

KURILPA BRIDGE

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BRISBANE QLD



A WORLD-FIRST BALANCING ACT

Everything about Brisbane's Kurilpa Bridge is a finely tuned balancing act, from the tensegrity structure itself to the construction process, managed by Baulderstone Queensland.

A world-first in design and engineering terms, the bridge combines tension and compression elements in such a way some of the main supports appear to be floating. An estimated 550 tonnes of structural steel, including approximately 6.8 kilometres of spiral strand cable are incorporated into the pedestrian and cycleway which spans the Brisbane River between the Southbank Arts precinct and North Quay in the CBD.

With a total length of 425 metres and a midspan of 128 metres, the bridge rests on piled foundations driven and drilled into the bedrock of the river, first passing through around 12 metres of mud and gravel. Its span is 11 metres above the water level of the river, and provides a 6.5 metre wide passage between the handrails at deck surface level. An estimated 1,500 cubic metres of concrete were used in elements such as the piers at both ends and the marine piles.

The Queensland Government is spending \$63.3m on the project which is being managed by the Department of Public Works, with Baulderstone appointed as the Contractor working in conjunction with Cox Rayner Architects and ARUP Engineers.

To achieve this extraordinary civic infrastructure feat took 25 Baulderstone Queensland staff, and fifty separate subcontractors and suppliers ranging from crane companies to barges. Project Manager Paul Stathis estimated 1,100 individual site inductions were carried out, and that at any one time there were 65 people active on-site. "There were a lot of specialists involved," he said.

Construction commenced with site establishment in October 2007, with completion due September 2009. The main construction phases were the land piles, the marine piles, the Tank Street approach piers substructure, the superstructure of the bridge, the main river pier piles and caps, the tensegrity bridge superstructure, the finishes and finally, landscaping at South Bank.

"Special accesses had to be put in for the construction process at North Quay for the main river pier," explained Paul Stathis.

"We used a temporary cantilevered steel access for the piling rig, this was then transformed and modified to be the falsework for the pilecap soffit formwork. A lot of innovative ideas like that were used in this project."

Numerous barges were involved, both for construction works including pile driving, steel erection and general construction material handling.

In addition, feeder barges were utilised to deliver supplies including structural steel and precast concrete elements, steel reinforcement and cables.

The design of piers and marine piling had to be made strong enough to withstand the impact of a barges sent out of control by a major flood event.

Timing was critical, as the project was undertaken as a fixed lump sum contract. With labour one of the biggest overheads, this meant absolutely meeting the schedule for each stage. In addition, rising costs for steel meant that we had a short time to lock in sufficient design for procurement.

Timing was also vital in terms of minimising disruption to traffic on some of Queensland's busiest roads. This required detailed traffic management plans and a great deal of liaison on the part of the project team, including daily communication with a multitude of bodies including the DMR, the Brisbane City Council, the Riverside Expressway Interfacing Authority, Brisbane Metropolitan Transport Management Centre, Brisbane River Harbourmasters and Emergency Services. "There has been a great deal of stakeholder management and approvals required," said Paul Stathis.

A Voluntary Impact Statement was carried out before works commenced, which resulted in mitigation plans for marine impacts, such as silt booms around key working areas in the river.

Baulderstone has previous experience on other Brisbane River Bridge icons, namely the William Jolly Bridge, the Victoria Road Bridge and the Story Bridge. Other major projects currently being completed by Baulderstone include the Gibson Island Water Treatment Plant, the Wesley Hospital, the Prince Charles Hospital, the Gatton and Townsville Prisons.

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WIZARDS WITH STEEL



Turning hundreds of tonnes of steel into components for a functional bridge is a big task at the best of times. When the bridge has been designed to be artistic, asymmetrical and generally spectacular, like Kurilpa Bridge, it becomes a massively complex fabrication job.

Luckily, Beenleigh Steel Fabrications are experts when it comes to turning designs into beams, trusses, struts, bracing, cables and even arty fiddly bits. They've been in the steel fabrication trade for 28 years, and have a highly skilled workforce of 120 at their Crestmead and Rocklea Workshops as well as on-site riggers and boilermakers.

For Kurilpa pedestrian bridge, they supplied and installed both permanent and temporary steel elements, using a Smithbridge barge for over water parts of the job.

"The bridge consists of 900 high x 450 wide box-beams with aerodynamic fairings attached totalling approximately 305 tonnes, which we fabricated from 4, 12, 16, 20 and 25 Gr350 plate," explained Director and Project Supervisor Frank Boyes.

"There are also 1500 wide x 8400 long floor support trusses totalling approximately 130 tonnes, 14 tonnes of 1680D x 7.1CHS floor bracing, vertical masts ranging from 18m to 30 m long which used 170 tonnes of steel and around 35 tonnes of horizontal flying struts ranging from 17m

to 24m. We also installed steel cables with varying diameters from 16 dia to 80 dia at lengths from 20m to 80m, and canopy framing comprising 250 X 150 X 6RHS portal frames, 150UC30 and 460UB82 rafters, 1140D X 6.0 CHS pyramids and 75 X 5EA purlins. In addition, around 130 tonnes of temporary steelwork was supplied and installed for use during the construction process, and dismantled when the bridge was completed."

All up the bridge contains around 12,000 individual parts weighing in total approximately 800 tonnes. Two key subcontractors were involved in working on this hefty structural steel consignment.

Online Drafting Services provided the workshop drawings for the project. This was an intensive process due to the complexity of most of the connections and the random nature of the structure's design geometry. They used Prosteel 3D to model the bridge, enabling easy fine tuning of the structural details as the project progressed, and allowing the idiosyncrasies of the geometry to be addressed on a connection by connection basis.

Tranzblast Coating Services treated all the steelwork for the project at their 4 hectare site at Carole Park. They applied a three coat system of Interzinc 52 primer, followed by an intermediate coat of Interguard 475HS and a top coat of Interfine 878. Tranzblast have worked on some

other outstanding steel projects including Queensland Tennis Centre, Robina Stadium, Brisbane's new inner city Bus Stations and Griffith University Pedestrian Bridge at Smith Street Gold Coast.

Beenleigh Steel Fabrications have been responsible for some of Queensland's most noteworthy and award-winning steelwork, including the Queensland Tennis Centre, the new Ipswich Courthouse and Watch house and police station, Queensland Cultural centre, Cairns International Airport, Brisbane's International Airport Extension, Brisbane Convention and Exhibition Centre, Logan Hyperdome, Movieworld Oxenford, Millennium Library, Queensland Conservatorium of Music, Boggo Road Busway and Suncorp Stadium. And when the Gabba was damaged in the disastrous storms of 2008, they were the company called in to fix it.

They have also fabricated, delivered and erected structural steel for projects further afield, including the Sydney Superdome and the Observation Lift Structure at Sydney Casino.

Their suite of services includes project management, contract administration, workshop detailing drawings, surface treatment, transport infrastructure planning, erection of structural steel and supply of cranes, riggers and doggers. Their lifting equipment includes 200T Lattice Boom crane on tracks, 100T All Terrain Demag crane, 70T P&H

Lattice Boom Crane, 60T All-Terrain Demag crane, 40T P&H Lattice Boom crane, 35T All-Terrain Demag crane, 20T Rough Terrain which was used on Kurilpa Bridge to assist bridge assembly, 20T Franna crane, Minicranes, Scissorlifts, and Snorkelift Articulating Telescoping Boom Platform.

In addition, Beenleigh Steel Fabrications can handle any pre-cast concrete erection requirements, a service they have provided to projects including Townsville Army Aviation Works, Townsville International Airport, Suncorp Stadium, Skilled Stadium and all stages of the Gabba.

They have a quality management system which conforms to ISO 9002, and strive to deliver a competitive price with finest quality to their clients.

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NOTHING TOO HEAVY OR HIGH

Using a sixteen tonne hammer to push pilings through up to 30 metres of water, mud and gravel while perched on a barge in the middle of the Brisbane River was just another day on the job for Universal Crane's Senior Operator Greg Harvey. Regular waves and backwashes every fifteen minutes or so caused by ferries, Rivercats and other marine traffic added somewhat to the challenge, but that's how it goes when you're building a project like Brisbane's Kurilpa Bridge.

Universal Cranes was subcontracted by Waterways Constructions to perform all the crane work on the project for the pilings.

Equipment they provided for the job included a M12000 and Fushun Crane, along with two skilled operators and SPMTs (Self Propelled Modular Trailers).

The job entailed building a platform for a drill rig, lifting cantilevered beams into position, lifting the piles, driving the piles in under guidance from a surveyor, hammering the pilings down into bedrock and building cages for the pilings concreting, all from a crane based on a Waterways Constructions barge anchored by concrete blocks on chains dropped by tugboat. That part of the job took three months. Then there was four months working on Southbank doing the main Kurilpa Bridge pilings.

Amazingly, Greg Harvey did the whole operation mostly by eye, rather than using dogmen. "Cranes have an advantage on water," he said. "But what we are doing in Australia is small compared to what's going on overseas. Computer technology makes the new cranes easier to operate, so long as the operator knows how to set and calibrate the equipment. And they are more bent on safety nowadays. The booms are lighter and structurally stronger, which makes them more stable. The critical factor is really operator experience."

Universal Cranes are partners in Lifting Skills, a training school for operators based at their headquarters in Brisbane. In recent years, an apprenticeship for crane operators has been introduced, and Lifting Skills gives apprentices an opportunity to learn in the best possible environment – the cabin of crane.

Universal Cranes was founded in 1993 with three Franna cranes operating out of a depot in Clontarf. Since then, Universal Cranes have undergone a change of ownership and rapid growth. The owner and many staff also had prior experience working on major infrastructure developments in Guam.

They have since grown into one of Australia's largest privately owned crane hire companies, with 150 employees and a fleet which includes crawler cranes, lattice boom truck cranes, non-slew cranes, telescopic slewing cranes, tower cranes and self erectors, along with heavy equipment transport vehicles. The cranes range from 5 tonnes to a massive 1100 tonnes, and the company is also the Australian representative for Sarens, world leaders in heavy lifting equipment.



There are Universal Cranes depots in Townsville, Rockhampton, Yeppoon, Sunshine Coast, Ballina and Wollongong.

The company motto is "nothing too heavy and nothing too high", and recent projects illustrate they live up to the claim.

New Windfarms at the ACT, Brisbane's Gateway Bridge upgrade, the Ballina Bypass in Northern NSW, Ipswich Motorway, Eagle Street Highrise, Horizon Alliance railway upgrade, Hale Street Link Bridge, and the fishing

platform on Horton Highway Bridge are just a few places their cranes have swung into action.

Universal Cranes will lift anything, anywhere, anytime, like their job on the Pinkenba Pipe in April 2007, when a phone call Friday afternoon resulted in three Crawler Cranes, a 100T Hydraulic Crane and a 50T crane along with a work crew on site the very next morning pulling a 730m long pipe under the Brisbane River from Murarrie to Pinkenba. Whether the area is remote, the job complex, or the site difficult, they'll rise to any challenge.

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ZERO HARM EXCAVATION

There's one sure way to avoid damage to cables and other sensitive subsurface elements when excavating – use a Vac-U-Digga™.

Designed and built in South East Queensland for Australia's tough soils and rough conditions, the Vac-U-Digga uses water and air conveyance to perform earthworks like trenching, potholes, underground surveys and potholing. The company is a pioneering vacuum excavation contracting business, started initially by two families in 2000 using research from the USA.

Since then, the company has grown to a staff of 65 across manufacturing and contracting disciplines. There are 22 vacuum units currently operational in the Ormeau based fleet, with several more to be added. The purpose-built range include short and long wheel base vehicles in both 2WD and 4WD, in addition there are two smaller 2000 litre units specifically for tight spaces like footpaths or environmentally sensitive areas.

As they leave no waste dirt behind, the process has a minimal ecological footprint. Vacuum extraction also avoids the risk of damaging subsurface utilities completely, something Dial Before You Dig plans alone can't guarantee. Operators constantly undergo training to heighten their underground utility awareness.

Vac-U-Digga worked on the Kurilpa Bridge project since the outset. Initial investigation works required 10 men and 4 major project units plus support vehicles in a single nightshift delivering information swiftly for the main contractor in the time critical design phase. This tailored solution included overnight traffic control, and re-instatement of pavement before peak hour traffic the next day. Ongoing works for locates, potholes, visual service confirmation and site restoration work utilised a standard 1 to 2 man crew.

Vac-U-Digga's are available for hourly rate work, and also at a fixed contract rate for potholes and trenching work. They have provided extensive services to LBBJV North South Bypass Tunnel, Safelink Alliance, Airport Link and various Pipeline Projects as well as ongoing services to Brisbane, Gold Coast, Ipswich, Logan and Redland City Councils, among others. They also perform contract work interstate and are remote area specialists.



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Trelleborg Engineered Systems Australia (TESA) specialise in design, manufacture and supply of elastomeric products for bridges, marine constructions, dams, infrastructure and offshore projects.

For the new Kurilpa Bridge across the Brisbane River, they supplied unique spherical bearings manufactured by German marketing partner Maurer-Soehne GmbH.

“Conventional products could not meet the engineers and designers intention,” explained Company Spokesperson John Mosel. “The unique structural design of the bridge which employs “Tensegrity” meant there are continuous uplift loads, an unusual loading for bridge bearings. The bearings we supplied carry the load, and prevent uplift and separation. They also had to allow the structure to look very light and slim. Look at the finished bridge and you will see what I mean”.

“Generally, we design and manufacture a lot of our products locally or procure them from specific partners. What makes TESA superior is a combination of the Swedish ethic, one of being people-focused internally and customer-focused externally, and the strength of the company's world-wide network of engineers, scientists and factories. Trelleborg AB is the largest manufacturer of elastomers in the world.”

TESA has offices in Brisbane, Melbourne, Adelaide and Perth. Their 90 staff include civil engineers, mechanical engineers, industrial chemists and specialist material technicians. They are part of the worldwide Trelleborg Group, which was established in Sweden in 1905, initially focusing on manufacturing industrial rubber goods and tyres.

Trelleborg AB purchased Queensland Rubber and its associated companies in 2000. Continual research and development allows TESA to undertake a wide diversity of challenging projects, such as installing a Trelleborg Flexidam at PT Newmont Nusa Tenggara, a large copper mine in Indonesia. The 47 metre long rubber dam raised the storage capacity of the Tongoloka on-site water storage reservoir, and raised the spillway by 1.5 metres.

Several thousand TESA built bearings are going into the Houghton Highway Bridge duplication being built by the J.F. Hull/Albem Constructions JV, which stretches across Brisbane's Moreton Bay from Brighton to Redcliffe Peninsula.

In New Zealand, they are supplying bridge expansion joints varying from 75mm to 1 metre wide for the Tauranga Harbour Link. TESA are supplying the bearings for the Geelong Bypass project, supplied marine fenders for Brisbane's Portside and the rail track vibration isolation systems for Sydney's Chatswood rail Interchange.

“We bring the knowledge of over 20,000 employees and 110 years of engineered elastomer experience to the market,” said John Mosel.

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TONNES OF EXPERTISE IN STEEL



Processing & Supplying up to 2,000 tonnes of top quality structural steel is no small task. Producing it with accuracy to bare minimum takes special expertise.

BSF Metal Centre supplied all the structural steel for Brisbane's Kurilpa Bridge, including 700 metres of 530UB92. They also supplied line pipes in 12 metre lengths including 914mm OD with 19.1mm wall, 760mm OD with 9.5mm wall and 457mm OD with 9.5mm wall.

All twenty-four of the staff had input into the project, from operating machinery through to logistics and delivery. Production was overseen by Manager Kevin Childs, who has forty years experience.

Most products went to Beenleigh Steel Fabrications for the next stage, but some were delivered direct to site, sometimes at unsociable hours. Owning and operating their own transport came in handy.

"The Kurilpa Bridge project gave us an opportunity to showcase our abilities, such as sourcing difficult and unusual sizes of steel," said company spokesperson Ken Cassidy. "We only get the best steel available from overseas."

The workshop employs boilermakers and experienced saw and drill operators who have a combined experience of over 100 years. They

work day and night shifts, and utilise bandsaws for cutting and a beam line for drilling.

BSF opened shop with one small shed and 60 tonne of stock in 2005, and has since grown to the point of relocating to a 9,500 square metre workshop with a large range of stock.

Stock includes structural sections, line pipe, flat bar, RHS and angle steel for big jobs like their recent work on the Titans new stadium on the Gold Coast or the Queensland Tennis Centre, through to handyman supplies like roofing and fencing products. They have extended retail hours from 6am-5pm Monday to Friday, and 8am-12pm on Saturdays.

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ONE MAN AND HUNDREDS OF TONNES OF CONCRETE



Brisbane's Kurilpa Bridge project used approximately 1,500 cubic metres of concrete, and one skilled tradesman did all cutting and drilling that concrete required.

Craig Blair Brown from Complete Cut Precision Concrete Cutting and Drilling set up shop in 2007, in partnership with Leanne Gillam, who handles all the administration. Auspiciously, this major Baulderstone Qld public infrastructure project for the Queensland State Government became their first big job. Not only is that a terrific start for a new construction industry business, it will be a great long-term advertisement of the company's skills, given many thousands of locals and tourists are expected to use the bridge every month.

Before commencing business as Complete Cut Precision Concrete Cutting and Drilling, Craig Blair Brown had eight years experience on a wide variety of projects.

For the cutting and drilling on Kurilpa Bridge, his tool kit included standard ring Saw, hand saw, road saw, core drilling and hydraulic equipment. No fancy new technology, just skill applied with precision. The work included cutting and drilling on some of the project's most fundamental parts – the all-important pilings and marine supports – in addition to the bridge approaches. The marine structures include challenging elements like concrete curves.

This workload meant being on site intermittently for almost the entire construction period.

Some of Australia's most reputable names in tools supplied the right gear for the job: Diamond Cutting Solutions, Husqvarna, Bianco and Ramset.

Since commencing operation, the company has also worked on the Hutchinson site, Police Barracks, down the road from Tank Street Bridge. The major part of this project is completed, but Complete Cut will also be continuing to provide ongoing services as required.

Craig Blair Brown is also working in conjunction with Complete Cut ACT on another Baulderstone project, the Edmund Barton Building in Canberra.

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INNOVATION IS THEIR MOTIVATION

What do a vegetable box and the Kurilpa Bridge have in common? Expanded polystyrene foam made by RMAX.

For Kurilpa Bridge, RMAX supplied 10.4 cubic metres of expanded polystyrene foam (EPS) in the form of waveform walls and filler materials.

The waveform walls were used to minimise the effect of the Brisbane River's tidal waves against the permanent structure of the bridge. Being super-fast to install was a distinct advantage for working at a height affected by the river's tides. EPS was also used for blocking out some of the stainless steel architectural features to prevent concrete filling parts of the deck.

"RMAX Expanded Polystyrene foam is an efficient way of filling space while concrete is poured, because it is faster and cleaner than many products," explained RMAX spokesperson Peter Brooker. "We have highly skilled team that can adapt to specific customer requirements and are comfortable with potentially challenging and unusual requests."

The RMAX product range includes RMAX GeoFoam®, used in a growing number of construction projects because of its versatility, durability and cost-effectiveness, and their building cladding product, ThermaWall® which is an alternative to bricks or other cladding materials. ThermaWall® has inherent insulation properties and is popular with developers as it is fast to install and saves significant costs on material and labour costs.

The efficiency of manufacture, installation on site and long lifespan means the product is carbon-negative as the energy saved is far greater than the energy used to produce it. EPS is 100 per cent recyclable, and uses only a small amount of water and steam in the production process.

RMAX are Australia's largest and most experienced manufacturer of expanded polystyrene products with branches in all major capital cities, Launceston and New Zealand. RMAX – innovation working for you. For more information contact Terry Imrie or Jason Robinson at the RMAX Brisbane site on 07-32774522 or 1300 888972

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RAPID BOOM BUSINESS

Expansion in the Queensland building industry inspired Rapid Access Australia Pty Ltd to set up shop in Brisbane in 2006. The company started in Newcastle in 1998, supplying mechanical access equipment for the busy construction industry. Demand for their specialist services further south became acute, so a Sydney office was opened in 2003.

With that kind of prior experience, the company quickly found a niche in Queensland, providing mechanical access equipment for projects including the Gateway Bridge, the North-South Bypass Tunnel and the Kurilpa Bridge development.

For the Kurilpa Bridge project, Rapid Access provided 34ft knuckle booms, 47ft and 66ft straight booms and 26ft rough terrain scissors.

Their wide range of equipment includes a 66' Track Machine, and a 64' Spiderlift. The 66' Track Machine, a boom lift on excavator tracks, is one of only few operating in Queensland, and has superior traction on difficult terrain. The Spiderlift is a light-weight, compact boom lift which can use an access as small as the average doorway. It is also perfect for weight-limited sites like a suspended concrete slab as it weighs in at just over 2 tonne.

They can also supply 2.5, 3 and 4 tonne material handlers, electric and rough terrain scissor lifts up to 53ft, and straight and knuckle booms up to 135ft. The 33, 43 and 53ft scissor lifts have onboard generators and the diesel boom lifts also have generators from 46ft and up. This

diversity translates into an ability to tackle all manner of projects under even the most challenging site conditions.

All up, business is booming, with ongoing involvement in various landmark projects underway including the Tugun Desalination Plant in Queensland, the new Sydney Desalination Plant and works at Sydney Airport, the NCIG Coal Loader at Newcastle, Port Waratah at Newcastle, and the Colongra Power Station on the NSW Central Coast.

As the amount of infrastructure being built in both New South Wales and Queensland continues to increase, Rapid Access Australia will continue their upward momentum.

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GET SMART

Any hour day or night, Smart Crane Truck Services can lift and transport just about anything.

For the Kurilpa Bridge project in Brisbane, the consignments included building materials, reo, steel frames, park furniture and wide loads of steel shutters. Many of the deliveries had to be performed at all hours of the night, to minimise traffic issues.

“If it can be lifted by a crane and carried on a truck, we’ve probably shifted it,” said Debra Smart, who started the business with husband Gavan in 1992. The business grew by word-of-mouth, and now employs 14 people.

With 30 years experience in the transport industry, they are able to advise potential clients on logistics, and whether a crane truck or perhaps their recently acquired Franna Crane will suit the situation.

Crane trucks can operate anywhere there is access for the vehicle, and can replace a combination of forklift and flatbed, saving space and improving worker safety.

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