



**CONSTRUCTION CONTACTOR :** Golding  
**CLIENT :** QLD Department of Transport & Main Roads  
**PROJECT VALUE :** \$148 Million  
**SIZE :** 4 Lanes Wide, 485m Long  
**COMPLETION :** June 2011  
**DESIGN ENGINEER (STRUCTURAL / CIVIL) :** GHD

# FORGAN BRIDGE

## IMPROVING MACKAY'S CIRCULATION

As Mackay has grown, the need for a better link between the CBD, Mackay Harbour and the Northern suburbs has become a matter of significant importance. It is the kind of project Golding excel at – delivering critical infrastructure in a difficult environment, on time, and within budget. Working under an ECI Contract, their assignment for the Forgan Bridge Duplication and Replacement Project involves a two year process of staged construction of the new four lane Forgan Bridge over the Pioneer River and a new six lane bridge over Barnes Creek. In addition the safe demolition and removal of the pre-existing Forgan Bridge forms part of the contract works.

The \$148 million project is being funded by the Queensland Government and delivered for the Department of Transport and Main Roads. Golding engaged GHD in early 2007 to provide design services for both the bridge and approaches as part of the ECI team. The new Forgan Bridge is 485m long - 30m longer than the old

bridge. On completion the new bridge will be 25m wide, providing four lanes with a right turn lane into River Street and comprising eighteen 27.3m spans.

Piling work for the bridge foundations commenced at the end of June 2008, with the driving of steel liners. A hydraulic drop hammer was used to drive the steel liners into solid ground with the piles then drilled out, providing a rock socket below the bottom of the steel liners to maximise pile capacity. The piles have been extended up to 30m below the river bed to ensure the bridge remains stable during seasonal flood events. Stage one piles were completed in October 2009.

A temporary working platform was constructed, commencing in July 2008, for the construction equipment used to construct the bridge. Equipment included a lead crane (180 tonne), drill rig and 2 tail cranes (also 180 tonne capacity).

The first deck units for the new Forgan Bridge were placed on 16 December 2008. Each bridge span comprises thirty 1200 x 710 deck units weighing some 38 tonne per unit - a total of 540 deck units. Just over 30,000 tonne of concrete is being used in construction of the new Forgan Bridge deck units, piles and headstocks. The last Stage 1 deck units were placed in December 2009, and traffic diverted onto the completed Stage 1 Bridge in April 2010.

A 4.5m wide shared pedestrian/cycle path has been constructed on the downstream side of the new Stage 1 Bridge, which features three viewing platforms located along the pedestrian/cycle path. The shared service corridor for sewer, water, power and telecommunications has been constructed underneath.

The Kooyong intersection was also upgraded to allow a tie-in to the new Joint Levee Road with a new six lane bridge over Barnes

Creek, constructed to match the new approach lanes to the Kooyong Intersection. The Barnes Creek Bridge is 1.5m higher than the existing structure. Earthworks for the additional lanes along Barnes Creek road commenced in July 2008, and initially involved placing geofabric and rockfill stabilization.

The new Barnes Creek Bridge is 72m long and 31m wide, allowing for six lanes, including a left turn onto the Joint Levee Road. It consists of four 18m spans, with forty-six 800 x 600 deck units per span – each weighing some 20 tonne. Barnes Creek Bridge has five 1200 diameter piles per pier, with some 5,500 tonne of concrete utilised during construction of the bridge. Traffic was diverted onto Barnes Creek Stage 1 in December 2009.

The next stage of the project involves demolition of the old existing Forgan Bridge by November 2010, completion of the Kooyong Intersection and diversion of traffic onto Barnes Creek Stage 2 by December 2010 with final piling works for Forgan Bridge Stage 2 to be completed by December 2010. The overall project is due for completion in June 2011.

Golding have a strong track record of success with complex construction projects across every development sector. Golding project works have included: Dalrymple Bay Coal Terminal Upgrade, Gladstone Airport Upgrade, Kirkwood Rd Stages 2 & 3 in Gladstone, the Third Rail Reveal Facility for Gladstone Ports Corporation, Lake Vermont Rail Overpass, Sunnybank Railway Overbridge, Yeerongpilly Rail Welding Facility, Gold Coast Hospital Site Preparation, Port of Airlie Site Development Works, Kogan Creek Civil Works and Mining Operations, Comalco Alumina Refinery Stage 1 and Yarwun Alumina Refinery Stage 2 Site Development Works, Harbour Town Canal Estate and Shopping Centre Expansion, and Mining Operations at BMA's Gregory and Blackwater Sites, Curragh, Phosphate Hill and Mt Rawdon Gold Mine.

In 2007 Golding won the Mining Industry Skills Centre Award for Best Training Practices and Processes for a large company. Golding's combination of extensive experience in heavy construction, comprehensive management of their plant fleet and a dedicated labour force enables ongoing successful project delivery outcomes for their many public and private sector clients.

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# SUPPLYING SUPERIOR LIFT AND SHIFT SOLUTIONS FOR FORGAN BRIDGE

To shift and lift components for the Forgan Bridge project, Golding Contractors called on the Sunshine State's most experienced private crane operators and their allied transport fleet. Walter Wright Cranes Australia and McAleese Transport have been in operation for almost 80 years, and are the largest privately owned crane and transport company in Queensland.

Together, the two companies provided Golding with integrated lift and shift solutions, crane hire and transport. Walter Wright Cranes carried out the erection of the bridge beams for both stages one and two of the project, and supplied the project with their new 110 tonne and 180 tonne crawler cranes, while McAleese Transport's trucks ensured all the necessary parts were on site, on time.

The crawler cranes made tackling the difficult site conditions including mangroves, silt and sand, more feasible. Walter Wright are known for being able to supply equipment for even the most challenging of projects, contracting their cranes to mining, construction and civil projects Australia wide. Erection of equipment is one of their specialities, and they provide a bona fide 24 hours a day, seven days a week service every single day of the year for both craneage and heavy haulage.

Working with allied companies around the nation, and with a network of depots in every state, Walter Wrights and McAleese Transport can also provide over-dimensional transport, general and express road transport, mine and industrial services transport, project management, warehousing and distribution. Their headquarters in Mackay manages a staff of approximately 500 across the country, and provides logistical and project management support for the operations of their fleet of more than 200 mobile cranes, ranging in size from 5t to 600t and including Franna Cranes, all terrain cranes, rough terrain cranes, crawler cranes and hydraulic truck mounted cranes. McAleese Transport's Fleet includes 16 row modules with 250t on road capacity, steerable jinkers, tri drop deck trailers, tri-axle trailers, dolly floats, extendable trailers up to 28.2m and specialised vessel carriers.



Walter Wright provide equipment on both a wet and dry hire basis, and also offer training, safety and risk management services, in addition to engineering and technical support. Detailed lift studies support all their undertakings, with highly experienced supervisors and specialised engineering staff ensuring that all lifts are carried out safely and efficiently. Their Operations Management Plan was developed specifically to meet the highest safety standards for the mining and construction industry, and ensures that all their equipment is safe to operate, and all operators properly authorised, trained and assessed. Their adherence to Working At Heights Guidelines includes designing and installing handrails and access ladders on all mobile and all-terrain cranes, and handrails on non-slewing cranes. All of their mobile crane and heavy haulage fleet are fitted with lockable positive isolation systems.

Another project currently utilising their reliable and professional services is the Brisbane Airport link, where again they are providing the critical lift and shift solutions that every major civil infrastructure project needs.

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# DESIGNING BRIDGES FOR CYCLONE-PRONE WATERS



Replacing a major part of Mackay's transport routes and ensuring the Forgan Bridge Replacement and Duplication Project would deliver infrastructure fit for purpose took some extremely innovative thinking. GHD provided it, supplying the engineering and planning know-how that kept an average of 29,500 vehicles a day moving across Mackay; provided the right design solutions; and kept the project on track, on budget and on time from early concept stage through to completion of Stage 1 this month. Their team included a Brisbane-based Project Manager and Bridge Design Team, a North Queensland-based civil engineering team and a Cairns-based traffic engineering team. "As a team we provided quite a few innovative design solutions to the Queensland Government and DTMR," said GHD Project Manager Duncan Moore.

"The solution chosen for the near coastal environment involved a new, wider size of girder. This reduced transport, lay-down needs and craning. It was very quick to construct, this system could achieve 1 week super structure cycle times.

"Stress bars are not normally allowed for the coastal environment due to the corrosion problems, we researched a double protected stress bar from DSI which would provide a 100 year design life. The use of these bars is first for Queensland. We specified a precast barrier that could be landed and grouted in-situ, which was a lot safer than casting on site. The design is an open style barrier which is a mix of high concrete curve and aluminium top posts and rails, allowing users to enjoy the view.

"Our geotechnical team gave very good prediction of the settlements of the site's soft soils. This enabled us to manage the geotechnical risks much more effectively."

Finite element modelling was utilised for the design of the traffic barrier, and 2D elastic analysis for the design of the bridge. Modelling with SAM enabled design for 1 in 2000 ARI flood loads and events.

GHD's traffic management plan needed to ensure minimal traffic disruptions, provide safety for traffic and workers and manage live

environment construction works in a strictly circumscribed area. Assessment of the surrounding network enabled GHD to formulate a strategy which enabled a trouble-free transition between the pre-existing bridge and approaches and temporary re-routings.

This Traffic Management Plan for the Forgan Bridge Replacement and Duplication project won the 2009 Engineering Excellence in far North Queensland Project of the Year. The project is also nominated for a Civil Contractors Federation EARTH Award, and is a brilliant example of ECI teamwork achievement.

"The project has been a great experience for GHD, the Early Contractor Involvement allows the best result for all parties involved; and the design developed so there is balance between economics and the focus on durability," said Duncan Moore.

GHD is working on other key transport infrastructure projects in the region, including the Bruce Highway Cooroy to Curra Upgrade, a 40 kilometre stretch of road which is statistically one of Australia's most dangerous stretch of tarmac. The entire project is being delivered in four stages over 15 years, and GHD are currently working on the preliminary design for Section A, a 16km stretch of road.

GHD has over 6,000 staff, providing world-leading innovations with engineering, environmental and design solutions across water, energy, resources, environment, property and buildings and transport on five continents. GHD are a member of the World Council for Sustainable Development and operate under a Practice Quality Management System ISO 9001:2008 and an Environmental Management System ISO 14001:2004, both certified by Lloyds of London.

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## HEAVY DUTY EXPERTISE

When you've got a crucial piece of infrastructure to build, you want the best team on the job. Team Engineering Services was engaged by Golding, Principal contractor for the Forgan Bridge Duplication Project, to carry out detailed engineering, drafting and fabrication of false work structure.

"This work was performed in house by Team Engineering Services structural and mechanical engineers in conjunction with drafting personnel who utilised Solidworks, a three dimensional modelling and drafting package. One of the benefits of this package was that Team Engineering Services was able to produce component assembly sequences to assist our client (Golding) in the training of their rigging/assembly personnel on field assembly of this structure," explained Team's Workshop Manager Mr Mark Harney.

"Fabrication of all components was performed in Team Engineering Services own workshop with all critical welded joints being ultrasonically tested. As the false work did not form part of the permanent structure but was required for the construction of both stages 1 and 2, a moderate level of corrosion protection was afforded with the application of a zinc rich primer to all surfaces which had been blast cleaned to 2.5. This was to minimise the water rust stains onto finished concrete structure.

"In close consultation with Golding, special consideration was given to the multi use of some components to minimise the handling of these components with the knowledge that the main working area had minimal storage for any components not being used. In addition all components were designed with the thought of ergonomic manual handling and safe access and egress to all locations of the false work structure."

Components also had to be designed for transport without exceeding normal load limits, while still meeting the design requirements.

Everything Team Engineering Services undertakes meets Quality Assurance 9001, from design and procurement through to fabrication. They provide heavy engineering construction and maintenance services and project management expertise to customers in the Mining, Minerals Processing, Port Facilities and Bulk Materials Handling Industries by safely delivering flexible, end to end solutions to the requirements of the

specifications. Their skills have been utilised around the country, including Tasmania, and their workshop runs 24 hours a day.

Other major projects include BMA – Hay Point Services, Hay Point Shiploader – SL1, comprising Design, Supply, Manufacture, Install and Commission new Wharf Rails, Boggles and Equalizers, Design, Supply and Install 230m of Aluminium and Stainless Steel Walkway on Seaward Rail; they also undertook the the SL2 & Berth 2 Fender Upgrade Site Works.

For BMA – Blackwater, the DRE 38 Tub Relocation, required them to dissect and transport 8200 Dragline tub from Wesfarmers Curragh to BMA Blackwater, executed incident free, a testament to the effectiveness of Team's stringent and comprehensive safety systems.

They have undertaken a complex set of tasks for Dalrymple Bay Coal Terminal 7X Project, including SR4 Relocation and Upgrade to RL2; Complete disassembly and relocation of 1200T Stacker/ Reclaimer SR4 and conversion to Reclaimer RL2 on a new bund, including new boom and hydraulic bucketwheel system; Upgrades to Shiploader SL2 comprising major upgrades to boom structure, shuttle trolley and system, installation of new high power VVVF luff winch, upgrade of long travel motors and bogies to comply with AS 4324; and upgrades to Stacker / Reclaimer SR5 involving slew bearing replacement, rebore slew bores, upgrade rail clamps and structure to AS 4324.

For BMA Coal Mines in the Bowen Basin, they undertook the Universal Dragline Retrofit rollout to fleet of 6 draglines, providing Total Project Management Services for the Design, Supply and Installation of the UDD System throughout four mines including fabrication of new 30t boom point and hoist drum and gearbox.

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## CERTIFYING THE GROUND IS SOUND

When what is in the ground, under the ground or going over the ground needs to be accurately assessed, Contractors call on experts like Bowler Geotechnical. Their NATA accredited laboratory at Mackay and highly skilled technicians there and on site at Forgan Bridge undertook all the testing of concrete for the double span bridge and all testing of soils and aggregates for the bridge approaches.

In an area subject to the kind of extreme weather conditions which are a feature of the Tropic zone, ensuring the materials were of the highest possible quality was imperative. Bowler Geotechnical undertook the job with the same eye for detail and reporting which has gained them a reputation over their 16 years of operation as leading experts in the geotechnical field. This expertise is also being put to work on other major infrastructure projects in the area, including the \$500million Jilalin Rail Yard, Missing Link and Abbott Point Expansion.

Bowler Geotechnical are part of the Cardno Group, and are able to provide tailored services which add value to client projects at every stage, drawing on a wealth of multidisciplinary consulting, engineering and management expertise.

Their close collaboration with clients from the outset ensures requirements are clearly understood, and fast results provided without unnecessary fieldwork or laboratory testing. Cardno Bowler have NATA accredited laboratories around the nation and also abroad, and also the ability to provide NATA-accredited mobile laboratories on site when required.

Utilising leading-edge technology, their comprehensive range of services includes construction materials testing for roads, railways, ports, commercial/industrial developments, subdivisions, mine infrastructure, quarry products, and environmental testing including acid sulphate soils and water quality. They also provide geotechnical



engineering services for projects including land developments, road works, mine infrastructure, multistorey buildings, basement excavations, soft soils, reclamation, acid sulphate soils, bridges, wharves, retaining walls, dams, stability assessments, effluent disposal designs and erosion and sediment assessment.

Cardno Bowlers' wide client base includes consulting engineers, all three tiers of Government, statutory authorities, private companies, developers, builders and contractors. Their geotechnical and environmental divisions work in concert to provide the services which can expedite land development, and ensure regulatory requirements are met as quickly as possible. Their skills are applied to all aspects of land, air and water based pollution not only in assessing pollution levels but also in providing professional advice on remediation including the development of site-specific solutions.

With over 200 staff, the combined talents of Bowler Geotechnical and Cardno Group have provided testing services for over 10,000 projects, including many of Australia's most critical infrastructure and sensitive development projects.

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