams had energy-savings advantages," says Boyd. "The method of installation also allowed maximum flexibility with tenant fitouts, as they had the ability to be moved within the ceiling space."

Along with maximising the floor-plate size by minimising core risers compared to an all-air solution, this solution also minimised the size of air-handling units (AHU). This meant all plant could be located within the narrow, stacked plant rooms.

According to Boyd, the total capacity of the various AHUs serving the building is 2600kW.

Air is supplied to the active chilled beams from the separate mid-rise and high-rise plant rooms, which both serve down the building. Cooling coils incorporated into the AHUs within these plant rooms provide pre-cooling and dehumidification of outside air.

High-temperature chilled water is supplied from two high-efficiency,

LESSONS FROM THE CONSULTANT

Arup associate engineer Cameron Dymond shares some of the lessons learned from the 8 Chifley project.

1. The client, Mirvac, trusted our engineering skills, and this was invaluable in aiming to achieve such an ambitious, bespoke building design.
2. Integrated coordination cannot rely purely on the Revit model, but it helps.
3. Comfort is subjective in naturally ventilated spaces, and needs careful explanation and pegging to standards such as ASHRAE standard 55.
4. Flexibility for the tenant is very important when you consider the whole life of a building.
5. The amount of space required to house trigeneration plant shouldn't be underestimated.

Thermal analysis was conducted on 8 Chifley's "vertical village" design.

magnetic centrifugal chillers of 1200kW each, located within the high-rise plant room.

Boyd says the use of energy meters, as well as variable-speed drives (VSDs) with high-level interface, allows the building management system (BMS) to monitor and view the energy consumption of every item of mechanical equipment.

Despite the relative challenges presented by the size of the floor plate, all services at 8 Chifley are located within the ceiling void, except for cable reticulation concealed in the raised floors.

However, the open floor-plate design with the single-side core meant very careful coordination with the structure was required to reticulate duct work.

LESSONS FROM THE CONTRACTOR

Mark Boyd, project manager for the Triple M Group of Companies, lets us in on the lessons learned on the 8 Chifley project.

1. Drawing and coordinating using 3D software was of huge benefit to the successful, clash-free installation.
2. Improved duct-installation techniques, together with pressure testing of the installation early on, gave a level of comfort that there would be no leakage issues during the commissioning phase, and any associated rectification requirements.
3. Staged pipework flushing of areas during construction saved time at the end of the installation.
4. Progressive commissioning of the installation, together with sign-off, saved vast amounts of time at the end of construction.
5. It was critical to ensure that the air risers built as part of the structure were sealed and air-tight.

Dymond says structural beam notches were planned for services, so as to achieve the ceiling heights required.

Due to the open atrium areas, and in consideration of height safety issues during construction, the design team purposely limited the amount of services and equipment located near these areas.

"This limited any working-at-height issues during construction," Boyd says, "but also meant that future maintenance of equipment would not create OH&S issues."

INFORMING DESIGN

From street level, 8 Chifley's five-storey high public space at its base creates a grand entry to the building. Its open "glass box" design presented the opportunity to incorporate natural ventilation to make the most of Sydney's climate.

> "The use of active chilled beams had energy-savings advantages"

Arup conducted thermal and CFD modelling of this space during the design phase to establish the extent and location of openings that would provide for the best comfort conditions year round. This analysis then informed the architecture, which incorporates the use of louvered glass and circular porthole openings that are controlled via the BMS.

Thermal analysis was also conducted on the vertical village design, so as to ascertain the movement of air over several storeys during both hot (summer) and cold (winter) periods.

According to Dymond, this analysis informed several outcomes, such as high-level dedicated exhaust/return air and low-level trench heating.

"The terrace areas created extra height for the linked-up vertical villages below," Dymond says, "and therefore created challenges in terms of smoke management that were carefully designed out by using smoke curtains and other smoke control systems."

The sky garden on
the 18th floor at 8 Chifley.

TRANSPARENCY

The high light transmittance of the building's façade is one of its most striking features.

The architectural desire was obviously to achieve transparency and a connection between the interior and exterior. Yet the benefit of extensive daylight penetration across the floor plate was naturally countered by the challenge of managing heat load.

In response, high-performance glazing has been used in conjunction with external aluminium louvre sun shades.

To strike a balance between maintaining harbour views and managing heat load, vertical louvre elements were incorporated to the building's northern façade, where the comparatively high position of the sun made external shading effective.

> This exports electricity into Sydney's new triplex district trigeneration network – the first building to do so

"These almost eliminate the need for internal blinds altogether," Dymond says, "and maximise access to the Sydney Harbour views."

On the east and west facades, the low position of the sun means high-performance reflective blinds were required. These work in concert with the high-clarity glazing to control occupant visual and thermal comfort.

MORE THAN SKIN DEEP

8 Chifley's sustainability credentials extend beyond its low-energy HVAC system and active façade to include a grid-connected trigeneration plant. This exports electricity into Sydney's new triplex district trigeneration network – the first building to do so.

The application of trigeneration was considered very early in the design phase as a means of reducing carbon consumption, beyond that which could be achieved through demand minimisation and plant efficiency.

According to Dymond, considerable time was spent on its feasibility. However, once it was established that it could export electricity, the system's viability immediately improved.

"Export to the grid enables the plant to operate at a higher capacity over longer periods," he says. "This improves its efficiency while providing low-carbon electricity for other buildings."

The trigeneration plant installed at 8 Chifley was carefully selected to match the thermal base-load of the building, and features a nominal engine size of 450kVA.

Likewise, the building features a blackwater treatment system that incorporates sewer mining. The system can maximise efficiency and treat a sufficient amount of effluent, so as to produce the quantity of recycled water to meet the building's demands.

Treated to "drinking water" standard, this water is used in the building's cooling systems, as well as for irrigation and toilet flushing, and contributes to a 90 per cent reduction in potable water demand across the site.

Additional sustainability elements of the base building design include T5 lighting, basement facilities for cyclists including bike racks, change rooms and lockers; the use of low-volatile organic compound (VOC) materials, and the minimisation of polyvinyl chloride (PVC) products.

A large canopy installed on the roof of the building also provides a degree of sun protection to the roof terrace. This has been designed to accommodate a photovoltaic array in the future.

Since practical completion was reached in July 2013, 8 Chifley has required only a modicum of fine tuning to ensure good indoor conditions are maintained. And with full occupancy soon to be reached, the collection and analysis of meaningful operational data will follow.

The five-storey-high space at 8 Chifley's base.

PROJECT AT A GLANCE

HVAC equipment

BMCS: Honeywell

Chilled beams: Trox

Chillers: York

Cooling towers: Evapco

Fans: Fans Direct

Trigeneration: Cogent

The professionals

Architecture: Rogers Stirk Harbour + Partners Lippmann Partnership

Builder: Mirvac Construction

Developer: Mirvac Projects

ESD consultant: Arup

Facility management: Mirvac Asset Management

Leasing: Mirvac Real Estate

Mechanical services contractor: Triple M

Mechanical services engineer: Arup

Owners: Mirvac Property Trust and Keppel REIT

Structural engineer: Arup