

BREAKWATER ROAD REALIGNMENT

MAIN CONSTRUCTION COMPANY : McConnell Dowell

CLIENT : VicRoads

DESIGN : VicRoads / Pitt & Sherry

PROJECT END VALUE : \$63 Million

COMPLETION : July 2012

SURVEYOR : Gertzel



DELIVERING A SIGNIFICANT PROJECT

The public will motor across the new \$63 million Breakwater Road realignment in Victoria's Geelong by the middle of 2012. The new road is 1.3km long, with 635 metres elevated over a floodplain area. Height restrictions on the old road under a rail bridge resulted in regular wedging from ambitious trucks and the road was also subject to flooding as witnessed first hand during construction.

VicRoads awarded the contract to McConnell Dowell in August 2010 and site preparation started in November 2010 with the building of substantial haul roads to get access into the project – recycled crushed rock was used for the roads and they will be demolished after the job.

Peter Saw, Project Manager for the Breakwater Road Realignment said, “at the start of 2011 we had two significant flood events where three quarters of the site was under about a metre of water”. This occurred during site preparation and the area was affected for about 10 days, though some higher ground areas were still workable.

Part of the site was the old Geelong tip and there was a lot of excavating at pier locations where the rubbish was up to 7 metres deep. Large solid objects like chunks of concrete were sent off for recycling, tree stumps were removed and smaller waste material was recompact back into the location for the driving of the precast piles. Asbestos was also discovered in the old tip and disposed of by a licensed facility. Ground improvement works, in the form of Controlled Modulus Columns, were needed at the western end of the bridge which is in a flood plain.

It was a construct only contract but McConnell Dowell worked in partnership with VicRoads to create an alternative design to replace the arch culvert section in the original designs. They proposed a conventional precast beam bridge for the 180 metres at the western end of the new bridge which provided a more cost effective option.

Construction of the 60 metre river span was a challenging exercise. McConnell Dowell built sheet pile wall cofferdams to construct the bridge piers on either side of the river and then utilised two large cranes to lift the bridge beams into place. The span consisted of 7 x 40 metre precast

beams, weighing up to 100 tonnes and Mr Saw said to install the beams, the first crane would pick up one end of the beam and place it on a barge on the river and then a truck would push the barge across the river to the crane on the opposite side. “Both cranes would then lift the beam up onto temporary falsework before being hydraulically pushed across into its final position,” he said. “It took two days to get all the beams in place across the river and all went according to plan.”

Another significant challenge was installing the beams over the existing Geelong-Warnambool rail line. The work took place during the night over a weekend when V-Line had closed the rail for maintenance. Despite significant rain (over 100mm rain within an 8 hour period) the 13 beams were installed on time for the Monday morning commuter trains.

During the course of the works, the existing Breakwater Road was closed 4 times as a result of trucks colliding with the rail bridge over the road. The new bridge spans both the river and the rail line eliminating any height restrictions so trucks will be able to run free.

With this project connecting a residential area to a significant recreational precinct for Geelong, McConnell Dowell and VicRoads have also placed a strong focus on engagement and communication with the local community. Monthly construction updates, bulletin boards along the riverside paths, information days and one on one liaison with residents and sporting groups has resulted in strong support for what was a historically contentious alignment and created open lines of communication that has helped manage the impact of works.

With 453 precast box culverts, 146 precast T-Beams, 474 precast barriers, 6400 tonnes of asphalt, 9000 tonnes of recycled glass and 10600m³ of structural concrete—is there anything McConnell Dowell can't handle?

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ROADS, RAIL AND RIVERS CONVERGE AT BREAKWATER ROAD

In late 2009, VicRoads tendered the realignment of Breakwater Road, in Geelong, as a “construct only” project. During the tender design period, McConnell Dowell approached pitt&sherry to assist with the investigation of alternative design solutions that would provide them with a competitive edge. McConnell Dowell were awarded the contract in August 2010 to construct the project including the alternative design solutions developed between McConnell Dowell and pitt&sherry. The design for the project is now complete, with construction now in full swing and completion anticipated for mid year.

The Breakwater Road project is a critical piece of transport infrastructure involving a 1.3km long realignment starting at the Barwon Heads Road intersection and linking directly to Fellmongers Road, Breakwater. The project includes the construction a new bridge spanning over the Barwon River and the Geelong-Warrnambool rail line. It is expected the new road will carry around 20 000 vehicles a day and provide the benefits of:

- Eliminating the flooding issues that, up to quite recently, have severely affected traffic flow in the area;
- Removing height restrictions and eliminating two right angled turns on the current route;
- Providing better connections to the industrial area of Breakwater Road and the recreational areas of Belmont Common;
- Two-metre wide dedicated bike lanes in both directions;
- A pedestrian path on the north side of the bridge; and
- New traffic signals at the Fellmongers Road/Tucker Street intersection.

As part of the arrangements for including the alternative design aspects into the Contract, pitt&sherry were required to take on the design



responsibility for the whole bridge. By working in a collaborative manner with both VicRoads and McConnell Dowell further improvements were able to be introduced into the project including:

- Raising the level of pile caps to reduce the amount of excavation and works required in the saturated ground conditions following flood events in early 2011;
- Providing larger storm water pits on the bridge spaced at approximately 30m centres to provide a more efficient drainage system off the bridge that will be less prone to blocking;
- The development of a collision protection system for the structure’s northern abutment to minimise damage in the unlikely event of a train impacting the bridge; and
- Refining the seismic design classifications for the structure. This included a geotechnical review to consider the potential for liquefaction under a seismic event.

McConnell Dowell’s Southern Region Manager, Trevor Cruden, said he was pleased with the progress of the project.

“We identified the Breakwater Road project as strategically very important for McConnell Dowell. I was very pleased with the collaborative approach taken between pitt&sherry and ourselves to provide a competitive edge during the tendering phase,” Mr Cruden said.

“During the construction phase the design team has worked well with our site team, VicRoads and the proof engineer to expediently resolve all technical issues. The construction work is currently ahead of schedule and, if current progress is maintained, it is likely Breakwater Road will be a very successful project for McConnell Dowell.”

Completion of the Breakwater Road project is expected mid 2012.

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ENSURING GROUND STRENGTH



As part of the Breakwater Road upgrade, a new 800m long multi-span bridge has been built over the Barwon River and surrounding low lying area, which was prone to flooding. Geotechnical specialists Menard Bachy were brought in to address the low ground strength of the flood plain, where the new road was to be built and design and implement ground improvement, where necessary, to accommodate safely the bridge structure and daily traffic flow of around 20,000 vehicles.

Geotechnical investigations found the floodplain area consisted of soft soil, swamp deposits six to eight metres deep. Without treatment, this ground would settle and compress over time, when subjected to the new embankment and traffic loadings, jeopardising the integrity of the bridge structure.

Several ground improvement techniques were considered – taking into account the schedule of the project and the budget. Menard Bachy proposed to improve the ground using the method of Controlled Modulus Column (CMC). This technique was developed in Europe and involves installing rigid grout columns using a displacement auger. Not designed to transfer surface loads to strong strata at depth like piles, these columns distribute the imposed loads through the soil and harness the higher capacity of the medium density soil, harder clay and limestone immediately below the low strength soils.

Tests were carried out to decide the optimum depth, anchorage length and grout design for the CMC columns. The columns measured 450mm in diameter and extended six to nine metres below the ground surface. The dry components of the grout mix comprised a combination including cement, fly ash and local sands. Field trials and rigorous testing were carried out two months prior to installation to ensure that the columns would satisfy the requirements of the specification – results indicated that the CMC inclusions exceeded the design criteria. Ongoing quality control and testing proved the production works during installation phase.

Over 12 weeks, in excess of two thousands CMCs were installed on site with a multipurpose foundation rig. The new bridge approach embankments were then erected on the improved ground which will benefit for decades to come from the technology and experience at Menard Bachy.

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CIVIL CONCRETE STRUCTURES

30 years ago, Ian Bell, from Portland in the far south west of Victoria, ditched his job in a bank to start Eastern Oak, a construction company specialising in concrete and formwork. Fast forward to the present day and there's hardly a journey Mr Bell (Manger) can make in Melbourne without passing some road or building that his company have had a hand in. From a modest start with just a couple of workers doing house slabs, Eastern Oak now employs 140 people. The company was responsible for the construction of the bridge for the Breakwater Road upgrade.

The new bridge spans 60 metres over Barwon River and consists of 10 metre cantilevered insitu piers and a 40 metre precast beam. Eastern Oak constructed the pole caps, the piers, the cross heads, the insitu deck across river and the bridge deck as well as placing the parapets and putting the precast beams up.

For Eastern Oak, the bridge build was a standard job. The most difficult thing was going across the river, which involved building a steel structure off piles on the river bank and building a platform

across the river – the bridge was built insitu from then on. The job took 14 months and went very smoothly.

Eastern Oak specialises in civil concrete structures, they also do commercial work such as shopping centres. They have had a team on the desalination plant in Victoria for two years, building concrete structures including big tanks. Eastern Oak teams are also working on the new Peninsula Link bridge in Melbourne and the APAC drive-on ramp at Tullamarine Airport.

Mr Bell said his company prides themselves on good people management, they have employed several generations from the same families – fathers, sons, grandsons and nephews - country boys working in the city.

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SUPPORT FROM START TO FINISH

Australian Post Tensioning were contracted to lock the insitu cross head and precast segments together on the new bridge over the Barwon River as part of the Breakwater Road upgrade. In from the start, Jason Xerri, Commercial Manager for Australian Post Tensioning spoke of being involved with the tender process and negotiating the contract with McConnell Dowell. Once the job started, they were on site for technical assistance and engineering support for the builders.

It wasn't a standard job as the bridge was constructed in two distinctive parts. The actual stressing anchorage was done in the precast yard as part of the making of the precast segment. The segments were then delivered to the building site and linked to the insitu cross heads on the bridge. The strand was then pushed and the tendons stressed on site - the final stressing of the bridge on site took a month to complete.

The tricky part in the precast yard was fitting the live stressing anchorage within the confinements of the massive precast segments – beams of up to 100 tonnes and up to 40 metres long. Mr Xerri noted 'The detailing of the reinforcements around the live ends were quite onerous

so there needed to be some careful attention to detail as to how all the components fitted together'. Once the precast segments were on site the job became a more standard procedure - the pushing of the strands and the stressing of the tendons was nothing unusual for Australian Post Tensioning, although due to the colossal nature of the beams, a larger than usual multistrand jack (700 tonne) was used.

Australian Post Tensioning are able to design, engineer, supply and construct within a broad range of post tensioning situations in both the civil and structural areas of the construction industry - their post tension solutions have propped many structures including the Westgate Bridge, the Peninsula Link and Adelaide Airport.

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INNOVATORS IN THE PRECAST INDUSTRY

Westkon Precast prepared some of the largest concrete precast beams ever to be manufactured in Victoria for the bridge on the Breakwater Road upgrade. With several weighing in at just under 100 tonnes, it was a big job. 104 precast beams ranging from 25 to 40 metres long x 1800mm deep were moulded – some of these beams were also fitted with special post-tensioned ducts. Another 42 precast beams were made with an average length of 30 metres and 1350mm deep. “The main river span of 60m was achieved by installing 41m long 1800 deep beams on temporary works while cantilevered Piers of 10m span were poured insitu and then post-tensioned together with the beams.”

Westkon Precast specialise in providing high quality precast concrete products and precast concrete structures - they also offer fully integrated design and construct services for precast structures. With architectural designs becoming increasingly ambitious, Westkon Precast can plan and manage projects with existing structures and potential building projects.

As well as prestressed bridge beams, planks, off and on-structure barriers and parapets, Westkon Precast are adept in hollowcore floor planks, prestressed stadium seating, sound and traffic barriers, precast stairs/landings and both architectural and structural precast panels and columns.

The company's commitment to sustainability means that moulds such as those used on the Breakwater Road Upgrade are reused – Lorenzo Cremasco, Director of Westkon Precast commented; “These are standard bridge beam profiles used throughout Australia, we have the moulds as permanent casting forms/structures that we use on most beam projects”.

All of the precast structures are manufactured locally with local materials allowing the concrete products to be made quickly and efficiently, saving time on site. Recycled materials are used in the concrete mixes, minimising waste. The precast concrete structures perform well acoustically, are fire resistant and highly durable with minimal future maintenance.

Westkon Precast are currently working on the M80 Western Ring Road Upgrade, the new peninsula link freeway and the Holbrook bypass, working closely with their clients to make innovative building designs achievable.

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