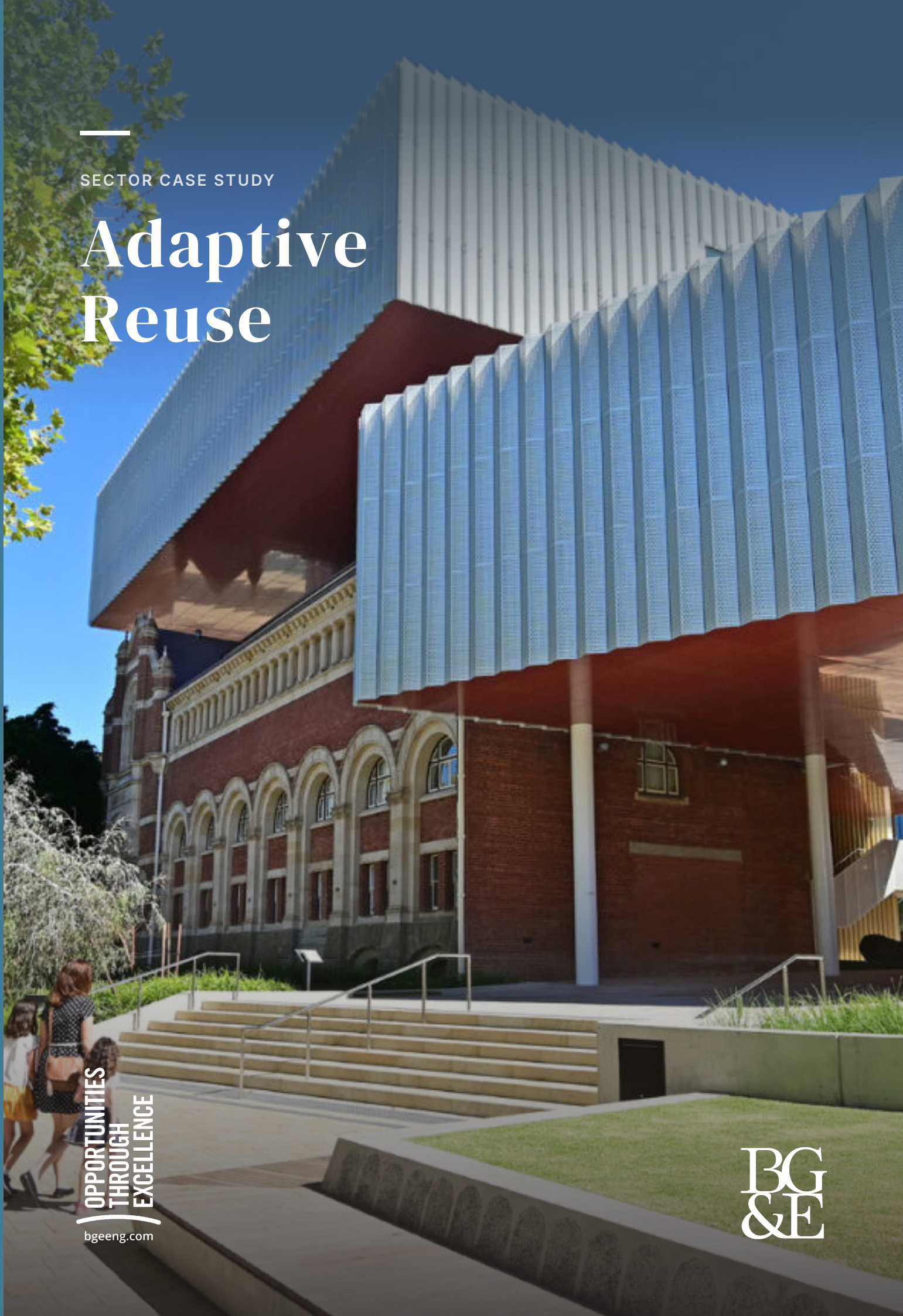
SECTOR CASE STUDY

Adaptive Reuse



OPPORTUNITIES THROUGH EXCELLENCE

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BG&E

Quay Quarter Tower

SYDNEY, NSW, AUSTRALIA
CLIENT: AMP CAPITAL

The Quay Quarter Tower (QQT) project comprised the redevelopment of a dated 50-year-old, 45-storey asset to a highly sustainable commercial vertical village, recognised as the largest adaptive reuse project in the world. BG&E was proud to play the key role in seamlessly transforming the architect's ambitious vision into a constructible solution, through our structural and construction engineering services from concept to completion.

In a construction world-first, one side of the tower was demolished and reconstructed, while the other side of the tower was retained and refurbished simultaneously – enabling significant environmental and operational efficiencies. During the upcycle of the existing building, around two-thirds of the towers original core were retained – conserving approximately 12,000 tonnes of embodied carbon.

Features:

- Height increased to 52 stories and five basement levels.
- 220-metres tall.
- Eight-metres floor to floor.
- Eight to 15-metre column grids
- Composite columns (concrete filled steel tubes).
- Composite floor construction.
- Demolition of approximately one-third of existing floor plate over full height of building to allow significant floor plate extension works.

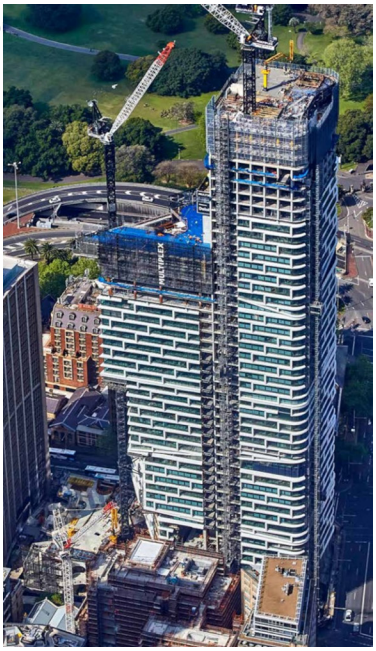
Quay Quarter Tower – Sydney, NSW, Australia.

- Irregular floor plates that vary up the building – no “typical” floors.
- Extension and strengthening of existing core for lateral stability.
- Raking columns forming part of complex transfer structures with columns being hung from the roof across 20+ floors.
- Unique ‘crown’ structure a-top the tower.
- Large atrium void for two-third of the building with framing allowance for future infill floor.
- Accelerated program with floor plate extension with composite floors to be built independently and ahead of the new core up to the integrated structural tie-in point.
- Continuous composite beam and slab system used to minimise additional load on the core.

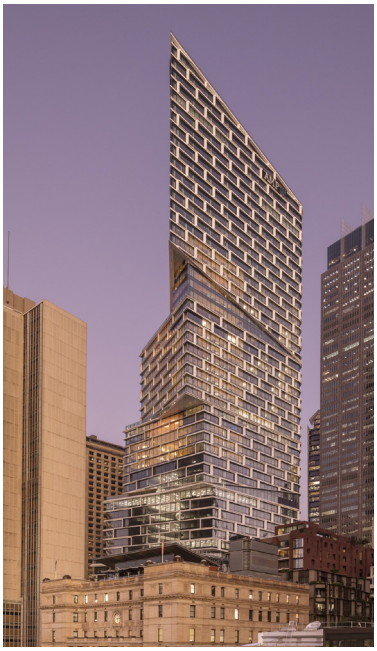
area and user accommodations, compared to the original tower – from 45,000 sqm to 102,000 sqm of usable area, and from 2,500 to 9,000 user accommodations, respectively.

The global recognition bestowed upon QQT is a testament to its remarkable achievement. It was awarded the ‘World Building of the Year’ at the 2022 World Architecture Festival (WAF) in Lisbon and received the prestigious 2022/23 International High-Rise Award. These accolades highlight the extraordinary transformation and sustainability of the project, setting a new global standard in adaptive reuse.

AMP Tower (constructed, 1976) - Sydney, NSW, Australia.



Quay Quarter Tower (in construction, 2021) – Sydney, NSW, Australia.



Quay Quarter Tower (completed, 2022) – Sydney, NSW, Australia.

BLUE at Lavender Bay

SYDNEY, NSW, AUSTRALIA
CLIENT: AQUALAND

BLUE at Lavender Bay is a luxury residential tower at 61 Lavender Street in Milsons Point, just minutes from Sydney's Central Business District (CBD). The development saw the adaptive reuse of the existing commercial building into residential apartments that boast uninterrupted Sydney Harbour and Northern skyline views.

BG&E provided Aqualand with structural design and engineering services for the redevelopment of the commercial tower which involved partial demolition, strengthening, and extension of the existing structure.

The existing commercial tower consisted of 17 levels of commercial office above ground level, one ground level, three basement carpark levels, and two levels of plant rooms at the top of the building.

The demolition works involved the demolition of the existing lift and stair walls, internal slab panels on all levels, and the entire slab on levels 18 to 20. The new building works involved the construction of new lift and stair walls, new internal slab panels, new slabs on levels 18 to 21, and composite steel balconies on the north and south building edges.

The new residential tower features 126 one- to three-bedroom open-plan layout apartments, which include floor-to-ceiling sleek curved winter gardens on the tower's southern side and fitted glass screens on the northern balconies for a sense of immersion with the surrounding nature.

The sought-after BLUE residences will support and shape the growth of Lavender Bay, voted Sydney's most liveable suburb by Domain in 2019.

333 Kent Street

SYDNEY, NSW, AUSTRALIA
CLIENT: FDC

The revitalisation of a 1980's Sydney merchant house at 333 Kent Street has transformed this site into a state-of-the-art workplace designed for 2024 and beyond.

This $400 million office tower redevelopment project seamlessly merges past and future, maintaining the integrity of the original building character - a nine-level building with a ground and mezzanine level, while implementing significant internal and external alterations – including seven additional stories and a section of the new commercial façade while retaining the heritage façade.

BG&E provided comprehensive material testing, construction engineering and structural engineering services from concept to construction completion.

Our work involved in-situ concrete wall and slab testing and investigation and analysis of the existing building's concrete properties to preserve the original structural elements. A key challenge was strengthening the structure to meet the latest design code, and ensured compliance through preparing performance solutions.

The project emphasised adaptive reuse and sustainability, delivering a carbon-efficient design solution while upcycling the iconic existing structure into an A-Grade commercial building in the heart of Sydney's CBD.

TNT Apartments, 1 Lawson Square

REDFERN, NSW, AUSTRALIA
CLIENT: DEICORP

The iconic Redfern Twin Towers at 1 Lawson Square have been transformed into stunning luxury apartments with offices on the lower levels. The ground floor contains a Woolworth Metro grocery store under one tower and the Redfern Police Station under the other. With construction completed in 2022 - the new TNT Apartments provide unrivalled views and convenience, just three kilometres from Sydney's CBD.

The project involved:

- The adaptive reuse of two existing 12 storey office towers to apartments.
- Demolition of the existing plant and lift motor room structures above level 12.
- Construction of six additional floors on each tower.
- Extension of the existing floor plate on the North to offer balconies with a maximised city view.
- Extensive upgrade of existing / development of new foundations and vertical elements to support the new loads.

BG&E was involved from the concept and development application phase through to the construction phase of the project, providing structural engineering and materials testing services for Deicorp.

Specifically, our work included:

- Strength and serviceability analysis to determine the extent of strengthening required for existing structural elements (columns, walls, floors, foundation) to withstand increased loads, due to change in usage and increased lateral loading (wind and seismic).
- Develop material testing plan to assess existing structures capacities.
- Demolition sequencing and temporary works design.
- Introduction of building movement joints at lower level combined podium slabs to minimise diaphragm lateral load transfer between two towers.
- Advice on column/wall strengthening sizes and methodologies.
- Achievement of seismic compliance to current codes, and where necessary, provision of additional lateral stabilising elements such as shear walls.
- A much simpler solution for vertical extension of the existing stair core, which did not require any strengthening of the existing walls or foundations, by installing new additional columns and foundations.
- Existing perimeter column and foundation strengthening was achieved through new piles external to the building extent, to allow access for large piling rigs, without the limitations on height and capacity that would otherwise be required for limited access rigs.

The TNT Apartments offer a chic inner-city lifestyle for the growing local population while contributing to the eclectic and vibrant suburb of Redfern.

TNT Apartments, 1 Lawson Square – Redfern, NSW, Australia.

Oxford Street Hotel

SYDNEY, NSW, AUSTRALIA
CLIENT: BOSTON GLOBAL

In 2019, BG&E was engaged for a $200 million revitalisation project for Sydney's Oxford Street. West's Olympia Theatre at One Oxford Street in Paddington is one of three heritage blocks approved for transformation from a heritage cinema into a boutique hotel.

Oxford Street Hotel required flexibility in design to accommodate latent and changing site conditions. The project comprised top-down construction, including plunge columns, slabs confined within retained heritage walls, and a construction platform. Temporary works challenges were exacerbated by restricted site acess.

BG&E provided structural engineering for both permanent and temporary works design from concept through to construction. BG&E has also provided a structural engineering assessment report for the building plan approval, alongside structural and façade design services to retain the heritage façade.

Oxford Street Hotel –
Sydney, NSW, Australia.

The successful retention of the heritage façade required significant strengthening, demolition, and temporary works, while navigating the complexity of Busby's Bore - a heritage Sydney Water asset that passed through the centre of the site with an unknown location.

To overcome this challenge, extensive on-site modifications and coordination of shoring piles and temporary propping were required to accommodate varying ground conditions and to mitigate any potential impact on Busby's Bore while working around existing structures and neighboring properties.

Rosebery Engine Yards

ROSEBERY, NSW, AUSTRALIA
CLIENT: GOODMAN

The Rosebery Engine Yard project by Goodman is an adaptive reuse development – transforming the existing engine yard into a modern, sustainable hub that features boutique premium workspaces, a showroom, and food and beverage spaces for lease.

BG&E oversaw the structural design and upgrades for existing heritage structures and industrial features, which encompassed retaining the timber framework, existing windows, original sawtooth roofing, and exposed brickwork.

The project is targeting 5 star ratings for NABERS and Green Star Design and As Built v1.3.

Scheduled to be completed in 2024, the project aims to revitalise the 100+ years old site, incorporating sustainable and modern design principles to create a vibrant environment that caters to both business and community needs.

Key technical challenges included:

- Retaining and upgrading the long spanning timber and steel sawtooth trusses to provide large open tenancies with high ceilings.
- Development of new strengthening methodologies to preserve the heritage fabric of exposed masonry walls and industrial steel framings.
- Full building upgrade, including installation of new roof lateral bracings, to meet the current code compliance.
- Development of a plan and undertaken substantial material testing that allowed approximately 90% of the existing structure to be kept achieving both a cost and carbon efficient solution.
- Extensive building service coordination to ensure loadings are not exceeded beyond existing roof structural capacity.

Tramsheds Harold Park

SYDNEY, NSW, AUSTRALIA
CLIENT: MIRVAC

Originally constructed in 1904 as the Rozelle Tram Depot, this site has been revitalised and transformed into a vibrant multifunctional hub known as Tramsheds Harold Park. It now serves local and international visitors as a European inspired food hall that also features a community centre, community garden, and a flexi-space, dubbed Artisan Lane, which houses an industrial sized kitchen and communal seating area.

BG&E provided structural engineering and materials testing services, specifically:

- Assessing the dilapidated state to tailor solutions for potential re-use of the existing steel roof structure.
- Detailing of the refurbishment requirements of existing structural steel beams to be re-used.
- Complex underpinning construction staging design and monitoring of heritage masonry walls and footings.
- Intricate detailing coordination of in-ground services concealed within the structural floor slabs and steel columns.
- Future-proofing suspended on-grade slabs for flexible retail reconfiguration.
- Detailing of new steel trusses and columns to match the previous dilapidated heritage steelwork.
- Designing a 20 metre span steel arch pedestrian bridge.

In delivering the scope of works, the façade was temporarily braced / propped during construction while the existing steel roof was demolished.

Our highly skilled team also undertook site testing on the existing heritage steel including hardness testing to determine the type of steel, yield, and tensile strength. The heavily pitted and corroded sections of the existing heritage steel beams were strengthened and refurbished offsite and transported back to site.

The building is founded on both bedrock and deep alluvial fill, hence complex underpinning of the heritage masonry walls and footings were required.

The new steelwork members and connections were detailed to match resemble the old Tramway Depot heritage appearance.

Staying true to the heritage building's roots, Tramsheds has been carefully restored and is a shining example of an authentic, highly considered heritage restoration project.

Tramsheds Harold Park – Sydney, NSW, Australia.

UNSW Sir Robert Webster Building

SYDNEY, NSW, AUSTRALIA
CLIENT: UNIVERSITY OF NEW SOUTH WALES (UNSW)

Located on the main UNSW campus at Kensington, seven kilometres from Sydney's city centre, the Robert Webster Building is home to the School of Arts & Media.

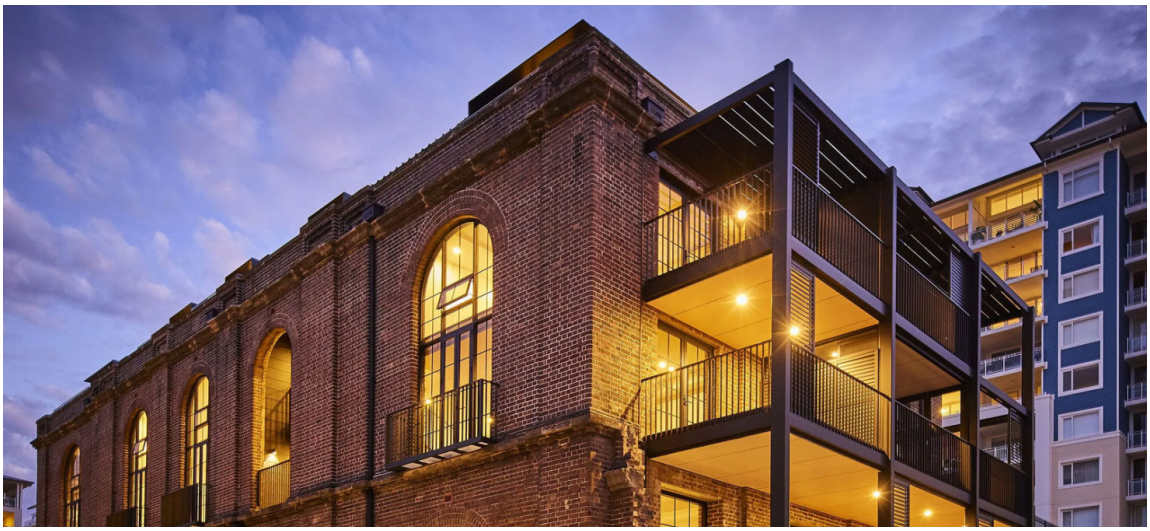
In 2009, the building was refurbished as a part of a broader effort to modernise and enhance the facilities on the Kensington campus, ensuring they meet the needs of contemporary educational and research activities.

The project brief called for major refurbishment and extensions to the existing 1950s building. Project components:

- The existing building structure was maintained and incorporated into the extension that approximately doubled the building size along with a new floor and roof structure that extended over the existing building.
- The façade was stripped back to the existing structure of the building and a new façade system was applied to match the extension.
- The primary structural feature of the adaptive reuse project comprised a steelwork and metal sheeting structure to the building extension. This light-weight construction was also used for the additional floor and roof above the existing building to minimise the requirements for costly strengthening works.
- A large cantilever steel-framed floor was added at the western end to accommodate the building's architectural form. To support the significant size increase, additional seismic shear walls were incorporated into the existing structure with minimal impact on the architectural layout.

Plumbers Workshop

SYDNEY, NSW, AUSTRALIA
CLIENT: ROSE GROUP



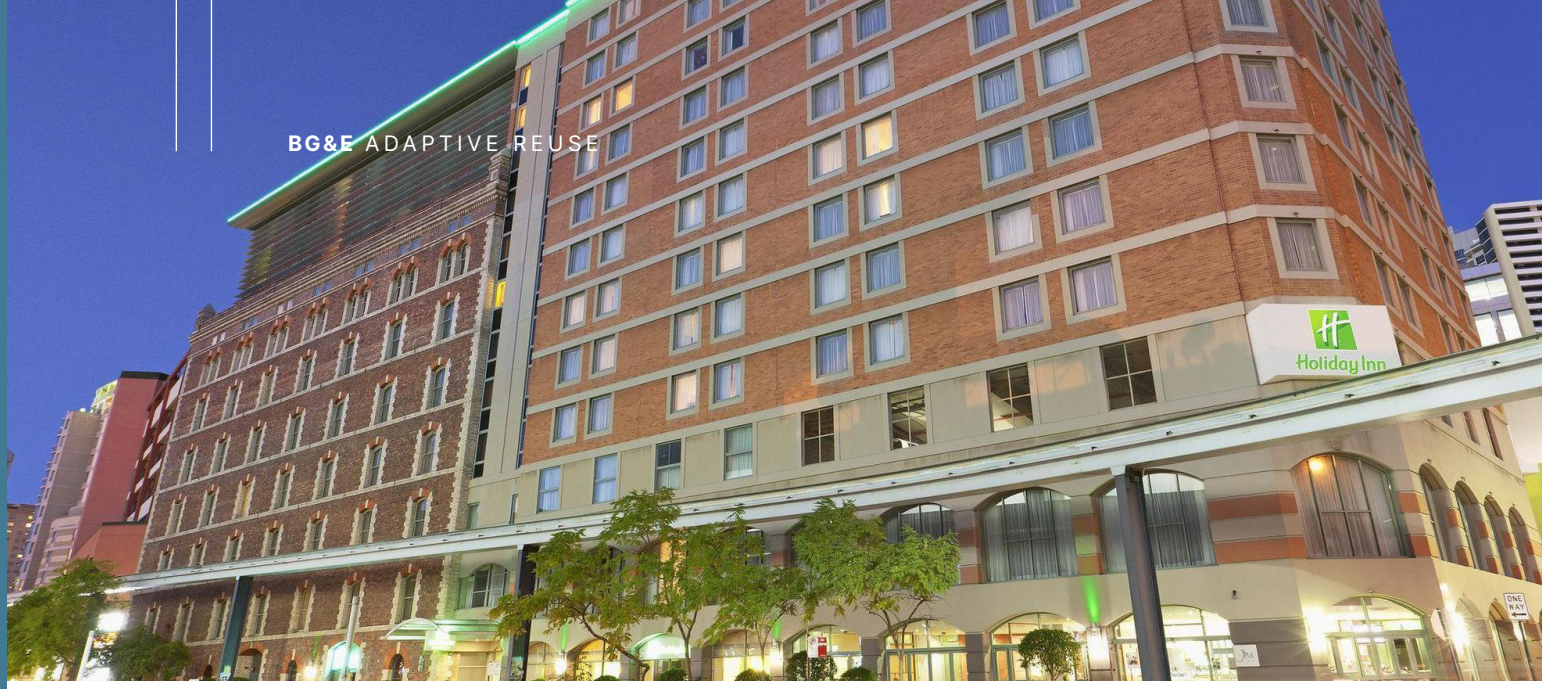
Based in the Local Government Area of Concord, the former Mortlake Gasworks operated from 1883 to 1990, during which time it provided the surrounding community with considerable employment. The heritage building has been retrofitted into a modern residential building that consists of 14 exceptional homes, designed to revere the buildings heritage and unique industrial style.

BG&E provided structural engineering and materials testing services, including investigation and existing structural assessments. Our role on the project continued on from preliminary design to detailed construction documentation as well as construction phase support.

The key aspects of the works included:

- Repurposing the 1850's masonry structure.
- Installing new light-weight floors.
- Installing a new mansard roof.
- Seismic assessment of existing masonry elements, validated with in-situ test results.
- Strengthening of existing foundations.
- Verification of existing concrete floor.

This former gas fitters' workshop in Breakfast Point has been revitalised and certification of the redevelopment was achieved by applying a performance-based design approach.



Holiday Inn Darling Harbour

SYDNEY, NSW, AUSTRALIA
CLIENT: GOLDEN SWAN INVESTMENTS

Originally construction in 1890, this heritage building in Darling Harbour precinct had previously gone through refurbishment with a mix of construction materials and framing systems completed in different periods. BG&E took on the challenge to significantly transform the technically challenging refurbishment project into the largest Holiday Inn in Australia.

The original brick masonry building from 1890 was expanded in 1989 with a separate reinforced concrete framed structure. This has introduced design complexity in the refurbishment scope to further extend three additional storeys above the existing nine storeys, whilst the building remained fully operational during construction.

The proposed additional loads required a full review of the existing building structure, including pile foundations, columns and transfer beams. Various structural options were considered for the new extension and a lightweight mix of timber and steelwork construction resulted to be the most cost-effective solution. The design had minimal strengthening of selected transfer beams and columns, with no impact on the existing hotel layout. The additional three storeys provided a significant increase of the seismic loads to the building, that had been constructed prior to the requirement for seismic loading. This required strengthening for full compliance to the current earthquake code.

Inverell Hospital

INVERELL, NSW, AUSTRALIA
CLIENT: HEALTH INFRASTRUCTURE / RICHARD CROOKES CONSTRUCTION

Inverell Hospital – Inverell, NSW, Australia.

Located in northern NSW, Inverell Hospital underwent a comprehensive $60 million upgrade which was completed in 2021. BG&E was engaged by Health Infrastructure for the civil and structural concept, schematic, and detailed design phases, and subsequently contracted to Richard Crookes Construction for the construction phase.

The project had heritage considerations, as the new three-storey building is adjacent to and connected with the existing brick hospital building.

The construction included both piled and pad footings, slab on ground, post-tensioned suspended slabs, and lightweight steel roof framing. Changes to the scope, which included additional CT scanning rooms and facilities, required rapid design incorporation and a high level of coordination with other consultants. The hospital building included offices in addition to clinical facilities, with a high level of service coordination and 3D modelling.

BG&E has also completed the concept, schematic, and tender design phases for Inverell Hospital Stage 1B, which involved the modification of the existing brick and timber hospital building for community health usage, with wards reconfigured into consultation rooms and offices. Existing load-bearing brick walls were removed to suit the new layout with limited space for the new structure, which posed design challenges. Additionally, the structure needed strengthening for AS 3850 seismic strengthening requirements.

Maitland Administration Centre

MAITLAND, NSW, AUSTRALIA
CLIENT: MAITLAND CITY COUNCIL

To accommodate the rapid growth of Maitland, the City Council has established the Maitland Administration Centre, specifically designed to address the needs of their expanding community.

The Administration Centre is located across the road from the Maitland Regional Art Gallery and incorporates the 19th century Town Hall Cafe. Redevelopment works ran from 2019 to 2022.

BG&E provided structural and civil design services from concept to tender stage for the alterations and extensions undertaken. The design process included the adaptation of culturally significant heritage assets into new office spaces as well as the design of a new two storey office space connecting into the existing buildings on the site.

Structural design undertaken at the site utilised flat plate post-tensioned concrete slabs with a lightweight steel roof to satisfy the large spans and open plan design proposed for the site. The structure was founded on piles in challenging ground conditions. Alterations undertaken on the existing structures involved the use of lightweight structural steel framing to minimise additional loads imposed on the existing footings.

Mudgee Art Gallery

MUDGEE, NSW, AUSTRALIA
CLIENT: NSW GOVERNMENT

Located in Mudgee, central New South Wales, the Mudgee Art Gallery is an integral component of the newly developed $8.1 million world-class arts precinct, which serves as a platform for nurturing the town's abundant arts and cultural legacy.

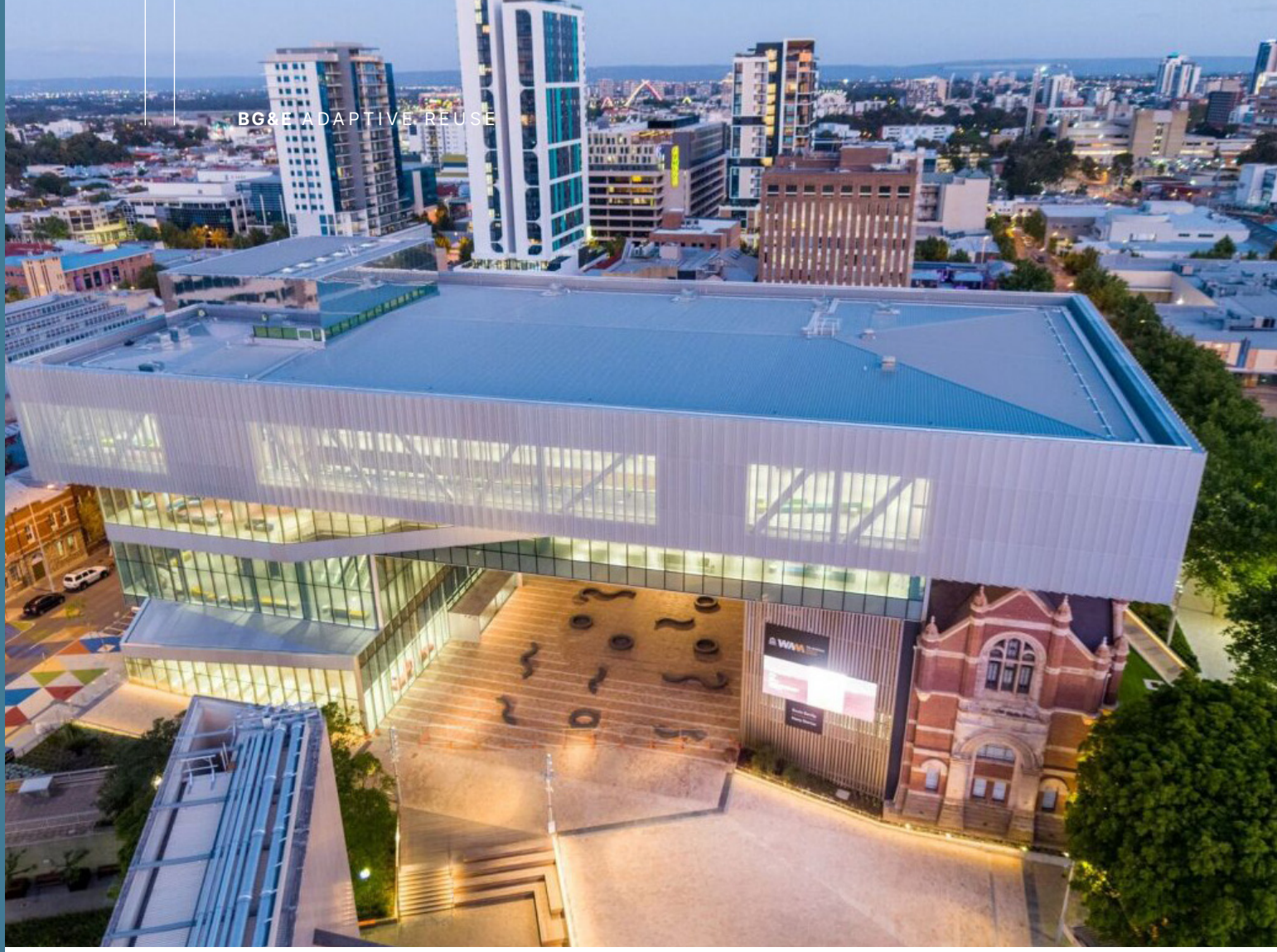
BG&E collaborated with the NSW Government to deliver the Mudgee Art Gallery, which aims to showcase the work of local talent and attract some 691,000 visitors to the region annually.

Our highly skilled team provided civil, structural, and construction engineering services to enable the adaptive reuse of an existing municipal building with heritage characteristics into a modern regional art gallery.

BG&E's technical expertise supported the distinctive architectural features, including moveable internal partitions and a stepped roof and façade. All structural modifications of the existing building upheld best-practice heritage design, preserving the original building for future generations.

Flood design work was also provided, which encompassed the new and existing buildings and the surrounding street works.

The Mudgee Art Gallery answers the community's call for a facility that proudly features local talent and shares the region's rich cultural history.



WA Museum Boola Bardip

PERTH, WA, AUSTRALIA
CLIENT: WESTERN AUSTRALIA STATE GOVERNMENT

The WA Museum Boola Bardip formally opened on 21 November 2020 in the Perth Cultural Centre, the State's premier cultural hub which houses its scientific and cultural collections.

The name 'Boola Bardip' pays homage to the local First Nations people's history and deep connection to their country. In Whadjuk Nyoongar, it means 'many stories,' reflecting the rich cultural heritage of the land where the museum stands.

BG&E provided structural and civil engineering services for this important building where stories are shared. The dramatic design links contemporary architecture with the historic and heritage-listed buildings, creating a visual landmark for the State. Column-free gallery spaces are elevated 15 metres above ground over clear external pedestrian areas of 40 metres x 50 metres, and over the top of an existing heritage building, requiring a long span and cantilevering structure.

DETAILS:

- Gallery floors were designed for total imposed loads of 14.5 kilopascals and 120 kilonewtons concentrated loads with stringent deflection and vibration acceptance criteria.
- Gallery floors comprise composite steel floors spanning 20 metres on two, two-storey high fabricated structural steel trusses. These trusses are located within wall lines and vary in depth - between seven metres and 15 metres.
- The trusses span up to 45 metres with a 17 metre cantilever where the new building is located over the existing heritage building.
- To minimise overall steel tonnage, high-strength 450-grade steel plate was used in the trusses.
- Columns are a mix of reinforced concrete and composite steel/concrete.

WA Museum Boola Bardip – Perth, WA, Australia.

WA Museum Collections & Research Centre

PERTH, WA, AUSTRALIA
CLIENT: WA AUSTRALIA STATE GOVERNMENT

The WA Museum Collections and Research Centre (CRC) accommodates the majority of the Museum's collections and research facilities. BG&E provided structural and civil engineering services for the construction of the new two storey CRC, positioned adjacent to an existing administrative building.

Key features of the new CRC building include:

- A steel-framed section with insulated cladding panels to house the valuable collection specimens.
- A concrete-framed section with precast wall panels to house the research labs and administrative and plant areas.
- Development of a new access road and carpark, and separate outbuildings for electrical services, generator, and ethanol storage.
- Refurbishment and adaptive reuse of existing buildings on the site, incorporating the installation of new services to meet modern amenity.

Key design issues included:

VIBRATION

The new CRC building includes large compactus storage for the collection of specimens, many of which are susceptible to damage from excessive vibration. The site is positioned in close proximity to Leach Highway and Orrong Road, which are subject to high volumes of traffic which represents a significant source of vibration through the ground.

Site measurement of vibration was conducted within the existing facility for assessment of acceptable levels, and the design of the ground slab upon which the compactus units are mounted included provisions for additional thickness and mass to mitigate the transfer of ground-induced vibration to the collection specimens.

Reciprocating plant and machinery were mounted on vibration isolation pads to avoid transfer of excessive vibration to the storage and research areas.

FIRE RESISTANCE

The large volumes of ethanol housed within the CRC building for preservation of the collection specimens represents significant Dangerous Goods implications, particularly towards onerous fire resistance requirement for the structure of up to four hours.

This was addressed through the use of various reinforced concrete load-bearing elements, including precast walls, in-situ columns and pre-formed in-situ wall (Ritek) systems. Joints and interfaces between various elements were carefully detailed to achieve the required fire-resistance, spill-proofing, and structural movement requirements.

WA Museum Collections & Research Centre – Perth, WA, Australia.

VALUE ENGINEERING

The original budget was not adequate to meet the requirements of the project brief, and extensive value engineering was required to develop alternative solutions to prevent excessive cost over-run.

As part of this process, the new building was tied to an existing building to overcome fire separation issues to allow the sharing of facilities and reduce the extent of the façade. The structural form of the new building was tailored specifically to the functional requirements, to provide a steel-framed insulated enclosure for the collection storage area, and a concrete framed fire-rated enclosure for separation to sensitive habitable areas.

PROTECTION OF EXISTING FACILITY & OPERATIONS DURING SITEWORKS

Construction of the new CRC building occurred whilst the site is occupied by WA Museum personnel, including storage of collection specimens within the existing warehouse building and ongoing research activities. The specimens and research activities are sensitive to excessive vibration, and thorough consideration for staging and sequencing of the works was necessary to minimise the impact of the siteworks.

Significant excavations were required near the existing buildings, and a detailed assessment of the extent to which buildings may be undermined was necessary. Where excavations could not be suitably managed, existing foundations were to be underpinned using permeation grout injection techniques.

WA Museum Collections & Research Centre – Perth, WA, Australia.

St Mary's Cathedral

PERTH, WA, AUSTRALIA
CLIENT: PETER QUINN ARCHITECTS

St. Mary's Cathedral, a heritage building at the heart of Victoria Square in Perth, has a rich history. Originally built in two stages, in 1865 and 1930, it underwent a significant redevelopment in 2006. This renovation included the preservation of the existing structure and the addition of new elements both above and below ground.

Today, St. Mary's Cathedral stands as a true architectural gem, featuring a striking curved design and an impressive second spire - ensuring the building remains a hallmark of architectural elegance.

BG&E provided structural engineering for the $35.2 million redevelopment, which encompasses a multi-functional basement level and a new ground level assembly area. The basement works comprised in-situ, reinforced concrete framing, and the new assembly area included the mixed use of structural steelwork and precast concrete. A significant amount of the structure was precast.

The partial demolition of the existing cathedral required the use of complex, permanent retention systems for the existing foundation and wall elements.

General Post Office (GPO)

PERTH, WA, AUSTRALIA
CLIENT: BROAD CONSTRUCTION

Australia Post undertook a $20 million transformation of their historic General Post Office (GPO) building in the city centre. Originally completed in 1923, the GPO is a heritage landmark building in Perth - located in the city's central business district, its imposing stone façade is in the Beaux-Arts style.

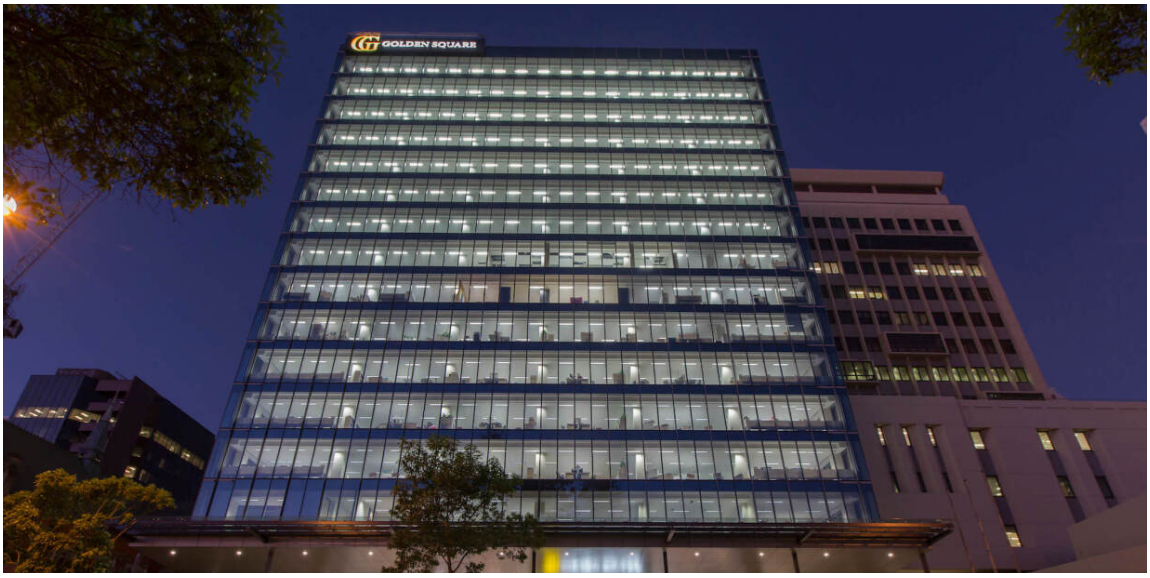
The development connects to the William Street train station and includes seven floors of commercial space, as well as ground-floor retail of approximately 1,000 sqm.

BG&E provided structural engineering services for this significant civic space, which included a new atrium roof over the top of an existing light well, sky bridges linking the atrium at four different floor levels floor levels, demolition of the original lift shaft, construction of a new shaft with three lifts, and the associated upgrade of the building's services.

The design followed similar principles to those deployed at the GPO redevelopments in Sydney and Melbourne.

32 Street, Georges Terrace

PERTH, WA, AUSTRALIA
CLIENT: GOLDEN GROUP



32 Street Georges Terrace is a unique project involving the redevelopment of the existing May Holman Building to enlarge the available floor area and convert the building into a contemporary office facility.

BG&E, involved from the concept stage, investigated several floor expansion options, initially considering demolition and rebuilding - however, this approach incurred significant costs. Ultimately the re-use of the existing building was determined to be the most cost-effective design solution, despite significant technical challenges as the existing building core required extensive re-planning and partial demolition.

The core strengthening process required partial demolition to enable the construction of the core that would suit the new structure. During this process, the stability of the existing 17-storey building had to be maintained. A carefully planned and staged sequence of core demolition and strengthening was developed so that only final and existing core walls were used to ensure stability during construction - without the need for additional temporary steel-braced 'wing walls' at the perimeter of the building, minimising cost.

The raft supporting the stiffened core needed strengthening to support the greater wind and seismic lateral loads imposed on it from the extended building footprint. This was achieved by dowelling into the existing raft and building on top of it creating a thicker and stronger raft, to increase its flexural and shear capacities.

A structural steel frame with composite slabs facilitated the efficient erection of the new floor areas in a constricted central CBD location.

32 Street Georges Terrace – Perth, WA, Australia.

Forest Chase Redevelopment

PERTH, WA, AUSTRALIA
CLIENT: ISPT

Forrest Chase commands the most prominent retail location in Perth's CBD, facing the central Murray Street Mall and the historic Forrest Place. The new Forrest Chase will total over 50,000 square metres of floor space and feature 200 linear metres of uninterrupted retail frontage across two levels.

BG&E provided feasibility studies into the refurbishment and expansion of an existing commercial retail building. The studies included mixed-use facilities including specialty retail, large retail, new public facilities and amenities, and new office levels above the existing development.

The refurbishment and expansion of the existing building were undertaken while keeping the existing commercial tenancies operational, which added complexity to the adaptive reuse project.

The design of the extension and refurbishment includes:

- Joining several commercial buildings at a number of levels.
- Realignment and relocation of vertical access elements.
- Linking of new vertical access routes with operational public pedestrian routes.
- Construction of additional floor levels above the occupied commercial levels.
- Construction methodology that can be completed in the congestion of the CBD with limited space while maintaining the operation of the existing commercial tenancies.
- Provide a structural design with suitable materials to minimise noise and vibration during construction.

West Australian Ballet Centre

MAYLANDS, WA, AUSTRALIA
CLIENT: WEST AUSTRALIAN BALLET INC.

The heritage-listed Blind Institute, standing for over 100 years from 1860 to 1920 in Perth's inner-city riverside suburb of Maylands, featured high ceilings, wooden floors, and a grand, classical structure. This architecture made the dilapidated structure ideal for conversion into Western Australia Ballet Company's' new Ballet Centre.

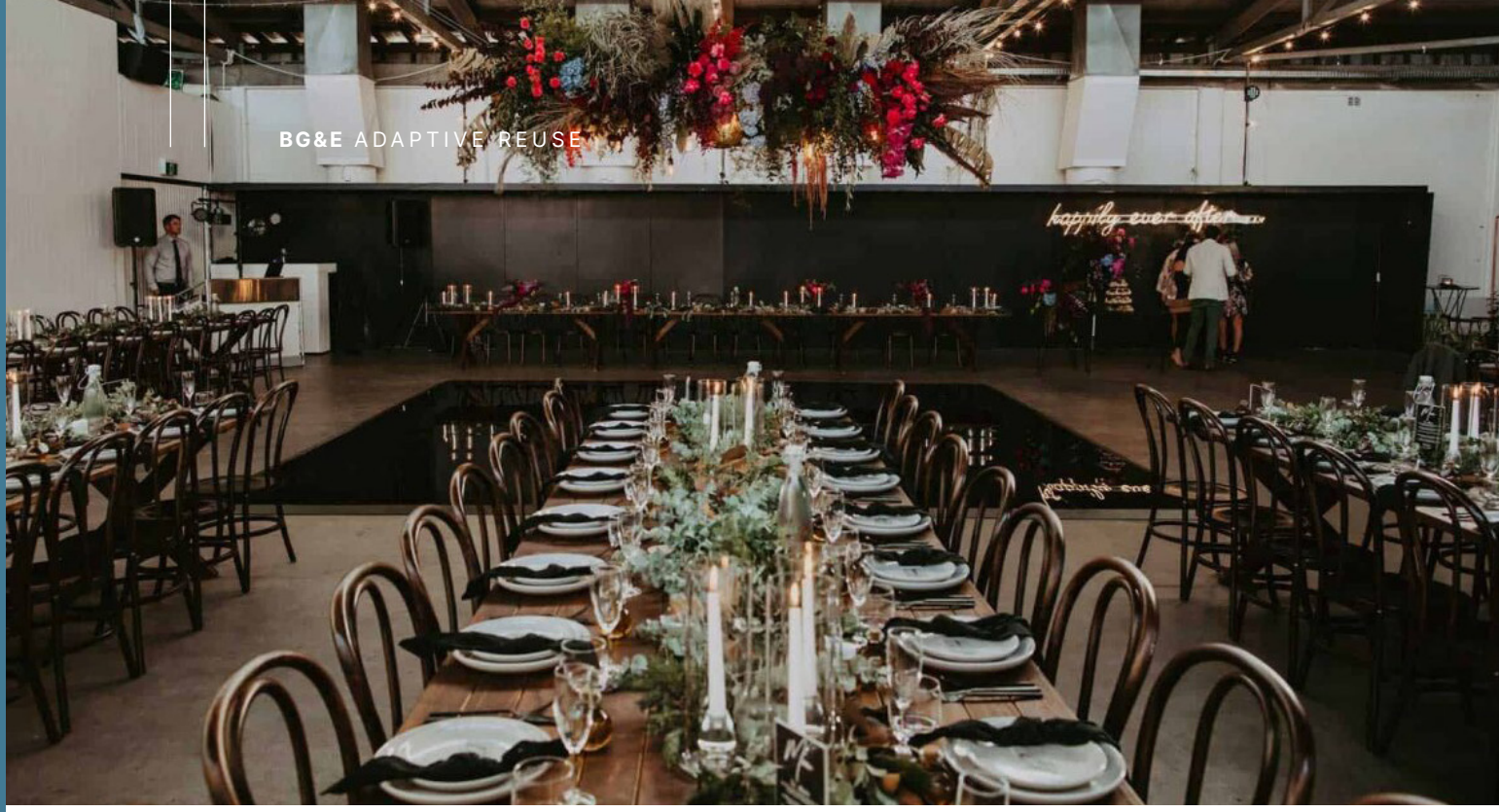
The $12 million redevelopment, finalised in 2012, revitalised the site, transforming it into a state-of-the-art ballet facility with three dance studios, a wardrobe and production department, administration offices, and a cafe.

BG&E provided structural engineering services for the adaptive reuse project, which involved:

- Demolition of the existing annex.
- Refurbishment of the existing building.
- Construction of a new annex linked by a 2 two storey glazed foyer and steelwork walkways with a reinforced-masonry lift core.

Verification and strengthening of the existing structure were carried out for the newly imposed design loads. Extensive demolition, alteration, and refurbishment works, along with the works associated with upgrading the building services for new facilities, were required. The repair of the existing masonry walls and strengthening of ground/first level jarrah floors, as well as the existing roof structure, was undertaken under strict heritage guidelines.

The Ballet Centre won the Adaptive Reuse Category at the WA Heritage 2013 Awards and was also submitted for the prestigious UNESCO 2013 Cultural Heritage Awards.



The Old Pickle Factory

LEEDERVILLE, WA, AUSTRALIA
CLIENT: AUTOMOTIVE PROPERTIES PTY LTD

Located in Leederville, the original warehouse building, built in the early 1960s and locally known as the Pickle Factory, was a two-level administrative block that comprised an expansive warehouse space suspended over storage areas on the ground level.

This heritage structure was repurposed into an industrial chic event space that can hold up to 400 people, situated in the heart of the burgeoning arts hub, The Pickle District, in West Perth.

The architectural planning for the building depicted extensive refurbishment of internal spaces, including a double-level restaurant and bar proposed for the existing warehouse space, and a new floor void which creates stair access to the repurposed storage area. The external envelope of the building received significant upgrades, including the replacement of the existing roof cladding and additional large operable windows.

BG&E provided structural and materials consulting services for the project, including the specification of inspections, testing regimes, and the analysis and design of strengthening measures to accommodate the proposed modifications and ensure the building is compliant with the current design standards - including the permitted threshold load assessment for seismic actions.

Hale House

PERTH, WA, AUSTRALIA
CLIENT: WESTERN AUSTRALIA DEPARTMENT OF FINANCE

BG&E provided structural and civil engineering services for the upgrade and refurbishment of the historic 1858 former Hale School Boarding House into the prestigious office of the Premier and cabinet rooms for Western Australia's Department of Finance. This endeavor revitalised a significant heritage site and established a dynamic civic facility for the State.

The scope of structural work for the cabinet offices consisted of the refurbishment of the existing Hale House building and a new two storey building to the South. The new building was to house cabinet and conference rooms, including new building services with stair and lift access.

The civil design upgraded the existing facility to accommodate emergency vehicles, over-length passenger vehicles, and service vehicles. The existing building access was upgraded, and additional parking facilities were provided for both short and long-term stays.

This refurbishment was completed in 2012.

The Doulton

LONDON, UNITED KINGDOM
CLIENT: THIRD.I GROUP

The historic 1980s Royal Doulton manufacturing site has been transformed by Third.i into The Doulton - a premium mixed-use building that boasts a health and wellness facility, private offices, three new storeys, and luxury apartments with floor-to-ceiling, double-height glass windows with views of the iconic London skyline.

BG&E provided materials, structural, and façade engineering services to the adaptive reuse heritage project - ensuring structural safety and performance enhancements while preserving 90% of the original building, resulting in a significantly reduced carbon footprint.

Due to limited information on the existing building, a key challenge of the project was understanding the structure's present behaviour and performance, in relation to the proposed design. To combat this, BG&E's materials team combined destructive and non-destructive materials tests to ensure a comprehensive dataset for structural analysis. Using this data, our buildings team developed a Finite Element (FE) model that accurately replicated the behaviour of the existing building.

The testing included:

- Electromagnetic cover scanning to identify embedded reinforcement location and cover.
- Rebound hammer survey as per BS EN 12504-2:2021.

Premier House & One Cathedral Square (1CS)

MANCHESTER, UNITED KINGDOM
CLIENT: PROPERTY ALLIANCE GROUP

The four-star Renaissance Hotel in Manchester has been closed since July 2020, in anticipation of an ambitious redevelopment by Property Alliance Group. Instead of taking the traditional demolish and rebuild route, the original hotel tower will be retained, undergoing restoration and upcycling.

The revamped 216-bedroom hotel, part of SH Hotels & Resorts, will operate under the 'Treehouse' brand. This project is a key component of the £181.6 million redevelopment plan for the Deansgate site, marking the second Treehouse Hotel in the United Kingdom, after the first in London.

BG&E is providing structural engineering and materials technology services for the refurbishment project. Our innovative technical solutions will significantly cut the development's embodied carbon emissions, facilitating owners and operators in achieving BREEAM Certification. The forecasted environmental benefits are substantial, projecting a remarkable 40% reduction in CO2 compared to constructing a new hotel of the same size.

Burlington Gate

LONDON, UNITED KINGDOM
CLIENT: BROOKFIELD MULTIPLEX

Burlington Gate is a luxury residential development in London's most esteemed neighbourhood - Mayfair. The 83,000 square foot commercial building was redeveloped into 42 one-, two-, and three-bedroom luxury apartments across eight floors, targeting the super-prime residential market.

BG&E was engaged by Multiplex to provide temporary works services for the development. Construction was completed in 2017.

The residential space offers:

- Hotel-style amenity - including an indoor spa, gymnasium and triple-level basement.
- New courtyard at the heart of the building with an easy west orientation, to facilitate natural sunlight into the space.
- Ground level arcade that embodies the Georgian architecture of the precinct and facilitates pedestrian movement between Old Burlington Street, Cork Street, and the secluded courtyard.
- Striking glazed lift shaft with glass lifts in the arcade courtyard, providing residents with direct access to their apartments.

Burlington Gate features exceptional detailing and innovative styling, inspired by Mayfair's rich cultural heritage and contemporary art scene.

At BG&E, we are united by a common purpose – we believe that truly great engineering takes curiosity, bravery and trust, and is the key to creating extraordinary built environments.

Our team of more than 1100 highly skilled people, in offices across Australia, New Zealand, South East Asia, the United Kingdom and Middle East, design and deliver engineering solutions for clients in the Property, Transport, Ports and Marine, Water, Defence, Energy and Resources sectors.

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