

# OUTSTANDING DELIVERY OF HARD YARDS AT BULLABURRA

The \$45 million Bullaburra West Upgrade is part of the Great Western Highway upgrade, and includes widening the existing two lane highway to a four lane divided highway.

Challenges like those encountered in constructing the Bullaburra Upgrade on the Great Western Highway give Daracon an opportunity to demonstrate skills of the highest order – something recognised by the client, RMS, who awarded the company a Quality Award for the job at the 2013 RMS Quality Awards. The basic scope, to upgrade a 2.5km section of two lane highway to four lane highway, sounds straightforward enough. However Daracon's Group HSEQ Manager, Bob Murphy, said that on a scale of 1 to 10, and given the complexity, this project was easily an 8 or 9 for difficulty.

“There are challenges from a technical point of view, including the slopes, grades, underbores, slippages; also ensuring all stakeholders are happy, all while keeping an eye on the weather at all times,” he said.

The project site is extremely narrow, with live rail corridor and two heritage convict roads on one side, and the National Park area of the Blue Mountains Escarpment Complex on the other. And it's steep too, with a geology which lends itself to rock falls and erosion. These constraints literally gave the Daracon team very little room to move.

In addition to the road construction, the scope included relocations of utilities including electrical, water and Telstra, with underboring of the live rail line required for the water and Telstra relocations, and a replacement

of the overhead power line over the rail possession for electrical. During the early works stage, Daracon needed to remediate two major landslips by placing 6,000 tonne of large boulder rocks at one slip site, and at the other undertaking 4,000m<sup>3</sup> of embankment reconstruction.

Then there was the weather – including wet days in excess of 100 days of close down due to bushfires in December 2013, and a day lost to snow in 2012. This stretched a two year project out to three years.

One of the major considerations was the environmental management, which required complete separation of clean and dirty water, and nil discharge of dirt-laden storm water into the National Park.

“There were clearing limits and robust erosion and sediment controls,” said Bob Murphy. “The site has very dispersive soils, and it was a challenge to maintain clean and dirty water separation given the grades and steepness. We put a lot of thought into how to channel clean water through the job. “Due to the endangered flora and fauna of the Blue Mountains Escarpment Complex, we were restricted in terms of clearing limits and we could only open up a certain sized footprint at any given time.

“Due to our planning, there has been nil dirty water discharge into the national park. There were really robust discussions during

planning, and meetings with RMS and the site team in developing site controls. “RMS identified the project as a site of best practice, and we received a Quality Award from RMS at the annual quality awards in 2013. RMS also produce a range of training DVDs, and in the one relating to erosion and sediment controls, this site was used to highlight best practice.”

In construction terms, the project has to date involved widening for the west-bound lanes on the cliff side, with a total 3,000m<sup>2</sup> of 15m high Reinforced Earth Walls constructed, and 30,000m<sup>3</sup> of backfill used.

“There has also been a significant amount of concrete wall to construct. Because of the terrain and its steepness, the carriageway is grade separated, with a retaining wall in the middle on top of the median strip. There is also a rock cutting in the median on the west-bound lanes,” said Daracon Project manager, John Rossi.

“We had to widen the existing cliff face at the top of the hill anywhere from 4m to 12m. Then, once the cliff face was excavated, we had to line it with gabion baskets for aesthetics, which amounted to 12,000m<sup>3</sup> of gabion baskets.

“At the beginning of the job we did temporary widening works to realign the existing road to enable us to move traffic onto it so we could build the west-bound lanes, which were opened by the end of January 2014. Then we moved traffic onto those lanes, and will complete the upgrade and construction works on the east bound lanes (the existing road) in one section.

“The three reinforced earth retaining walls were started May 2012 and completed in August 2013. It took us just over 15 months to excavate for them and do the required temporary shoring. It also took another three months to complete because of the tight access and need to put in temporary shotcrete and soil nails to shore up the road as we worked.”

With all of these complexities, on a tight site with little room for plant movements, heavy traffic including fast west-bound trucks, working near cliff edges and around unstable soil and rock areas, safety was a not-negotiable priority.

Daracon hand-picked their plant operators for the project from staff who had demonstrated experience working in steep terrain, to reduce the risks of plant roll-overs. The Project Manager, John Rossi, and all of the 25 Daracon staff including engineers, site supervisors and operators had all worked on numerous RMS projects, and have the Daracon safety culture firmly embedded in their work methods.

“The prevailing safety attitudes permeate everything,” said Bob Murphy. “Unless people live and breathe that safety focus, the potential exists for incidents to occur. On this site, the subcontractors have adopted this mentality and taken it on board, and we have had a LTI-free project to date.”

There have also been no complaints from the many stakeholder and local community groups, due to the impeccable management of environmental and traffic constraints.

Daracon is an integrated company with a number of divisions including civil construction, mining, rail, landscaping and property. This has given them a degree of resilience through tough industry times, with the rail division currently working on ARTC projects, and the landscaping and property divisions engaged in a number of projects. Other recent civil projects have included the Third Hunter River Crossing, the Ravensworth North Upgrade and the environmental remediation of BHP's former site at Mayfield.

For more information contact Daracon Group, 17 James Street, Wallsend PO Box 299, Wallsend NSW 2287, phone 02 4903 7000, fax 02 4951 1070, website: [www.daracon.com.au](http://www.daracon.com.au)

MAIN CONSTRUCTION COMPANY : Daracon Group  
CLIENT : Roads and Maritime Services  
CONSTRUCTION VALUE : \$45 million  
COMPLETION DATE : May 2014  
GEOTECHNICAL CONSULTANCY : Jeffery and Katauskas  
SURVEYOR : Mountain Engineering



## A WATER-TIGHT ASPHALT REPUTATION

With their substantial experience in every aspect of spray sealing and a 'can do' approach, All Pavement Solutions (APS) deliver best-practice solutions for every project they undertake. At Bullaburra West Upgrade, they undertook bank stabilisation, erosion control and water proofing membrane works for Daracon.

APS applied one coat of 7mm C170 Bitumen spray seal, using a Bobcat Broom and manual sweeping to prepare the area. Post-application, tipper trucks with aggregate were reversed over the spray seal, and manual sweeping carried out to ensure aggregates covered all areas evenly before the roller was used to finish the seal surface.

"APS prides itself on a precision spray application, which in result leaves an extremely neat job for our clients," said All Pavement Solutions Director, Craig Murphy. "We use a particular instrument to measure and record the temperature of the pavement. The temperature of the pavement is a crucial part of our operations, with works only being carried out if the temperature is at an ambient degree," said Craig Murphy.

"False pavement will occur if sealing is conducted with unsuitable temperatures. During the winter months, APS will discuss with the client undertaking seal works through the middle of the day where maximum temperature is achieved, and also using a cutter to cut the bitumen back.

"Safety is also paramount. Every site is assessed individually for hazards including weather conditions and environmental factors, and all our staff hold Workplace Health and Safety Construction Induction Cards.

"Our highly experienced operations managers have knowledge gained over 20+ years in the industry, and can advise clients on the most appropriate solutions and recommendations on suitable spray sealing options (aggregate size or type of bitumen or primer seal).

"All Pavement Solutions would like to say thank you to Daracon for awarding us the contract on the Bullaburra Upgrade."

Their reputation for professionalism ensures APS are in demand for projects where an extremely high level of quality is vital. In addition to other sections of the Great Western Highway, these have included Sydney Airport, Port Botany, NCIG, AGL Tomago, the MUR project, the M2 and M7. The range of services provided included AMC0 Primer Seal, 14mm and 7mm single coat spray seals, single coat poly seals and single coat poly/rubber seals.

APS staff hold a wide range of certifications and licenses ranging from National License, Licenses to Perform High Risk Work, and Perform High Risk Work through to Dangerous Goods Driving License, Heavy Vehicle Driving License and Australian Asphalt Pavement Association Seal Design. APS hold National Code Compliance and are members of the Australian Asphalt Pavement Association.

**For more information contact All Pavement Solutions P/L, 3/322 Annangrove Road, Rouse Hill NSW 2155, PO Box 735, Kellyville NSW 2155, phone 02 9679 2044, website [www.allpavement.com.au](http://www.allpavement.com.au)**



## ESSENTIAL SURVEY SKILLS FOR EVERY ASPECT OF CIVIL PROJECTS

With some extremely challenging terrain for a construction site, the site surveyor for the Bullaburra Upgrade on the Great Western Highway, Mountain Engineering Surveys, needed to have sharp eyes, an ability to manage multiple tasks, and a willingness to do a fair amount of bushwalking.

Company Director Andy Hickey was on site from the very first day, with the survey tasks ongoing until the final as built surveys in September or October of 2014.

His scope included all the marking out for vegetation clearing, setting out for the bulk earthworks including the roads and the retaining wall structures, and the detailed set out for walls, footings, drainage, retention basins and the road alignments.

"Snakes were the biggest worry, because I would be the first one into the bush for the vegetation clearing set out," commented Andy.

His tasks also included the accurate surveys for the road pavements, which involved surveying each one of five different layers and producing a conformance report for each separate layer. Once the final layer of asphalt was laid, he completed the line marking, guide posts and signage surveying and setout, in addition to taking measurements for everything constructed for the final as-built drawings. A Trimble

GPS system and Trimble Total Station were used, to ensure the most accurate and reliable data.

In addition to preparing all the survey data, conformance reports and survey drawings, Andy performed the quantity calculations for materials, printed out plans on an as-needs basis.

Being on site every day meant he was able to respond quickly to requests for assistance by the various subcontractors and Daracon's team, anywhere on the site, which given the 100m drop from top of the site to the bottom meant a lot of legwork.

Mountain Engineering has been providing cost-effective, reliable and efficient survey services since 1986, working across road projects, bridges and residential subdivisions. Their services include construction survey and set out, quantity estimating and as-built surveys.

Other major projects the company has contributed their expertise to include the Moorebank overpass for the M5 widening project, the Sydney Desalination Pipeline, and the 6Km Road Realignment at Castlereagh.

**For more information contact Mountain Engineering Surveys Pty Ltd, Winmalee NSW, phone 0416 251 067**





## GEOTECHNICAL EXPERTISE TAMES THE TERRAIN

The construction challenges on the Great Western Highway Upgrade at Bullaburra West included the extremely high degree of geotechnical difficulty created by the terrain. Daracon engaged the specialist expertise of JK Geotechnics to assist with resolving key aspects of the construction program, including the design and construction of the reinforced earth (RE) walls, the safe construction of deep rock cuttings, stabilisation of active landslides and construction of a 0.8m diameter underbore below the live rail corridor.

“The design and construction of the RE walls provided the greatest geotechnical challenge. The Great Western Highway generally runs along a ridgeline and widening the road required three large RE walls, with maximum heights of about 16m, to be constructed on steep slopes of around 30° off the ridgeline,” commented JK Geotechnics Associate Woodie Theunissen.

JK Geotechnics completed the global stability, sliding resistance and bearing capacity design for the RE walls in accordance with the RMS’ site-specific specification (R57), and also designed the temporary support systems for their construction. “Due to constraints placed by the RMS on material parameters and groundwater levels as well as the steeply sloping topography, difficulties were experienced in achieving the required Factors of Safety (FOS) within the available wall footprint,” said Woodie. “Following detailed analysis, refinement of subsurface conditions and parameters and extensive discussions with the RMS engineers, the required FOS were justified.”

To allow construction of the RE walls vertical cuts to a maximum depth of about 15m were necessary which extended to the edge of the existing Great Western Highway. JK Geotechnics designed temporary support for these vertical cuts comprising rock bolts with shotcrete facing, and completed site inspections during excavation to verify that construction had been completed to design specifications. JK Geotechnics also progressively inspected the project’s rock cuttings

during excavation, advising on their stability and on remedial measures for sections which were identified as potentially unstable. Remediation advice was also provided for an active landslide (unrelated to the construction activities) which occurred within the project area.

During the drilling of the underbore, JK Geotechnics staff provided materials inspection services and technical advice on minimising the risk of excessive movement being induced below the tracks during drilling operations.

JK Geotechnics staff of geotechnical engineers and engineering geologists provide advice across all construction sectors including infrastructure, commercial construction, industrial projects, government projects, waterways, utilities, maritime and coastal developments. The services provided are varied and include:

- Numerical analysis of the interactions between structures and subsurface materials.
- Slope stability and groundwater modelling using both finite element and limit equilibrium packages.
- Geotechnical investigations.
- Route assessments.
- Construction supervision.
- Advice on excavation and retention.
- High level and piled footing design and pavement design.

As part of the JK Group, they have access to the in-house Soilcheck drilling services, Soil Test Services’ NATA accredited laboratory and Environmental Investigation Services who provide environmental assessment services

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## THE PERFECT RETAINING WALLS FOR TOUGH TERRAIN

The Bullaburra West Upgrade is the most recent RMS project to install the The Reinforced Earth Company’s innovative and distinctive TerraClass® reinforced earth walls. TerraClass® walls provide a flexible and robust engineered solution for retaining walls which are designed to last for 100 years.

For the Bullaburra West Upgrade a reinforced soil structure was designed using precast cruciform-ribbed facing panels with a black exposed aggregate finish. The finish is intended to symbolise the rich mining history of the Blue Mountains and is a unique design specific to this and other Great Western Highway projects.

The TerraClass® system with its unique cruciform-shape design has become synonymous with RECO projects around the world. It is designed to withstand the elements, seismic activity, crash impacts, and is extremely suitable for soft ground.

The benefit of the system for highway widening projects like Bullaburra West is that the walls are constructed from within the structure thereby saving on the space limitation of a very tight site. The wall reaches 15m in height and the panels are installed fairly rapidly with minimal environmental impact. The use of on-site backfill was incorporated into the design.

The black exposed aggregate finish requires the front face of the panels to be water-blasted during the precasting stage. With consideration to environmental sustainable results RECO introduced a water pump system at their Tuggerah precasting facility which recycled this water on a daily basis.

An integrated construction program was implemented by the RECO team. Design work commenced in January 2012 in readiness for the precasting which began in February 2012 and continued for the next 12 months. The first panels were delivered to site in May 2012 and onwards for an October 2012 to September 2013 construction period.

RECO’s team included a designer, design technician and project manager, who all made use of specialist technology to provide a quality project. The design modelling of the RE walls was completed using in-house computer programs. Valdez was used for the internal design of the walls, STARES for stability analysis of reinforced soil, and data processing programs for crash barrier loading checks and concrete panel capacity checks. RECO have the advantage of substantial engineering and technical expertise amongst their staff and the resources of a world-wide organisation to draw upon for local projects.

For more than 20 years RECO have been working on RMS projects in the Blue Mountains. Other sites include the Woodford Bends, Warrimoo, Linden Bends, Blackheath and more. The level of service the company provides, the flexibility of their approach to project challenges, logistical organisation, and overall design expertise makes them unique in the market as a provider of sustainable retaining wall solutions for large-scale applications.

*For more information contact Reinforced Earth Pty Limited, Level 4, 20 George Street Hornsby NSW 2077, phone 02 9910 9910, fax 02 9910 9999, email [recoaustralia@reco.com.au](mailto:recoaustralia@reco.com.au), website [www.reco.com.au](http://www.reco.com.au)*

# Bullaburra Project **TIMBERFIX DELIVERS**



Suppliers of a large range of industrial hardware and fasteners, Timberfix successfully negotiated the supply and delivery for the Bullaburra Project.

Timberfix worked closely with Site Project Engineers, the Procurement team and our vast list of suppliers to ensure our products were delivered "on time and on budget".

Working with the engineers is paramount on a job of this nature, most products are specified and we MUST meet the stringent requirements of the principal contractor and the RMS. Some of the products supplied on the job include

- Traffic barrier installation bolts with NATA certification and fully compliant to RMS B240.
- Elastomeric sealants to RMS B312.
- SIKA and Parchem products.
- Curing Compounds to R82/3.
- Full range of PPE and site safety supplies.
- General fastener and hardware items.

Timberfix has been servicing the construction industry in Sydney for more than 10 years. Our main areas of expertise include high end residential, commercial construction and

infrastructure. Having our own delivery service means we can offer service second to none. With our vast array of suppliers we are able to source almost any product.

"Our focus is to offer service to our customers which is like no other. If we receive an order by 5pm, it will be delivered to site the next morning (Syd Metro) area. We cater to all aspects of construction all around NSW and have recently opened a branch in QLD and vision of moving into the Victorian market. Although Sydney will be our focus over the next 5 years with the infrastructure boom" explains CEO Mr. Wayne Clark.

Timberfix have worked on other infrastructure projects including Leighton's M2 Upgrade, Fulton Hogan Gerringong Project, John Holland Wyangala Dam upgrade, Lend Lease Engineering M5 Upgrade and Lend Lease Engineering Bullaburra Project.

We would like to take this opportunity to thank the team on the Bullaburra project and look forward to working on your next project.



## HI-TENSILE BOLTS



## STUDS



## THREADED ROD

## STAINLESS STEEL & ALL CONSTRUCTION FASTENERS



## GROUTS



## EPOXY

## CURING COMPOUNDS

## WATERPROOFING



## SIKAFLEX

## CHEMICAL ANCHORS

## DRILL BOLTS



## CORE BITS

## DIAMOND BLADES

## DYNABOLTS



## SCREWBOLTS



## AESTHETIC TACTICS FOR ROAD INFRASTRUCTURE

Stabilising the sliced landscape for the Bullaburra West Upgrade was the kind of challenge that Riverview Civil Pty Ltd revels in. With their specialty being gabion basket retaining walls, this company can bring to a project both a unique visual element along with a highly economical and environmentally considered product.

With the Bullaburra West Upgrade being conducted by RMS, subcontracting the local Blue Mountains company of Riverview Civil was beneficial in terms of local knowledge as well as experience. Covering around 1300m<sup>3</sup> of wall, Riverview Civil supplied and installed the gabion basket system – comprised of wire boxes filled with locally quarried rocks.

A gabion wall is traditionally a modular system, and can be modified to suit virtually any geometric shape. For this project a 2 x 1 x 1m modular basket volume was used, with the basket made from aluminium-zinc wire with a PVC coating. A challenge experienced for this construction was the wall being up to 11.5metres in height at some places, along with the narrow access, required specialty crane equipment for its construction.

A particular benefit of this system is its flexibility in design and mitigation of movement, with the use of a continuous lacing method using cable wire for interconnection.

"Gabions offer a range of advantages over other retaining solutions because they are flexible, modular and porous. If built well, they can certainly add an aesthetic dimension or can be used for aesthetic reasons by an architect or an engineer. They compare very favourably to any other wall system, in terms of cost and technical aspects" Matthew Howell, Director commented.

Working on projects across Australia, Riverview Civil cater to government, commercial and residential sectors. Other current and recent projects include Whytes Gully Waste Depot at Kembla Grange, a project with City Rail in the Blue Mountains, National Arboretum Canberra, and Mount Victoria Embankment Stabilisation.

For further information contact Riverview Civil Pty Ltd, Matthew Howell, mobile 0408 836 323, website [www.riverviewcivil.com.au](http://www.riverviewcivil.com.au)