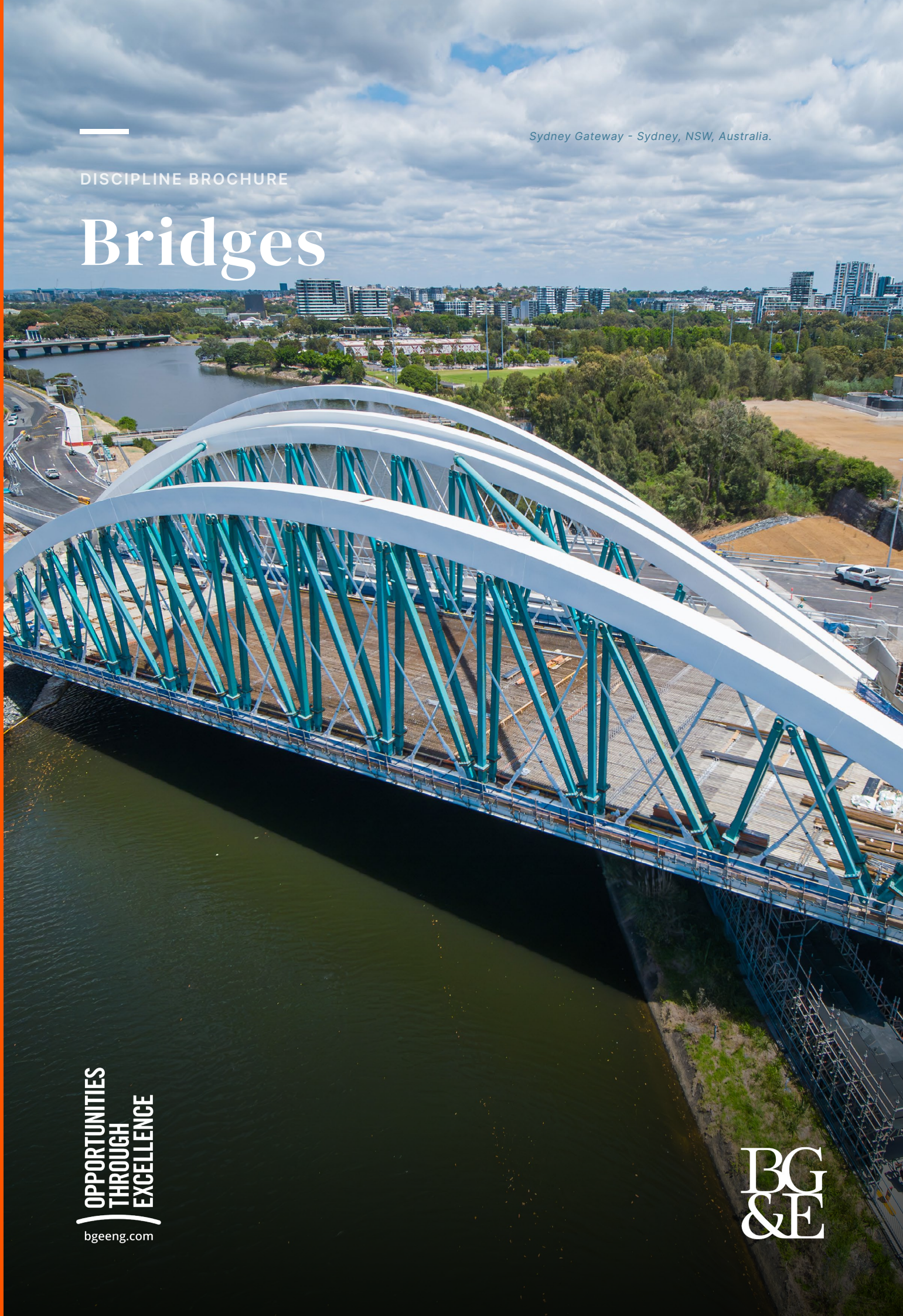
DISCIPLINE BROCHURE

Bridges



Sydney Gateway - Sydney, NSW, Australia.

OPPORTUNITIES THROUGH EXCELLENCE

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BG&E

BG&E

BG&E is an international civil and structural engineering consultancy celebrated for its innovative, cost-effective, and award-winning designs.

With a dynamic team of over 700 people spanning 15 offices worldwide - including Australia, New Zealand, South East Asia, the United Kingdom, and Middle East - we unite local and international professionals to deliver practical solutions with a strong focus on constructability.

Our clients consistently return to us, attesting to our exceptional service, responsiveness, and track record for delivering tailored solutions for technically challenging projects. The quantity and scope of engineering awards we've received acknowledge our diverse industry contributions and the exceptional quality of the services we deliver across a host of regions, disciplines, and sectors.

Industry Leading Bridge Design

Our technical expertise and knowledge of material behaviour ensure we provide award-winning solutions for clients at all stages of a project lifecycle - including strategic master planning, design and construction, and asset and network management.

Mandurah Estuary Bridge - Mandurah, WA, Australia.

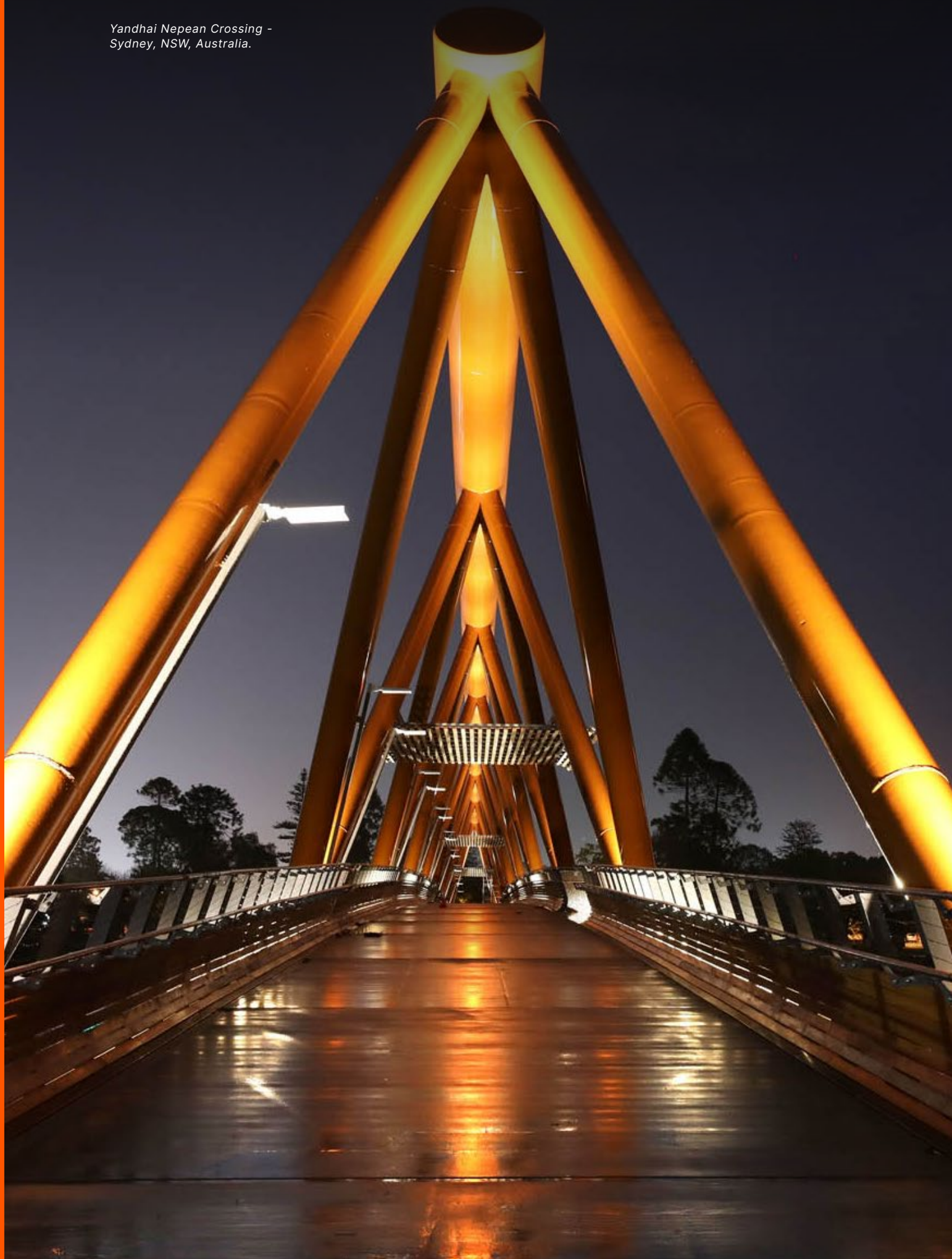
Over the last five decades, BG&E has been at the forefront of bridge design. We were the first engineering consultancy to introduce incremental launching techniques in Australia. Since then, we've developed significant expertise in designing complex bridges across all types of construction, structures and materials.

Our bridge capabilities are best characterised as inventive, resilient and sophisticated. They encompass planning and feasibility studies, conceptual, schematic and detailed design, construction documentation, and site support.

We also have a dedicated team of accredited inspectors who are experts in the cyclic and integrated nature of bridge asset management, working at all stages of the structure lifecycle - from inspection, condition assessments and evaluation, to maintenance and strategic review.

From balanced cantilever, segmental, incrementally launched, and cable-stayed - to precast modular components, in-situ and prefabricated - BG&E has a well-deserved reputation for delivering designs for durable structures with a focus on constructability.

Fitzroy River Bridge -
Kimberley Region, WA, Australia.



Yandhai Nepean Crossing -
Sydney, NSW, Australia.

Bridge Types

SUPPORTING STRUCTURES

As a multi-award-winning consultancy with experience in road, rail, pedestrian and metro bridge design – we deliver projects that drive economic and social progress, enhance transportation, unite communities worldwide, and can serve as iconic landmarks in urban landscapes.

ROAD BRIDGES

BG&E has a proven track record in delivering various types of bridge infrastructure, including road bridges, flyovers, overpasses, underpasses, tunnels, interchanges, and mixed-use bridges that accommodate a mix of vehicle, rail and/or pedestrian transport.

Our expertise also encompasses asset management and refurbishment design services to help our clients to maximise the lifespan of a bridge - addressing challenges like evolving safety regulations and usage scenarios, or structural degradation due to ageing.

Ipswich Motorway Upgrade (Rocklea to Darra - Stage One) - Brisbane, QLD, Australia.

RAIL BRIDGES

BG&E works with clients in passenger, freight, and heavy haulage rail, to design and deliver bridges, underpasses and tunnels that are underpinned by careful consideration of operations, safety, tightly constrained sites, remote locations, sensitive environments, constructability, and community needs.

The design of rail bridges has distinct requirements, including fatigue, track and structure interaction, and collision and containment protection. The heavy haulage rail bridges generally have additional demands with design controlled by fatigue or rail traction and braking.

We're experienced in maintaining and managing existing assets to provide for continued safe operation and minimise structural deterioration caused by heavy train loads and environmental exposure.

Eliwana Rail Bridge - Pilbara Region, WA, Australia.
Avon River Bridge - Stratford, VIC, Australia.

PEDESTRIAN BRIDGES

While pedestrian bridges typically have lighter loads, we understand the need for careful consideration of pedestrian movement, dynamic effects and other environmental and social factors.

Pedestrian bridges can enrich urban landscapes, and we carefully balance aesthetics with safety and accessibility requirements to ensure functional integration within the structure.

Yandhai Nepean Crossing - Penrith, NSW, Australia.
Exmouth Marina Bridge - Exmouth, WA, Australia.

Bridge Types

SPANNING STRUCTURES

Our comprehensive understanding of constructability, coupled with our collaboration with contractors and other stakeholders, ensures that we deliver enduring structures that are built over varied environments, like permanent water, operating roads and railways.

OVER ROAD BRIDGES

Over road bridges are vital to today's advanced transport infrastructure systems, optimising land use, enhancing resilience of infrastructure, and improving traffic flow. Considerations in design include:

- Clearance requirements, considering the height of trucks and other tall vehicles.
- Structural integrity to withstand live loads from vehicles and dynamic forces.
- Bridge barriers to prevent debris or objects falling on the below road and to contain traffic on the over bridge.
- Collision protection, including crash barriers and guardrails.
- Drainage management, preventing accumulation of water on the bridge deck and ensuring proper runoff management to minimise the risk of flooding or erosion.
- Accessibility for maintenance personnel, including safe access to elevated areas.
- Lighting and signage, enhancing visibility and safety, especially at night.
- Environmental impact, including habit disruption, noise pollution and runoff management.
- Adherence to relevant regulations and standards to ensure compliance and approval from regulatory authorities.
- Consideration of economic, social and environmental outcomes.

Captain Cook Highway - Smithfield Bypass - Brisbane, QLD, Australia.
Saar Interchange - Saar, Kingdom of Bahrain.

Pacific Highway Upgrade - Karuah Bypass - Sydney, NSW, Australia.
Mandurah Estuary Bridge - Mandurah, WA, Australia.

OVER WATERWAY & MARINE ENVIRONMENT BRIDGES

BG&E has decades of experience designing bridges that traverse bodies for water. We are cognisant of factors including high flood velocity, environmental sensitivity, ship impact, scour, and geological circumstances that require specialist pile designs.

Unique considerations when designing bridges that pass over permanent bodies of water and marine environments include:

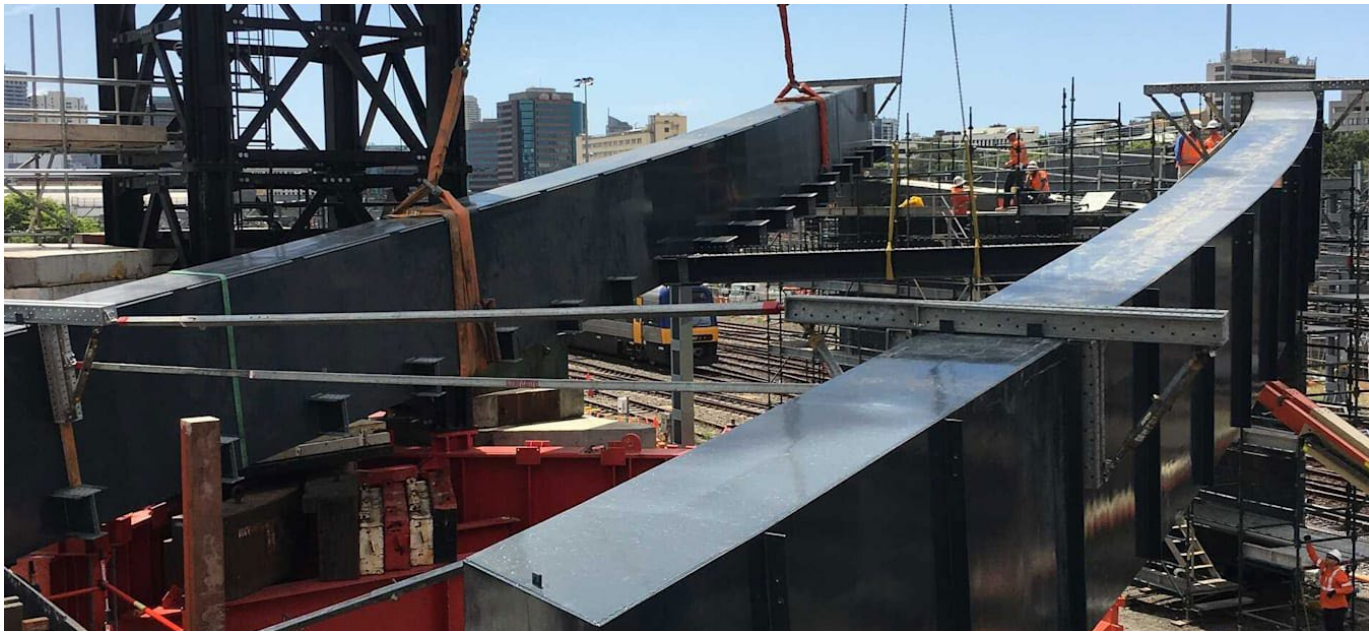
- Boat protection to withstand potential impact.
- Navigation clearance, vertical and horizontal clearance to accommodate watercraft.
- Water loads, including bouyancy, water pressure and wave action.
- Flooding and hydrology, including floodplain analysis to ensure resilience against an event.
- Streambed impacts, including sediment transport, scour, erosion and habitat disruption.
- Corrosion protection via use of resistant materials or coatings.
- Wave action, mitigating forces with measures like breakwaters or wave barriers.
- Impact on fauna and flora, including water quality, migratory patterns, etc.

OVER RAIL BRIDGES

Designing and constructing bridges over rail infrastructure necessitates awareness of the following unique requirements:

- Clearance requirements for trains passing under and consideration of overhead electrical lines and other infrastructure.
- Dynamic loads and vibrations generated by passing trains.
- Bridge barriers to prevent debris or objects falling on the rail tracks and to contain traffic on the over bridge.
- Collision protection, including deflection walls and collision walls.
- Earthing and bonding.
- Accessibility for maintenance personnel, including safe access to elevated areas.
- Environmental impact, including habit disruption, noise pollution and runoff management.
- Adherence to relevant regulations and standards to ensure compliance and approval from regulatory authorities.
- Lighting and signage, enhancing visibility and safety, especially at night.

Sydney Yard Access Bridge - Sydney, NSW, Australia.
METRONET Thornlie-Cockburn Link, Ranford Road Bridge - Perth, WA, Australia.



OVER NATURAL ENVIRONMENT BRIDGES

Bridges that travel over natural environmental spaces are key to reduced disruption to ecosystems and preservation of habitats and cultural or heritage sites. Other benefits include enhanced wildlife connectivity, unimpeded water flow and mitigation of flood risks. Unique considerations for design include:

- Ecological impact assessment to understand potential effects of the bridge.
- Minimisation of disruption in construction and operation to the natural environment, including preserving existing vegetation, sensitive habitats and waterways.
- Wildlife crossings, reducing risk of roadkill or habitat fragmentation.
- Hydrological considerations, including water flow, sediment transport, aquatic ecosystems, and natural draining patterns.
- Water quality protection, including stormwater management systems and vegetated buffer zones.
- Erosion control, including stabilising embankments, erosion control blankets, and use of native vegetation.
- Public access and recreation to enhance connection between community and environment.

Bilya Djena Bidi Footbridge - Murray River, WA, Australia.

Bridge Types

STRUCTURAL FORMS, CONSTRUCTION METHODOLOGIES & MATERIALS

Throughout the design process, BG&E sets new benchmarks by delivering adaptable solutions tailored to each project's complexities, considering technical design, construction methodology and materials selection.

STRUCTURAL FORMS

For over five decades, BG&E has led the way in bridge design in Australia. We have demonstrated experience in designing both complex and simple bridges across all types of construction, structures and materials.

We have experience with the design of non-integral, semi-integral and integral bridges to suit bridge configuration, site conditions and client preferences.

Our capability includes the following structures:

- Cable-stayed bridges.
- Suspension bridges.
- Precast girder beam-and-slab bridges.
- Precast plank bridges.
- Slab bridges (solid and voided).
- Box girder bridges (single and multi-cell).
- Arches (suspension and network arch).
- Truss bridges.
- Through-girder bridges.
- Tunnels and underground structures.

Roy Hill Bridge (Steel through-girder bridge) - Port Hedland, WA, Australia.
Sydney Gateway(Network arch bridge) - Sydney, NSW, Australia

CONSTRUCTION METHODOLOGY

BG&E is sought out in the industry for our positive reputation - earned by working closely with contractors - to deliver designs that prioritise constructability and practicality.

We have extensive experience with the following construction methodologies:

- Balanced cantilever bridges.
- Incrementally launched bridges.
- In-situ false work.
- Lift-in spans.
- Self-Propelled Modular Transports (SPMT).

Hunter Expressway Viaduct (Match-cast balanced cantilever bridge) - Branxton, NSW, Australia.
Mandurah Estuary Bridge (Incrementally launched bridge) - Mandurah, WA, Australia.

Leach-Welshpool Alliance Bridge (Precast prestressed concrete) - Welshpool, WA, Australia.
South Coast Highway (Timber bridge refurbishment) – Albany, WA, Australia.

MATERIALS

Leveraging long-standing industry partnerships and strong ties to academia, our highly-regarded Materials team specialise in materials selection, specification and optimisation, durability design, design and specification conformance, constructability staging, asset inspection, remaining life assessments, defect and dilapidation remediation strategies, and non-destructive and destructive materials testing.

Our materials knowledge also allows us to inform and achieve materials-related sustainability specifications in asset design.

We are familiar with the following bridge materials compositions:

- Post-tensioned concrete.
- Precast prestressed concrete.
- Cast in-situ reinforced concrete.
- Steel and concrete composite.
- Steel.
- Timber.
- Carbon fibre.

We also have experience in the assessment of existing structures constructed using the following materials:

- Timber.
- Brick and masonry.
- Wrought iron and cast iron.

Ipswich Motorway: Rocklea to Darra (Stage One) - Rocklea, QLD, Australia.

The Bridge Lifecycle

BG&E provides professional services at various points across the asset management lifecycle - from planning through to decommissioning.

1. PLANNING

- Feasibility studies at the strategic (pre-concept) and concept stages.
- Concept design and reference design.
- Development of capital works programs.
- Whole of life costing.

2. DESIGN & CONSTRUCTION

- Detailed design.
- Temporary works and construction support, e.g. incremental launching, propping and shoring falsework, construction staging, deflection control, and load assessments.

3. OPERATE & MAINTAIN

- Routine and detailed visual inspection of bridges.
- Special inspection and assessment of bridges, e.g. materials and destructive testing, and remaining useful life assessment.
- Bridge load rating for different vehicle configurations.
- Development of maintenance works programs for individual structures and asset portfolios.
- Manage maintenance work and schedules.
- Detailed design of refurbishment and strengthening works.
- Emergency response: inspection and design work following catastrophic events, e.g. collision impacts, flooding, bush fires, and earthquakes.

4. DECOMMISSIONING

- Design refurbishment and reuse of existing structures, e.g. existing road and rail structures for reuse as pedestrian bridges, and existing substructures to support new superstructures.
- Advising on demolition and decommissioning, e.g. temporary works and staging.

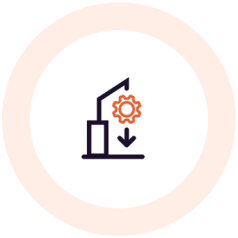
ICON LEGEND

Technical Bridge Support

With a comprehensive suite of in-house engineering disciplines that work synergistically, we are strategically positioned to deliver industry-leading bridge design solutions. Additionally, we can leverage our network of proven and trusted sub-consultants when necessary.

CIVIL ENGINEERING

Optimising alignment for roads and pedestrian bridges. Integrating disciplines, including traffic engineering and transport planning.



CONSTRUCTION ENGINEERING

Focusing on constructability. Our detailed design process includes temporary works consideration.

DIGITAL ENGINEERING

Inhouse capabilities that include Building Information Modelling (BIM). Parametric design.

FLOODING & HYDROLOGY

Expertise in addressing scouring and waterway challenges.

GEOTECHNICAL ENGINEERING

Considering ground conditions. Designing foundations, support and deep excavation.

MATERIALS & DURABILITY

Proficient in materials selection, durability testing and coating and treatments.

SUSTAINABILITY

Assisting with social and environmental initiatives, inc. environmental preservation and carbon reduction.

RAIL & RAIL INFRASTRUCTURE

Advising on rail structure interaction for rail and over rail bridges. Optimising track alignment.

Our Broad Profile

1985

TONKIN HIGHWAY FORRESTFIELD BRIDGES
Forrestfield, WA

BG&E introduced incrementally launched bridge construction to WA.

1995

GOONGOONGUP BRIDGES
East Perth, WA

Spanning 400 metres across the Swan River, this was the largest rail bridge delivered by BG&E at the time of construction. Significant incrementally launched post-tensioned concrete box rail girder bridge.

2000

WINDAN BRIDGES
East Perth, WA

Significant incrementally launched post-tensioned concrete box girder traffic bridge spanning the Swan River in Perth. BG&E's largest traffic bridge at the time, at over 400 metres long.

1999

PACIFIC HIGHWAY UPGRADE - YELGUN TO CHINDERAH
Duranbah, NSW

BG&E designed all overpass bridges, including seven Super-T bridges (span upto 38.5 metres), two arch bridges (span over 50 metres), one post-tensioned two span Twin-T bridge, and four fauna arch tunnels.

2001

KWINANA FREEWAY EXTENSION - BERRIGAN DRIVE TO SAFETY BAY ROAD
Perth, WA

BG&E delivered 12 bridges, introducing the use of 'teeroff' style precast trough beams in WA (with beam spans up to 48 metres). Included the largest precast bridge trough girders in Australia for some time.

2000

PRESTON STREET FOOTBRIDGE
Como, WA

Twin tower cable stayed shared path footbridge spanning over the Kwinana Freeway, with shaded viewing platform and associated ramp structures.

2008

EXMOUTH MARINA FOOTBRIDGE
Exmouth, WA

Delivered a 90 metre span network arch footbridge with precast concrete deck construction, designed for a severe cyclone region.

2002

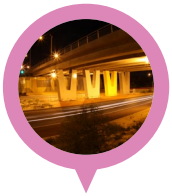
KARUAH BYPASS
Karuah, NSW

Was the longest incrementally launched bridge in Australia at 594 metres at the time of construction. Two separate bridges tied together and launched from a common launch bay.

2012

MITCHELL FREEWAY EXTENSION - HODGES DRIVE TO BURNS BEACH ROAD
Perth, WA

Designed three major road bridges with 'teeroff' precast trough beams, a continuous haunched post-tensioned footbridge, several underpasses, and an arched precast rail tunnel with associated dive structures.



2012

MALCOLM FRASER BRIDGE
Majura, ACT

One of the first bridges where we incorporated BIM modelling. Delivered a pair of four span, 202 metre incrementally launched concrete box girder bridges across the Molonglo River and Morshead Drive.

2013

MAMBO & TEMA BRIDGES
Mambo & Tema, Tanzania

Five BG&E staff relocated to Tanzania to help rebuild three essential bridges damaged by flooding - providing pro-bono construction, employment, and training for the local community.

2013

ROY HILL BRIDGE
Pilbara, WA

BG&E was engaged at ECI and EPC stages for this heavy-haul rail line. Included detailed design of eight over-water bridges (steel-concrete), three over-rail bridges (steel-concrete through girder), and an over-rail bridge.

PACIFIC HIGHWAY - WOOLGOOLGA TO BALLINA
Mid North Coast & Northern Rivers, NSW

Delivered the design of 73 bridges in ten months. Our package subsection (one of four packages) had the lowest reinforcement rate of all design teams.

2015

YANDHAI NEPEAN CROSSING
Penrith, NSW

Delivered the longest clear span footbridge in Australia - a 200 metre, simply supported Warren truss bridge.

2018

AVON RIVER BRIDGE
Stratford, VIC

Delivered a new 500 metre long rail bridge over the Avon River in VIC.

2020

TEES TRANSPORTER BRIDGE ASSET PROTECTION
Middlesborough, UK

Conducted an independent Category Three Check - Structural and Mechanical Assessment of the bridge and mechanical components and access span of this historic structure.

2023

FITZROY RIVER BRIDGE
Kimberley Region, WA

BG&E, an Alliance partner, designed the replacement Fitzroy River Bridge, destroyed by Cyclone Ellie. The incrementally launched weathering steel and concrete bridge was completed over six months ahead of schedule.

COOMERA CONNECTOR NORTH
Gold Coast, QLD

860 metre long bridge over Coomera River and Salt Water Creek within a very narrow construction corridor and adjacent to a south coast railway line. Design of bridge was in deep soft ground, upto 20 metres deep.

Currently underway

NORTH SOUTH CORRIDOR (NSC)
Singapore

BG&E performed the Accredited Checking Role for multiple design and build package for the multi-modal transportation corridor, including segmental and balanced cantilever bridges.

BILYA DJENA BIDI BRIDGE
Lane Pool Reserve, WA

BG&E provided pro-bono engineering for a new 92 metre weathering steel suspension bridge, replacing the original track crossing destroyed by a bushfire.

2017

GATEWAY WA
Forrestfield, WA

BG&E was an Alliance partner in delivery of the largest road infrastructure project undertaken at the time in WA. Involved design of several road bridge, underpass and associated structures.

IPSWICH MOTORWAY UPGRADE PROJECT - ROCKLEA TO DARRA: STAGE 1
Brisbane, QLD

Upgrade to existing asset and adjacent service roads through a low level floodplain utilising complex staged construction methods. Constructed while maintaining motorway traffic.

2021

SAAR INTERCHANGE
Kingdom of Bahrain

BG&E introduced incrementally launched bridge construction to the Kingdom of Bahrain.

SYDNEY GATEWAY
Sydney, NSW

Delivered a wide variety of bridge structures in a heavily constrained brownfield site, including steel network arches, Super-T, steel box and concrete box bridges - improving connection to Sydney Airport.

2024

METRONET THORNLIE-COCKBURN LINK
Perth, WA

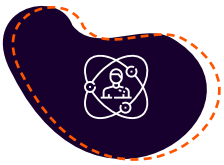
BG&E was part of the design JV for the rail extension project, including a 14.5 kilometre rail extension, and Perth's first cross-route rail connector. Also included road, rail and pedestrian bridges, and assessments and upgrades to existing tunnels.

PAKENHAM ROADS UPGRADE
Packenham, VIC

BG&E's first major detailed design for a road bridge in VIC, representing a significant milestone in our expansion across Australia.

Why BG&E?

With a deep understanding of modern bridge construction, we provide innovative, practical and cost-effective solutions while maintaining a client-friendly approach.



Demonstrated expertise in delivering bridge **designs at the tender phase that win the job.**

Delivering jobs while **de-risking delivery,** ensuring **timely completion,** and achieving **functionality.**

Seasoned experts with **25+ years of experience** in their respective fields and regions.

Active representation in AS 5100 (Australian bridge design code) and development of industry guidelines, confirming our position as industry leaders.

Long standing relationships with regional industry bodies, fostering a deep understanding of their operations.

Recognition for **award-winning projects,** receiving prestigious accolades that underscore our commitment to excellence.

Our Approach to Success

To ensure our client's success, BG&E has identified critical risks and hot-button issues in the bridge design and delivery process, and developed targeted mitigation strategies and opportunities in response.

INTERFACES & APPROVALS

- Asset owners and operators
- Utilities
- LGAS
- Water corporations
- Environmental agencies

CONSTRUCTABILITY

- Clashes
- Temporary stability
- Lead times (supply chain)
- Material vs labour trade-offs
- Worker safety

PROGRAM

- Program slippage
- 'Eleventh hour' surprises
- Mis-aligned incentives

TECHNICAL SOLUTIONS

- Lack of technical innovation at the concept stage to provide competitive advantage
- Conservative designs

RESOURCES

- Lack of skilled and experienced staff
- Changes to team structure during delivery

MITIGATION MEASURES

- Leverage national footprint
- Commitment of key staff for duration; no 'swap outs'

- Provision of experienced technical leaders to steer solution from the start
- Avoid 'gold-plating'
- Internal challenge is BAU

- Culture of 'on-time delivery' central to BG&E value proposition
- Intermediate milestones written into contract to drive accountability

- Integration of in-house Construction Engineering team
- BIM adoption through development
- Collaboration and co-design with client construction experts

- Team leadership experienced in approvals process
- Early engagement with stakeholders
- Diligent use of requirements register
- (VCRM)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THROUGH
EXCELLENCE

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 700 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.

OPPORTUNITIES THROUGH EXCELLENCE

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