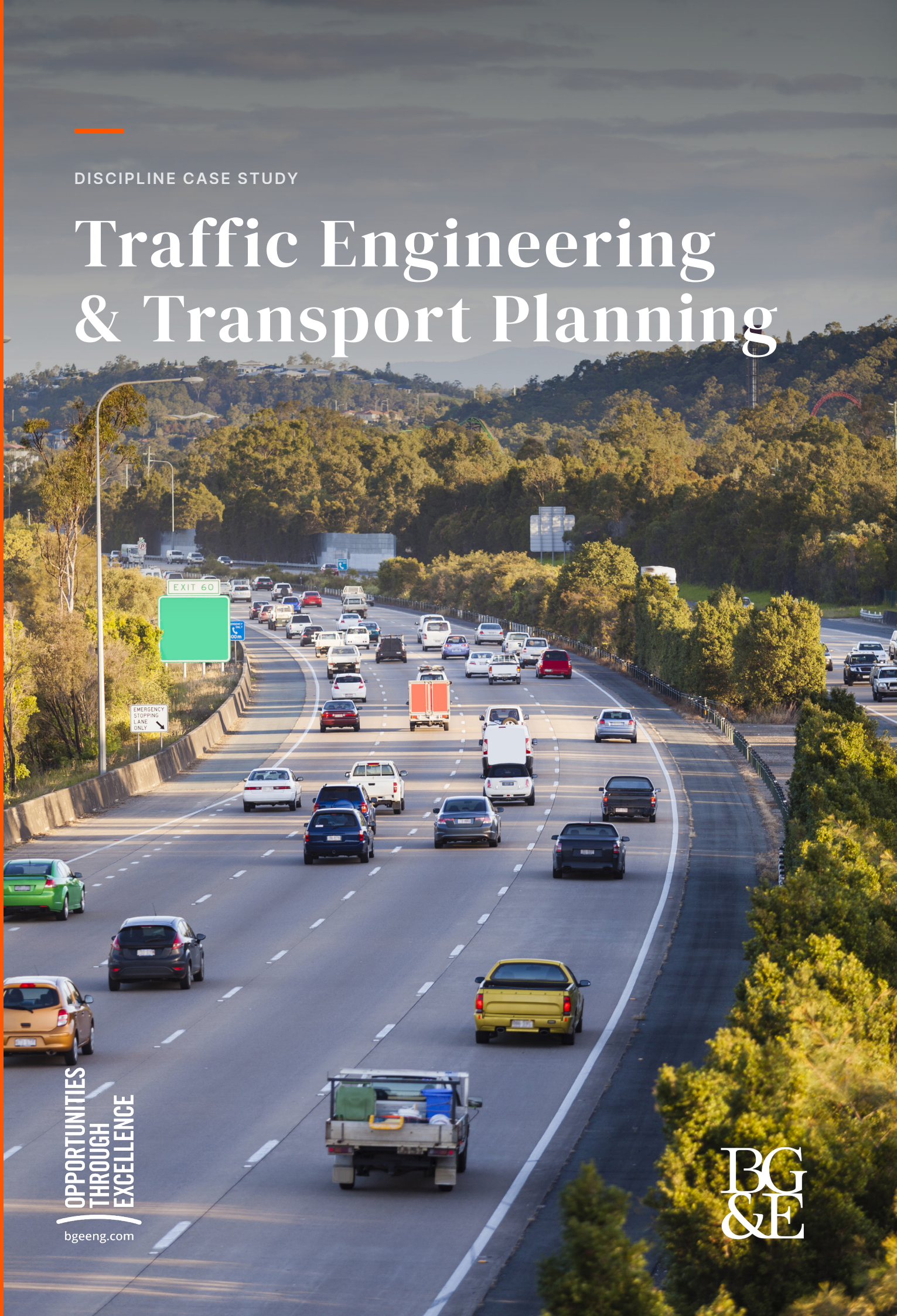
DISCIPLINE CASE STUDY

Traffic Engineering & Transport Planning



OPPORTUNITIES THROUGH EXCELLENCE

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BG&E

M1 Pacific Motorway Extension to Raymond Terrace

NEWCASTLE, NSW, AUSTRALIA
CLIENT: JOHN HOLLAND & GAMUDA JV

The M1 Pacific Motorway (M1) to Raymond Terrace Extension is a 15 kilometre extension of the existing M1 at Black Hill to the existing Pacific Highway at Raymond Terrace, NSW.

BG&E is part of the design JV currently developing detailed design for the southern package from Black Hill to Tomago - which consists of 10 kilometres of new dual carriageway motorway with interchanges at Black Hill, Tarro, and Tomago.

Our scope of work includes civil engineering design, structural design, and traffic engineering and traffic micro-simulation.

Key features of the project include:

- Motorway access from the existing road network via the new interchanges at Black Hill, Tarro, and Tomago.
- 2.6 kilometre viaduct over the Hunter River flood plain, including new bridge crossings over the Hunter River, the Main North Rail Line, and the New England Highway.
- Local road connections, including Lenaghan's Drive, Old Punt Road, and access to the Hunter Region Botanic Gardens.
- Roadside furniture, including safety barriers, signage, fauna fencing and crossings, and street lighting.
- New structures including bridges and noise walls.
- Walking and cycling facilities.

M1 Pacific Motorway Extension to Raymond Terrace – Newcastle, NSW, Australia.

Narre Warren North Road Upgrade

NARRE WARREN, VIC, AUSTRALIA
CLIENT: SYMAL INFRASTRUCTURE & MRPV

Narre Warren North Road is a primary arterial road that forms part of the State Route C404 along with Narre Warren-Cranbourne Road, Belgrave-Hallam Road, Monbulk Road, and Hereford Road. It provides access to the Fountain Gate and Narre Warren District Centre and connects to the Monash Freeway and Princes Highway - which are key roads in Melbourne's transport network.

The Narre Warren North Road, between Fox Road and Belgrave-Hallam Road, in Melbourne's South Eastern suburbs, was upgraded by the Victorian and Federal governments to improve safety and travel times for the more than 14,000 vehicles that use the road each day.

Narre Warren North Road is predominantly a dual carriageway road, except between Belgrave-Hallam Road and Fox Road, where it narrows down to a two way undivided single carriageway.

The project included:

- Duplication of approximately 700 metres of Narre Warren North Road between Fox Road and Belgrave-Hallam Road by adding an extra lane in each direction.
- Upgrading major intersections at Ernst Wanke Road and Heatherton Road.
- Signalising the intersection at Memorial Drive.
- Simplifying the operation of the Brundrett Road intersection to remove the right turn egress.
- Simplifying the operation of Crawley Road intersection (left in and left out).
- Upgrade and completion of the shared use path on the western side of Narre Warren North Road between Heatherton Road and Ernst Wanke Road.
- Street lighting, barriers, road signage and landscaping.
- New drainage and utility service upgrades and relocations, including the extension of an existing culvert structure to facilitate the road widening.

BG&E provided civil engineering, road design, traffic modelling, flood modelling, drainage and pavement design, and geotechnical services to the project.

Key features include:

- Significant improvement to the intersection layout, road alignments and overall project costs savings with the removal of the reverse curve on the Memorial Drive approach, removal of over 100 metres of retaining walls, reduction in the scale of the overhead power pole relocation, and provision of sufficient clearance to property boundaries for maintenance access.
- BG&E proposed an innovative structural solution for the retaining wall which allowed the wall to sit over the culvert but with the two structures being completely independent of each other. This enabled utilisation of standard off-the-shelf crown units, significantly reducing the procurement and construction timeframes, thus minimising the construction program and the duration of full road closures.

Works started on the project in March 2021 and were completed in May 2023.

Narre Warren North Road Upgrade – Melbourne, VIC, Australia.

Hallam North & Heatherton Road Upgrade

ENDEAVOUR HILLS, VIC, AUSTRALIA
CLIENT: SYMAL GROUP & MRPV

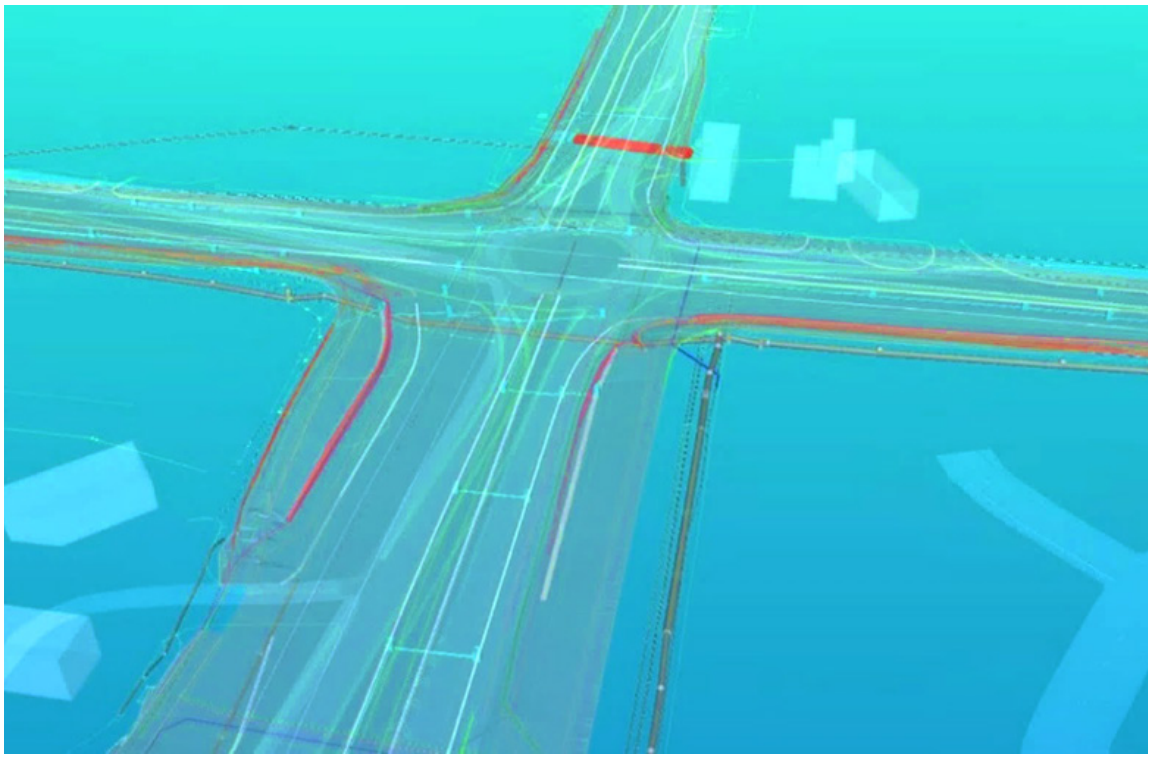
As a part of Victoria's Big Build, Hallam North and Heatherton Road were upgraded, with works beginning in September 2020 and completed in late 2022. The upgrade included the duplication of Hallam North Road, upgraded intersections, and new walking and cycling paths.

The works consisted of:

- The duplication of Hallam North Road from two lanes to four lanes (two lanes in each direction).
- Intersection upgrade and signalisation of the Hallam North and Heatherton Road intersection to replace the roundabout.
- Dedicated turn lanes and U-turn facilities.
- Upgraded signalised intersection with Thomas Mitchell Drive to improve access and safety.
- New and upgraded shared paths along both sides of Hallam North Road and Heatherton Road for project length.
- Road works, earthworks, retaining wall design, street lighting, safety barriers, new shared paths, traffic signals, and associated works.
- Stormwater and sub-surface drainage design and flood modelling.
- Relocation and protection of utility services.
- Landscaping, urban design, and associated works.

The team identified and proposed several road improvements including the signalisation of a shopping centre access.

The upgrade has improved traffic flow and eased congestion at the Heatherton Road intersection, improved accessibility to the freeway network, made it easier for the local community to walk or cycle in the local area, and lowered the risk and severity of crashes by adding safety barriers.



Hallam North & Heatherton Road Upgrade – Endeavour Hills, VIC, Australia.

Western Port Highway Upgrade

MELBOURNE, VIC, AUSTRALIA
CLIENT: MRPV & DOWNER GROUP

Western Port Highway is a north to south arterial road starting 35 kilometres south east of Melbourne's CBD, which extends south from South Gippsland Freeway to Frankston Flinders Road. Western Port Highway forms part of a wider freeway network that services the south east suburbs of Melbourne and passes through Dandenong South, Lyndhurst, Cranbourne West, Langwarrin, Somerville, Tyabb, and Hastings.

Two intersections along Western Port Highway are proposed to be upgraded to signalised intersections:

- Ballarto Road, Cranbourne, Victoria.
- Cranbourne-Frankston Road, Cranbourne, Victoria.

BG&E, along with design and construction contractor Downer Group, developed the project scope and budget in collaboration with Major Road Projects Victoria as the delivery authority.

BG&E was the lead consultant and responsible for traffic, civil, and structural engineering, along with specialist subconsultants for the provision of lighting, landscape, environmental design, cultural heritage review, and road safety audits. The project involves:

- Removal of existing roundabouts and upgrade to signalised intersections.
- Traffic modelling.
- 3D road design.
- Barrier design.
- Signage and line marking.
- Traffic signal layout, equipment locations, and proposed connections.
- Street lighting and ISOLUX modelling.
- Structures design, retaining walls, and culvert headwalls.
- 3D drainage design (including water sensitive road design).
- Flood modelling and flood mitigation measures.
- Pavement design.
- Utilities coordination.
- Landscaping and urban design.
- Shared use path networks.

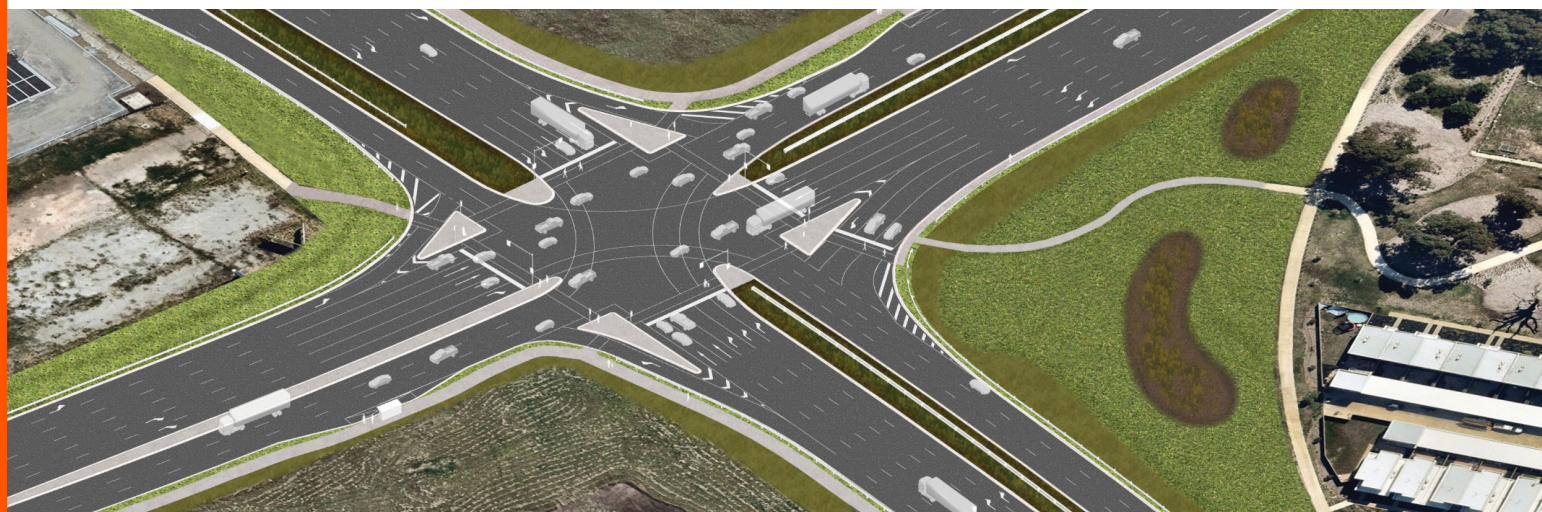
Key features include:

- The removal of CFA pile walls significantly reduced the use of reinforced concrete on the project. It also provided opportunities to activate the area by providing extensive landscaping and trees instead of four metre shotcrete walls hardscapes.
- Minimising the depth of the overall pavement thickness, significantly reducing the extent of asphalt required.
- Maximising the use of Emesh as a replacement to reinforcement with reinforced concrete footways.

BG&E has worked to bring value to the projects by maximising social procurement opportunities and capitalising on the use of recycled products - BG&E maximised RAP content in pavement designs and the use of the Reconophalt™ product.

The Western Port Highway project has eased traffic flow and reduced travel times, enabling all four sets of traffic lights within a six kilometre stretch to be sequenced. Travel efficiency will add capacity to the local road network and support communities with faster connections for people and freight.

Western Port Highway Upgrade – Melbourne, VIC, Australia.



Lang Lang Bypass

LANG LANG, VIC, AUSTRALIA
CLIENT: CARDINIA SHIRE COUNCIL

BG&E was engaged by Cardinia Shire Council to undertake a feasibility study of the proposed Lang Lang Bypass.

The purpose of the proposed bypass is to divert heavy vehicles, consisting mainly of sand and quarry trucks, away from the town centre. Diverting heavy vehicles away from the town centre promotes a safer road environment, reducing the number of conflicts with heavy vehicles and increasing amenity for residents.

The study investigated the feasibility of the proposed bypass, including aspects such as:

- Traffic implications.
- Concept design considerations.
- Land acquisition requirements.
- Flood modelling.
- Environmental considerations.
- Cultural heritage considerations.
- Cost estimates.

BG&E delivered the following key scope items:

- Reviewed the existing information provided by Cardinia Shire Council.
- Development of several options:
  - » Preferred option (with no land acquisition) for interim and ultimate solutions.
  - » Alternative option (expensive option without compromise on design standards) for interim and ultimate solutions.
- Undertook concept design development of intersections at various locations.
- Undertook and investigated flood modelling.
- Prepared a preliminary breakdown cost plan.

The project involved conducting a feasibility study and providing concept design services aimed at alleviating traffic congestion around Lang Lang town.

Throughout the project, BG&E maintained close collaboration with key stakeholders, including the Cardinia Shire Council, transportation agencies, and community representatives, integrating their feedback and addressing concerns. We carefully assessed existing site conditions and constraints such as topography, land use patterns, and environmental factors to develop a design that minimises disruption and maximises efficiency.

BG&E remained flexible to accommodate design changes and updates at various stages of the project, while also considering constructability factors to facilitate smooth implementation. We prioritised safety in design by incorporating various measures to ensure the Lang Lang bypass provides a safe and reliable transportation solution.

The project started in October 2023 and was completed in mid 2024.

Grattan Street Corridor Upgrade

CARLTON, VIC, AUSTRALIA
CLIENT: CITY OF MELBOURNE

The Grattan Street corridor, located in Carlton on Melbourne's CBD fringe, was subject to significant change as part of the Metro Tunnel Project (MTP), which includes a new train station and an upgrade of Grattan Street between Flemington Road and Bouverie Street.

Using the MTP as a catalyst, the City of Melbourne (CoM) had an opportunity to improve public amenity, prioritise active transport, and establish innovative spaces along the full length of Grattan Street whilst tying into the MTP works area.

To achieve this, several transport modal filter options were proposed to filter out through vehicles travelling along Grattan Street whilst maintaining access for cyclists, pedestrians, and public transport.

BG&E delivered the following key scope items associated with the project:

- Review of background documentation, including CoM transport plans and strategies, MTP design drawings and documentation, existing traffic counts, CoM urban design plans, and a CoM opportunities plan.
- Procurement of traffic surveys for the entire Grattan Street corridor.
- Preparation of modal filter options and scenarios for input into traffic modelling.
- Managing a subconsultant to undertake DOMINO (VISUM) modelling of proposed options and scenarios.
- BG&E used modelling outputs to identify and quantify traffic redistribution within the surrounding area, viable detour routes, volume and capacity assessments of the surrounding road network based on modelled options, and travel time impacts based on model determined origin-destinations.
- SIDRA modelling of intersections along the Grattan Street corridor, using the DOMINO modelling results and traffic surveys as input to quantify anticipated intersection impacts of the proposed options/scenarios.
- Presentation of the modelling process in a technical traffic report including key findings.
- Presentation of findings to Council and the Department of Transport and Planning.

Grattan Street Corridor Upgrade – Carlton, VIC, Australia.

Yan Yean Road Upgrade: Stage One

PLENTY, VIC, AUSTRALIA
CLIENT: VICROADS & BMD CONSTRUCTIONS

This design and construction project consisted of the upgrade of approximately four kilometres of Yan Yean Road between Diamond Creek Road and Kurrak Road in the suburb of Plenty. The works consist of the duplication of Yan Yean Road to four lanes, two lanes in each direction, and the upgrade of major intersections. This was a complex design along a constrained corridor with existing services, protected vegetation, and hilly terrain.

The project included:

- Road works, earthworks, retaining wall works, street lighting, safety barriers, drainage improvements, new shared paths, traffic signals, and associated works.
- Six intersection upgrades (Diamond Creek Road, River Ave, Memorial Drive, Browns Lane, Kurrak Road, and Nillumbik Shire Council Recycling and Recovery Centre).
- Widened and installed safety improvements at the Mackleroy Road intersection.
- Relocation and protection of utility services.

Features of the project include:

- Safety barriers.
- Shared paths for pedestrians and cyclists.
- Stormwater drainage design.
- Pavement design.
- Dedicated bus lanes at the Yan Yean Road and Diamond Creek Road intersection.
- Replacement of the existing roundabout with new traffic signals at the Yan Yean and Kurrak Road intersection.
- Traffic modelling.
- Six intersection upgrades.
- Extensive retaining walls and earthworks.
- Straightening of road alignment for improved visibility.
- New refuse islands to connect pedestrians with bus stops.
- Relocation and protection of Utility Services.
- Public lighting and traffic signal design.

Sustainable design measures adopted include optimised earthworks to reduce the extent of import and export of materials from the site and WSRD and drainage design to accommodate high flood runoff were the remedial measures introduced to minimise adverse flooding impacts to neighbouring properties.

BG&E's innovative design saved over 1000 trees that were originally planned for removal by refining the road alignment and reducing the overall footprint of the works. Any trees and plants that were impacted by the road widening works were replanted. Wood from trees that were cut down was made into benches and sculptures, enhancing community spaces.

The project also introduced dedicated bus lanes, and undertook intensive traffic modelling in SIDRA and VISSIM to improve intersection performance.

BG&E optimised the existing road reserve and optimised lane transitions to reduce bottlenecks and potential queuing through the intersection.

BG&E's innovative design solution for the Diamond Creek and Yan Yean Road intersection increased the design life of this intersection by approximately 10 years over the reference design (by others).

Yan Yean Road Upgrade: Stage One – Melbourne, VIC, Australia.

Coomera Connector: Stage One North

GOLD COAST, QLD, AUSTRALIA
CLIENT: DEPARTMENT OF TRANSPORT & MAIN ROADS, QLD

Stage One of the Coomera Connector project provides the first 16 kilometres of an alternate 45 kilometre motorway connection between Coomera and Nerang. The new road will be an alternative to the Pacific Motorway (M1) and provide greater connectivity to communities east of the existing M1, enabling development, community connectivity and economic activity

Stage One is being delivered as three packages. Stage One North package is a four kilometre section connecting Shipper Drive to Helensvale Road.

The package includes:

- Four lanes with provision for future widening.
- Grade separated interchanges at Shipper Drive and Helensvale Road.
- One kilometre bridge over Coomera Creek and Saltwater Creek.
- Upgrades to a section of Foxwell Road and Shipper Drive (now known as the Coomera Link Road).

BG&E provided traffic modelling and analysis to support the preliminary and detailed design for the new motorway, interchanges and arterial road intersections.

Traffic engineering was required to demonstrate the design meets project traffic performance requirements.

RPEQ-certified traffic engineering reports were produced to support design documentation.

We also provided traffic engineering representation at wider team meetings and with key stakeholders including local government and state government subject matter experts.

Coomera Connector: Stage One North – Gold Coast, QLD, Australia.

Strategic Transport Corridor Planning & Prioritisation Process

MORETON BAY, QLD, AUSTRALIA
CLIENT: CITY OF MORETON BAY

The City of Moreton Bay's Strategic Infrastructure Planning department utilises Council strategies and policies to guide detailed planning. BG&E was commissioned to assist with the Council's strategic transport corridor planning by developing a planning framework, prioritisation process, and communication plan.

Key responsibilities and achievements on the project included:

- The BG&E project team undertook a series of interviews with different Council departments impacted by transport corridor planning to understand their experiences and aspirations.
- Findings from the interviews informed a draft framework with subsequent combined workshops to inform the development of a planning framework, prioritisation approach, and communication plan.
- The framework and prioritisation approach aligned with the Council's movement and place principles, considered environmental and carbon budget impacts, and opportunities for active and public transport to reduce corridor footprint.

John Street Upgrade

IPSWICH, QLD, AUSTRALIA
CLIENT: DEPARTMENT OF TRANSPORT & MAIN ROADS, QLD

BG&E was appointed to undertake a flood immunity study, options analysis, and business case for the main street of Rosewood on the outskirts of Ipswich, to improve flood immunity and road safety.

The first stage of the project was problem definition - to confirm whether a flooding problem still existed following recent upgrades to the upstream retention basin and mining leases, or if the issue had transformed into a drainage problem.

BG&E worked with Ipswich City Council and TMR technical specialists to update the Council's flood model, incorporating recent changes and recalibrating it using gauge data and BOM information. The updated model confirmed a flood problem still exists - though not in the primary catchment.

The second stage of the project involved developing a long list of options to address the confirmed flooding issues and identified safety concerns through the main street.

These were discussed in a strategic merit test workshop with key stakeholders and three options were selected for refinement.

The three short listed options were assessed in a multi criteria analysis with an initial assessment refined in a collaborative workshop with key stakeholders including Ipswich City Council, TMR Project Delivery, and TMR Engineering and Technology (hydraulics, pavements and active transport).

BG&E is delivering the business case for the preferred option, undertaking sufficient design and hydraulic modelling to inform a P90 cost estimate to enable TMR to make an informed decision on whether to fund the preferred option for delivery.

Warrego Highway 18E Principal Cycle Network

ROMA, QLD, AUSTRALIA
CLIENT: DEPARTMENT OF TRANSPORT & MAIN ROADS, QLD

BG&E was engaged to provide an options analysis and business case for a section of the principal cycle network through the town of Roma to enable increased active transport.

Key issues for resolution include the competing functions of the highway for longer distance inter-regional travel, a road train route, local access, and a spine in the active transport network.

Operational issues associated with driveways, parking, loading and unloading, and truck swept paths were also accounted for.

Key responsibilities and achievements on the project included:

- Development of options for an active transport link through the highway corridor, including in-carriageway and out-of-carriageway options and both shared and separated facilities.
- Delivering workshops to obtain buy-in from key stakeholders during the project evolution, including a collaborative Multi-Criteria Analysis workshop to agree on a preferred option.
- Delivering a combined OnQ Options Analysis and Business Case report to enable the State to secure funding to deliver the project.
- Feedback from community engagement and local property owners was incorporated into the development of options and selection of a preferred option.
- The preferred option was refined to sufficient detail to inform a P90 cost estimate. This included resolving side road crossing treatments, PUP requirements, driveway treatments, and highway crossing treatments.
- The ultimate option would be delivered in two stages, with BG&E providing layouts and cost estimates for each stage.

Warrego Highway 18E Principal Cycle Network – Roma, QLD, Australia.

Richlands Station Park ’n’ Ride Expansion Business Case

BRISBANE, QLD, AUSTRALIA
CLIENT: DEPARTMENT OF TRANSPORT & MAIN ROADS, QLD

The project aims to address the issue of insufficient parking at the existing multi-storey Richlands Station Park ‘n’ Ride by expanding the facility and adding a new level. This expansion will increase the number of commuter parking bays, accommodating the growing demand for parking. The business case design captures the civil and structural elements for the new parking level while considering accessibility needs and building services design.

BG&E conducted a traffic assessment that investigated the traffic and transport aspects associated with the proposed expansion and redevelopment and included:

- Review of the existing site conditions and transport infrastructure servicing the site (pedestrian, bicycle, bus, and car).
- Review of existing traffic surveys and commissioning additional traffic surveys.
- Assessment of the current parking demand profile over the time of day with arrival and departure profiles.
- Review of the traffic generation and distribution onto the adjacent road network, including interrogating the Brisbane Metropolitan Aimsun Model and undertaking SIDRA analysis for key intersections in close proximity to the site.
- Development of a traffic report to outline the transport planning implications and traffic assessment for the site.
- A parking assessment for the proposed expansion, including identification of options for displaced parking during construction.

Ipswich Hospital Redevelopment

IPSWICH, QLD, AUSTRALIA
CLIENT: QUEENSLAND HEALTH

The Ipswich Hospital Expansion project, valued at $710 million, will benefit patients by providing upgraded services and infrastructure by the end of 2027.

BG&E was engaged by BESIX Watpac to prepare a traffic impact assessment for stage two of the project, including:

- 200 new acute inpatient beds and a range of health services within functionally efficient spaces.
- A new purpose built acute clinical service building.
- A new emergency department.
- A new emergency department driveway and ambulance parking area accommodating up to 14 ambulances.
- Redevelopment of the main entrance and pick up and drop off area.
- Construction of 82 additional car parking spaces.
- A new loading dock facility.

The traffic assessment investigated the traffic and transport aspects associated with the proposed expansion and redevelopment and included:

- Review of the existing site conditions and transport infrastructure servicing the site.
- Review of the proposed site layout, access roads, ramps, driveways, and vehicle circulation to ensure compliance with relevant standards - including the preparation of vehicle swept path diagrams to ensure satisfactory access by design vehicles.
- Review of the traffic generation and distribution onto the adjacent road network including SIDRA analysis for key intersections in close proximity to the site and commentary around traffic impacts.
- A parking demand assessment for the proposed expansion and redevelopment including accessible parking spaces as well as parking for drop off and pick up, emergency services, ambulances, and other vehicles.
- An assessment of bicycle parking associated with the development.
- Review of internal traffic movements to ensure the safe and efficient movements of pedestrians, cyclists, service, and private vehicles.

Ipswich Hospital Redevelopment – Ipswich, QLD, Australia.

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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