

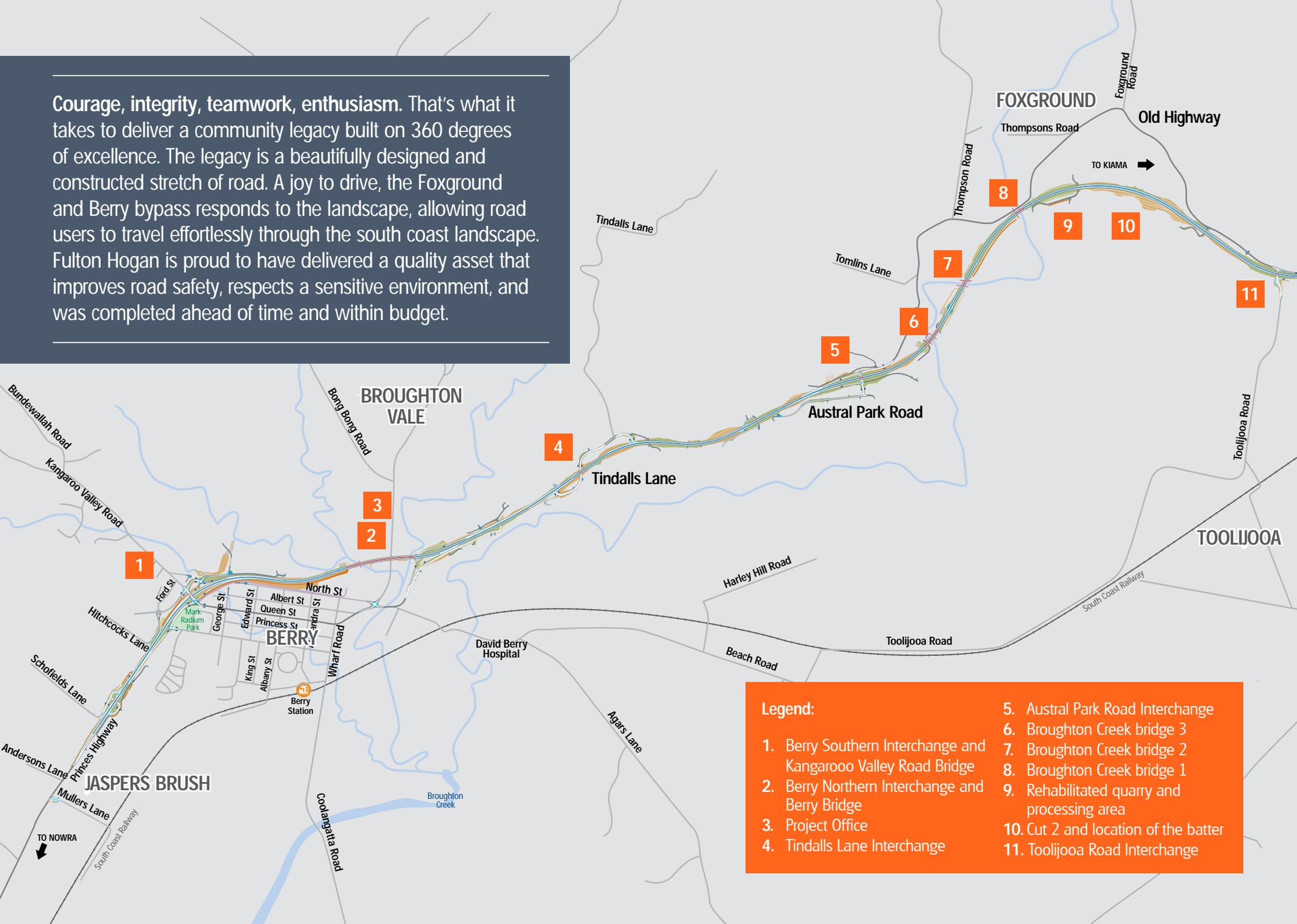


TECHNICAL PAPER FOR THE AUSTRALIAN CONSTRUCTION ACHIEVEMENT AWARD 2018

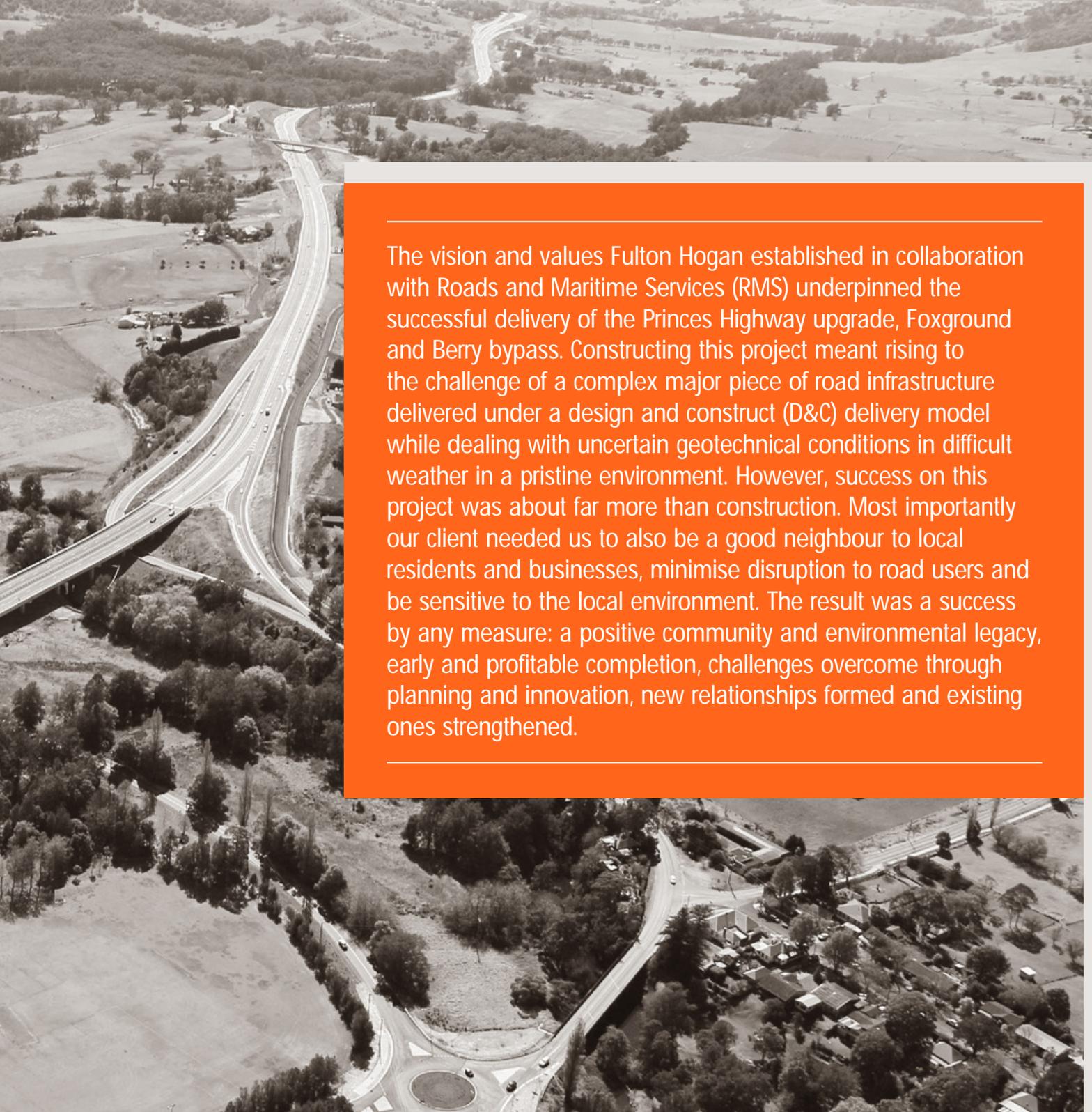
Princes Highway upgrade
Foxground and Berry Bypass



Courage, integrity, teamwork, enthusiasm. That's what it takes to deliver a community legacy built on 360 degrees of excellence. The legacy is a beautifully designed and constructed stretch of road. A joy to drive, the Foxground and Berry bypass responds to the landscape, allowing road users to travel effortlessly through the south coast landscape. Fulton Hogan is proud to have delivered a quality asset that improves road safety, respects a sensitive environment, and was completed ahead of time and within budget.



- Legend:**
- | | |
|---|---|
| 1. Berry Southern Interchange and Kangaroo Valley Road Bridge | 5. Austral Park Road Interchange |
| 2. Berry Northern Interchange and Berry Bridge | 6. Broughton Creek bridge 3 |
| 3. Project Office | 7. Broughton Creek bridge 2 |
| 4. Tindalls Lane Interchange | 8. Broughton Creek bridge 1 |
| | 9. Rehabilitated quarry and processing area |
| | 10. Cut 2 and location of the batter |
| | 11. Toolijooa Road Interchange |



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The vision and values Fulton Hogan established in collaboration with Roads and Maritime Services (RMS) underpinned the successful delivery of the Princes Highway upgrade, Foxground and Berry bypass. Constructing this project meant rising to the challenge of a complex major piece of road infrastructure delivered under a design and construct (D&C) delivery model while dealing with uncertain geotechnical conditions in difficult weather in a pristine environment. However, success on this project was about far more than construction. Most importantly our client needed us to also be a good neighbour to local residents and businesses, minimise disruption to road users and be sensitive to the local environment. The result was a success by any measure: a positive community and environmental legacy, early and profitable completion, challenges overcome through planning and innovation, new relationships formed and existing ones strengthened.

01.

Overview

Scope of the project

The Princes Highway is the main north-south transport corridor linking Sydney and Wollongong to the New South Wales South Coast, an important freight route and a major route for tourists.

The existing highway consisted of two undivided lanes with inconsistent horizontal and vertical grades resulting in lower speed limits, traffic inefficiencies, and reduced safety outcomes for road users. With a fatality rate fifty percent higher than the New South Wales average, improving this section of the highway greatly benefits all road users as well as the local communities.

During the contract period the project was extended to provide an additional 900 metres of divided dual carriageway, extending to just south of Andersons Lane. This resulted in an overall length of 12.4 kilometres of new and upgraded highway.

Fulton Hogan was already delivering the design and construction of the \$320 million Princes Highway Gerringong Upgrade (Mount Pleasant to Toolijooa Road) when it was selected by Roads and Maritime Services as its preferred design and construct contractor. Fulton Hogan entered into a design and construct Project Deed in June 2014 to complete the \$580 million Foxground and Berry bypass.

Key features

- Four lane divided highway (two lanes each direction), median separation, and climbing lanes in each direction at Toolijooa ridge (six lanes over 1.5km);
- Construction of 6.6km of new dual carriageway that deviated from the existing highway alignment;
- Upgrading the remaining 5.9km existing highway to new dual carriageway;
- 5 grade separated interchanges;
- Reused 500,000 tonnes of rock from major cutting at Toolijooa Road;
- Approximately 3 million tonnes of earthworks, included 1.2 million tonnes of reprocessed rock reused in pavements and backfill;
- 5 new highway bridges, including three crossings of Broughton Creek;
- 2 complex concrete highway overbridges including a new Kangaroo Valley Road interchange;
- 8 underpasses for vehicles, drainage channels and fauna crossings;
- Augmented and integrated existing highway into local roads accommodating forty property accesses.

Contract type

The Foxground and Berry bypass was delivered as a D&C project with a fixed lump sum price.

The challenges

Fulton Hogan managed the major cost risks including weather, geotechnical assumptions and interpretation, design (design cost and design scope development from concept to final), industrial relations, and compliance with LGA and utility authority requirements other than telecommunications. The contract sum was subject to rise and fall, with the Date for Construction Completion was adjustable for Variations and inclement weather delays affecting the critical path.

Our solution

We're committed to developing strong, collaborative relationships with clients. The familiarity we had developed with this RMS client team on our previously successful completion of the Princes Highway Gerringong Upgrade enabled us to confidently take a collaborative rather than combative approach to a D&C contract. Our willingness to go beyond the contract and look for ways to improve design, performance, quality and delivery was embraced by the RMS team.

Key numbers:

2.2
million
man hours worked



3
million
tonnes of
earthworks/rock
extraction



1.2
million
tonnes of aggregate
processing



35,000m³
of concrete



15km
of stormwater
drainage pipes



130,000
tonnes of asphalt



250,000m³
of drill and blast /
hard rock extraction



40 traffic
switches

408
reinforced concrete
bridge girders



160,000
tonnes of heavily
bound base



139 large diameter
reinforced concrete
box culverts



02.

Outcomes achieved against planned targets for key project parameters

RMS Contractor Performance Report results

Co-operative relationship	Superior	10
Community interaction	Superior	10
Environmental management	Superior	10
Skills and training development	Superior	10
Quality system	Superior	10

"They aren't afraid to raise items and issues for fear of costs or not wanting to know the true reason."

Extracted from the RMS Contractor Performance Report

Workplace health and safety

We're proud of our workplace, health and safety performance on the Foxground and Berry bypass. The project finished with no lost time injuries and an industry-leading Total Recordable Injury Frequency (TRIF) rate of 1.86.

The challenge

Keeping our people, the community and road users safe in a complex, fast moving traffic environment.

Our solution

Our robust safety inductions and systems are second to none, but it's our approach to developing each individual's personal responsibility to remain vigilant, for themselves and others, that drives us. Our people are asked to focus on their surroundings and everyone is empowered to stop the work if they believe it poses a risk to safety. Fulton Hogan has been recognised for its outstanding safety performance on the Foxground and Berry bypass with RMS making favourable mention in their publications and to senior management. Fulton Hogan was also awarded the Safework NSW/Master Builders Association South Eastern Region Safety Award for the Civil Construction category.

See page 28 for more safety information and statistics

Time

Ahead of every milestone

Fulton Hogan and RMS executed the Project Deed on 10 June 2014. The Date for Construction Completion at the time of execution of the Project Deed was 26 May 2017. Construction Completion is the equivalent to Practical Completion in other forms of contract. The Date for Construction Completion was adjustable for excusable causes of delay such as inclement weather and no Separable Portions were included in the original Project Deed.

The challenge

Looking for ways to deliver the project ahead of schedule to contain costs which would also allow us to provide the community with a safer road sooner.

Our solution

We focused and motivated our teams to look for efficiency in the design, scheduling and resourcing of the project. We could see how design changes, use of separable portions, bringing on more resources at the front end, and clever planning, could achieve this outcome. We embraced working in genuine collaboration with the client to achieve shared goals.

The key milestones achieved during the project are set out in the table below:

Milestone	Approved Date	Actual	Variance
Foxground bypass opens (Separable Portion 1)	28 February 2018	10 April 2017	11 months early
Separable Portion 1 Practical Completion (Construction Completion)	28 February 2018	30 June 2017	14 months early
Berry bypass opens (Separable Portion 2)	28 February 2018	14 July 2017	7 months early
Separable Portion 2 Practical Completion (Construction Completion)	28 February 2018	16 December 2017	2 months early
RMS Publically Announced Completion	June 2018	16 December 2017	6 months early

Cost

A D&C hard dollar contract delivered within budget, 12 months early

The project was completed under Fulton Hogan's budget and we understand the project has been completed within RMS budget. This was achieved even with the significant variation, extending the project by a further 900 metres to the south.

The challenge

To not only look for ways to stay within budget while managing risk and delivering ahead of schedule, but to also deliver the additional 'southern extension'. The extension included a further two bridges in addition to 900 metres of earthworks, pavements and drainage.

Our solution

The only way to achieve significant cost savings was to revisit the design, and that could only be done with a client that is prepared to consider alternatives. During the detailed design and construction phase Fulton Hogan proposed a number of design alternatives which resulted in a lower out-turn cost for RMS including reduced bridge spans, eliminating retaining walls and a revised pavement design which reduced the overall asphalt thickness. The team's willingness to look at alternative designs and test innovative solutions supported Fulton Hogan's ability to deliver the entire project early, accommodating the additional 'southern extension'; all within the early finish construction program and without an extension of time.

Quality

Striving for quality – in both product and delivery – is embedded in our culture. Fulton Hogan's approach to quality is to do it once and do it right, and eliminate costly re-work.

The challenge

To deliver the project to the desired quality, whilst integrating many new innovations into the design, construction and delivery processes.

Our solution

The project team developed a Quality KPI for 'Workmanship' designed to monitor performance and ensure minimum standards were exceeded.

The workmanship KPI was developed after the Deed was executed, again demonstrating the value that strong commitment to collaboration brings to a project. The desire to work together to enhance quality underscored the client/contractor relationship, allowed the focus to be on improving quality across all activities as they begin, rather than looking for ways to assign blame afterwards.

"The WHS planning and preparation for the project is evident with demonstrated effort placed with the management of risks associated to the project. [...] There is a demonstrable level of commitment toward the implementation of the [WHS management] system and the compliance to WHS and OFSC Scheme criteria. [...] The positive cultural approach to WHS on the project is tangible."

Office of the Federal Safety Commissioner Audit, 2015.



900m
of earthworks,
pavements and drainage



month
advance in
project completion

Environment and heritage

Through its commitment to establishing a culture of 'Beyond Compliance', Fulton Hogan achieved outstanding performance in environmental management on the Foxground and Berry bypass, completing the project without any environmental infringements. The New South Wales Environmental Protection Authority took the unusual step of writing to Fulton Hogan and RMS to commend it on its outstanding environmental performance, given the complexities of the project. Additionally, in 2016 Fulton Hogan was announced as the winner of the International Erosion Control Association Award for Environmental Excellence for the Australasian region, also receiving a Merit Award for Innovation.

RMS, in its quarterly Contractor Performance Reports, consistently rated Fulton Hogan's performance for environmental management at 10/10.

The challenge

To look for ways to deliver a significant piece of infrastructure in a particularly sensitive environment with a sophisticated and active community anticipating adversarial relationships.

Our solution

Fulton Hogan brought its 'Beyond Compliance' approach to managing environmental issues on the project. Adopting an active program of community consultation and issues management, the team set about building meaningful relationships with stakeholders and "saying what we'll do, and doing what we say". Monthly scorecards were used to recognise and reward innovation, and a healthy sense of competition developed across the project's teams. We undertook landscaping early in the process, as much to stabilise and protect as to enhance the appearance along the route. Mindful of the sensitive nature of the waterways, we developed innovative solutions like:

- Designing creek crossings that maintained fish passage, protected the natural creek bed and minimised flood damage.
- Managing the treatment of runoff using self-dosing sediment basins, and
- Developing a proprietary new heavily bound base layer product that utilises waste from steel manufacture.



Broughton Creek environment

"The EPA (New South Wales Environmental Protection Agency) would like to commend **Fulton Hogan** on planning and implementing a high standard of sediment and erosion control at the site. We also commend construction staff who are demonstrating a strong commitment to ensuring that sediment and erosion controls at the site are implemented and properly maintained. As **Fulton Hogan** is aware, the site is located adjacent to a number of highly sensitive and challenging receiving environments and the EPA recognises **Fulton Hogan's** efforts to minimise and ameliorate the impacts of the project on both the natural environment and the local community." –

Julian Thompson, Unit Head – South East Region, NSW Environmental Protection Authority in a letter dated 30 October 2015

Sustainability

Fulton Hogan took a triple bottom line approach to delivering the Foxground and Berry bypass, recognising the importance of delivering a project safely and profitably but also through supporting the regional economy, being environmentally responsible and becoming part of the social fabric of the region and leaving behind a positive legacy.

Spoil becomes a resource

Fulton Hogan recognised an opportunity to design and manage balanced cut and fill across its three site zones. Investigation proved that almost all of materials coming out of the site were of sufficient quality to be redeployed in locations that would otherwise have needed material purchased and hauled to site.

Only a small percentage of material from excavations to the south of the route was deemed to be unsuitable due to its moisture content and grading, needing time and cost to treat. However, Fulton Hogan was able to locate a nearby project which could take the material at no cost to the project.

All concrete waste on the project was reprocess onsite for the purpose of being incorporated in other parts of the construction process. Road millings were donated to farmers for use on their internal roads rather than becoming waste product.

Managing runoff to protect waterways also protects people

The innovative design of the self-dosing sediment basins not only protected the area's sensitive creeks and waterways. This clever design also meant that people weren't lugging loads of pipes and other equipment across rough terrain to service the contained water. Fully autonomous, these 50 basins efficiently managed the area's rainfall, retuning treated water to the natural environment while reducing the plant and labour required to manage the process. The successful trial of this design on the project has created an improved approach that can be applied to future projects.



High efficiency self-dosing sedimentation basins were successfully trialled on the project.

Innovation and new technologies used

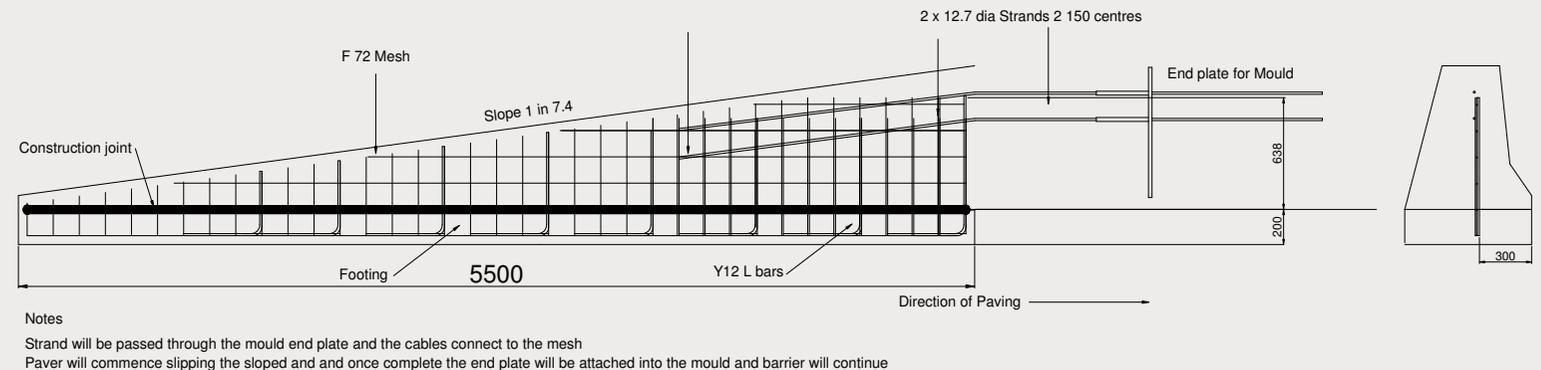
Standardised the design to facilitate use of modular formwork

Fulton Hogan through the design and construction process standardised the pier and headstock design across four structures which allowed it to design a re-usable steel modular formwork system across those structures and thirty sets of piers and headstocks across four bridges, significantly improving productivity and consistent quality of finished concrete. The system will be re-used on future projects.

HBB proprietary product

During the design process Fulton Hogan proposed an alternate pavement design for the main carriageways. The alternate pavement design would result in significant time and cost savings for the project, by reducing the asphalt thickness and thickening the underlying heavily bound base layer using a bound product which included a blend of graded air-cooled blast furnace slag modified with a slag cement/lime binder. The design was also more environmentally friendly incorporating a bi-product of the steel production process.

Sloped end 820 high Type F barrier at start of paving run



Modified barrier design

The benefits of slip forming over conventional Form Reo Pour (FRP) options is well known. On this project we set out to remove any require FRP following the slip forming processes on Bridge connections, Barrier tapers and Barrier transitions. Bridge connection we changed design profiles were changed to "head width" to match precast bridge parapets. Moulds for Tapers were redesigned to form the barriers to compensate for the cast in mesh and footing design required. For Transitions we designed a method of

holding the required anchor assembly's at a transitions to G4 barrier. All these changes allowed the slip forming process to either commence from or terminate at any type of connection or transition on the project. No change to the RMS standard design other than the "head width" was required in order to achieve the above.

Radar VMS mounted on paving machine

The high productivities required to meet the program expanded our working areas and the effectiveness of controls within one critical risk area. The team worked with suppliers to produce a

purpose built radar VMS sign that could be easily attached and interchanged between pavers required. Allowing real time feedback on the effectiveness of the traffic control setup this also helped name and shame speeding motorists, greatly improving safety for road workers when required to pave under traffic.



Stakeholder satisfaction

Being in, connecting, and caring for communities is a commitment we take seriously and we're proud of what we've achieved on all our projects. On the Foxground and Berry bypass, community engagement and stakeholder satisfaction was a point of excellence identified by the project team from the outset, and given the project's historically controversial standing with the community, represented a significant challenge.

Being a good neighbour during construction was Fulton Hogan's goal from the outset. In order to measure how successfully we were in delivering against that objective, Fulton Hogan and RMS created a Key Result Area for 'being a good neighbour and promoting positive perceptions of the project in the community', measured using a bi-annual survey.

"The bypass is fabulous and Fulton Hogan has done a fantastic job"

Louise Riles, Local Business Owner,
Illawarra Mercury 10 November 2017

The survey invited the community to rate and comment upon the performance of Fulton Hogan during the course of the project. Fulton Hogan achieved 90% of the KPI inferring an average rating of 9/10 by respondents. On average, 87% of respondents 'strongly agreed' and 'agreed' that Fulton Hogan was accessible, polite and managed communications, the environment and traffic.

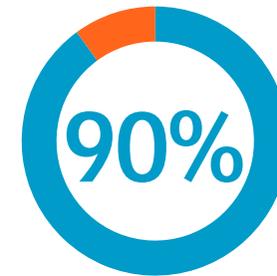
In its quarterly Contractor Performance Reports, RMS consistently rated Fulton Hogan's performance for community interaction at 10/10.

Fulton Hogan as a company, by encouraging and empowering each individual within the team, demonstrated that they were walking the talk by actively contributing to the local community.



Berry Bridge community celebration walk

10/10
for community
interaction



90% of the KPI inferring an average rating of 9/10 by respondents

"I believe **Fulton Hogan** have been exceptionally good corporate citizens. From many accounts both personal and second hand they have been an asset to the town. In a perverse way they will be missed, they are open minded, transparent and approachable."

Kay Jarrett, Berry resident, December 2016 Community Survey.

03.

Complexity, difficulty, and optimisation of the construction task

As a hard dollar D&C project, Fulton Hogan assumed most of the risk on the project. Recommending deviations from the contract's specified design placed even more responsibility on the team, but Fulton Hogan could see potential for time and cost savings, confident it could harness not only its core construction and management skills, but also its depth of expertise in quarrying, logistics and road industry product development.

Fulton Hogan brought a unique blend of expertise to the project. Leveraging the strength of its vertically integrated model the team was able to incorporate range of innovative design and materials solutions that will set the standard for future projects. The project delivered an enhanced outcome for both client and community – well ahead of its scheduled completion date and within budget.



Logistics

Balancing materials minimised waste and haulage

The aim was to take big trucks off the main roads by balancing the materials in sections and using off-road haul roads. This careful approach to limiting moving materials around was greatly appreciated by the community as well as providing a benefit to road users through decreased construction traffic.

The project team optimised the mass haul to reduce on-road hauls wherever possible. Temporary bridges were used to cross Broughton Creek at two locations and Broughton Mill Creek to enable off-road dump trucks to haul material along the alignment until the permanent bridges were constructed. The mass haul was adjusted to make use of the Berry bridge as a haul route once it was safe to do so significantly reducing truck movements within Berry. Safe crossings of the Princes Highway were established under traffic control to allow articulated dump trucks to safely cross the Princes Highway eliminating on road truck hauls.

Reuse of excavated material

Construction of the new alignment required approximately 1.5 million m³ of earthworks (120,968m³ per kilometre of new carriageway). Fulton Hogan optimised the mass haul by ensuring that, as much as possible, all excavated material was re-used in constructing the new highway. This was a significant risk and challenge given limited geotechnical data and uncertain geotechnical conditions. In fact, the project team encountered significant geotechnical challenges: material with high natural moisture content, highly fractured rock, residual soils and a higher proportion of rock to general fill than anticipated.

To accelerate the program and achieve the early opening of the Berry bypass the project team needed a solution, which was to locate an offsite receiver nearby.

Adapting excavation methods in response to uncertainty

The major rock cutting on the project through the Toolijooa Ridge (Cut 2) was assumed from the geotechnical data to include 504,548m³ of excavation of which 246,424m³ was rock requiring reprocessing to produce pavement and foundation materials. The intent was to use drill and blast to extract the material, requiring ten months and 40 blasts. This was complicated by the adjacent existing Princes Highway and a sensitive receiver (house) located 70 metres from the blast site.

Over nineteen separate blast mitigation measures were implemented to reduce the risk of drill and blast activities on site, including individual communication strategies for certain sensitive receivers. During blasting it was necessary to ensure comprehensive communication of upcoming blasts, coordination with the NSW Traffic Management Centre to allow closure of the Princes Highway during the blast event and ensure the adjacent resident was not in the dwelling during the blast.

Although a number of successful blasts occurred in Cut 2, issues began to arise with respect to oversize material following blasts. The project team needed to develop an alternate construction method for the remaining two thirds of rock excavation in Cut 2 to prevent damage to the rock face and significant rework.

The solution used three separate methods to extract the remaining volume:

- eleven excavators with hammer attachments were used simultaneously to extract the rock from within four metres of the finished batter profile, preventing damage to the final rock face
- blast the cut floor and push up the blasted rock to form a working platform for the rock hammers and
- mobilise a surface miner to complete the final floor cut to ensure a consistently level floor.

This strategy allowed the rock excavation in cut 2 to proceed without damage to the final rock face. Some program impact was evident, but increasing resources in the cut enabled the Foxground bypass to open well ahead of schedule.

The sheer volume of rock available project-wide created challenges as it significantly exceeded construction requirements. The majority of rock came from Cut 2, which couldn't be reduced in size due to the topography and subsequent alignment constraints. A new design converted Fill 4 from general fill into a large rock fill embankment, using the excess rock from Cut 2. This was a non-critical fill and a short haul allowing fast and economic construction to be completed in conjunction with more critical areas elsewhere, and acted as a buffer for rock volumes.

Just-in-Time manufacturing of material on site

Manufacturing material for reinforced wall backfill was another challenge. Critical structures have onerous specification requirements requiring



Cut 2

substantial chemical and property analysis. Material must be quarantined and conformed, a process can take up to six weeks. Geotechnical engineers investigate conforming areas of the cut prior to blasting and rock from the area was crushed, separated and conformed for just in time use to avoid congestion.

To assist with congestion around the height and width restrictions of the cut a remote crushing yard was established on private land. The quarry area was restricted for stockpiling due to the area being bound by Broughton Creek, a Class 1 waterway.

To manage the available space, a just-in-time crushing process was back-calculated from the aggregate products required for different areas, all having separate specification and grading requirements. This process required a significant amount of front end testing far exceeding the standard 1 in 4,000T requirements of the Specification to establish the material quality and ensure quality would remain consistent. Once established, a rolling average graph of material quality enabled the project team to visualise in real time how the quality of the material was performing. This process allowed effective management of supply and demand for materials across the project, despite competing workfront requirements and different product requirements.

24 hour continuous concrete pour on the Kangaroo Valley Road overpass bridge

Kangaroo Valley Road is Berry's main southern interchange and the main link to Kangaroo Valley and the Southern Highlands and Hume Highway. Project design requirements prevented central piers on overpass bridges and were developed as single spans. The Kangaroo Valley Road overpass is a 47.1 metre single span with a deck length of 48 metres to clear the new dual carriageway Princes Highway.

The overpass bridge superstructure comprises 2400mm deep cast-in place post-tension voided concrete slab constructed 'top down'. The 1,100 m³ of concrete had to be placed in a single continuous concrete pour, challenging because concrete needed to be supplied, delivered and continuously placed over a 24 hour period, in close proximity to residents, and requiring an exception to the project approval working hours.

Extensive planning and community consultation was essential to ensure approvals were obtained for continuous operation. Additional challenges for this overnight work were the logistics of ensuring continuity of concrete supply in case of plant failure or road closure and resource management to prevent fatigue and manage the work safely.

Three batch plants ensured continuity of supply. Once work commenced the team was committed to completing the pour. Disrupting or abandoning it would have caused extensive direct cost losses and delays of several weeks as the bridge was on the critical path. The result was a pour completed ahead of time in around twenty-two continuous hours, no complaints received, no safety incidents, and minimal concrete waste.

I would like to congratulate your Fulton Hogan team for the way that you have approached the Bundewallah Creek diversion works. The commitment you have shown towards minimising construction impacts, implementing high quality erosion and sediment control, progressive stabilisation of riparian corridors and recreation of natural habitat features is very refreshing. The Team's efforts in terms of active and open consultation with DPI Fisheries is also very welcome."

Allan Lugg Regional Manager, NSW Department of Primary Industries (Fisheries) Aquatic Ecosystems South

Interfaces

The new highway crossed the existing highway in several locations, or was constructed adjacent to the existing highway which would then be augmented and integrated into the new highway

Working in and around live traffic in high traffic volumes is a high risk interface almost unique to major road upgrade projects. It adds a layer of complexity in terms of programming, construction methodology and safety that is typically not experienced on other types of projects. Approximately 50 per cent of this project, by length, involved augmenting the existing highway and its infrastructure and integrating it into the new highway whilst the existing highway remained open during construction and crossed the new alignment at several locations.

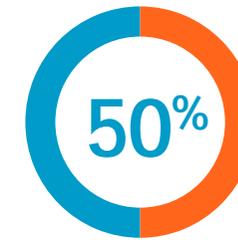
In total, thirty-two separate traffic switches and three hundred traffic management plans would be required to construct the project.

In addition to the complexity of planning and constructing a new highway involving several existing highway crossings, it was crucial to maintain road user experience and safety as well as the safety of workers. The existing Princes Highway carried on average 19,000 vehicles per day, a number that surged during the holiday period. Staged bridge construction was required for four of the new highway bridges, which meant the bridges had to be constructed in halves. Temporary creek crossings were constructed to reduce on-road earthworks hauls. Right turns against traffic were typically restricted along the alignment, requiring careful planning for materials deliveries and mass haul requirements.

The contract required the existing Princes Highway to operate at 80 km/hr during construction. In addition, Key Result Areas were established to measure road user disruption and experience. Fulton Hogan achieved 100% of the KRA.



of the Key Result Areas were achieved by Fulton Hogan



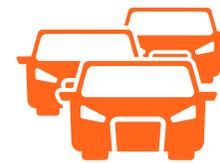
of this project, by length, involved augmenting the existing highway*

* Approximately



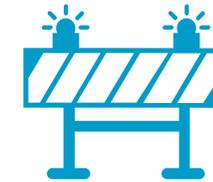
300

traffic management plans required



19000

vehicles on average carried on Princes Highway per day



32

separate traffic switches required



80km/hr

speed operation requirement during construction

Constraints

Inclement Weather

Weather was a significant risk and constraint for the project with approximately thirty-three percent of working days impacted by inclement weather. Wet weather adds complexity to the interface constraint of working adjacent to and around live traffic, as well as creating environmental issues. Wet weather not only impacts significantly on productivity and cost, but creates issues around prevention

of sediment runoff from the site. Construction of the project involved placement of approximately three million tonnes of earthworks for the new road. During construction, the project experienced several significant wet weather events including at least one 1:20 year storm event. Despite the challenges wet weather presented, the project was completed well ahead of time, under budget and without a significant environmental incident.

Rainfall 2015 -2017



Community

Becoming part of the community

It was clear from the onset that to face to face interaction was the best solution for this community, which meant it needed the personal touch. We allowed every member of the public having access to our people and managed this through a vigorous door knocking campaigns (reaching over 1,000 residents) when OOH works or upcoming changes were due that would affect the people. This built a truly personal relationship between the town and our team, who took great pride in resolving issues raised and providing feedback during the process. Fulton Hogan also presented regularly at meetings of local community groups to keep the community informed of progress. This was not a contractual requirement.

We were able to deliver on our intention of being a good neighbour for the wider community, a community that included many project staff who made their homes in the area.

Understanding and responding to community issues

One of the major issues raised by the community was the risk of Berry township losing its trees. Fulton Hogan worked tirelessly with Berry LandCare and local advocates to ensure that the village atmosphere was maintained through a range of initiatives and programs. A propagation shed at the Berry Public School was sponsored and supplied with native seed stock begin the program. Native seed was collected by Fulton Hogan staff during the removal of trees along the construction corridor under the guidance and tuition of the local LandCare.

Tree planting days were organised and well attended by our personnel and subcontractors, matching the already important work of planting along Bundawalla creek, known for its bass and platypus population. The team also redesigned and constructed one of the main side tracks into the village centre eliminating the need to clear four significant Liquid Amber Trees on the direct approach to Berry's town centre.

Measuring our responsiveness

At the start of the project we set aside an incentive pool of funds agreeing a distribution framework to reward our people's performance. This included a measure for community engagement. Performance in this area was an RMS priority, and we felt confident we could excel in this area. The proposal was developed before 360 degrees of excellence was formally embedded into the project, coming as it did from Fulton Hogan's values and commitment to communities.

Supporting the community

Our team put a high priority on putting in place a Community Relations strategy and structure that would deliver the results RMS required and assure the community their views mattered. Fulton Hogan took the lead in developing community collateral, managing the community relations incoming calls, enquiries (and complaints), coordinating media events and kept the community informed of project progress and future changes. Our performance, as measured and reported in Contractor Performance Reports, the KPI scoring, and comments from respected community members Peter Hands and Stuart Coughlan endorsed our efforts.

The team also found ways to show their commitment to the community through a number of activities.

Fulton Hogan engaged the local Mens' Shed to build a Santa chair for the community's annual Berry Merry Christmas festival. For three years, in their own time, staff assisted with the annual Santa photos. When the project was completed the chair was donated to the festival.

Fulton Hogan also worked with the local Mens' Shed group to tailor project needs with local expertise. Bollards for the Kangaroo Valley Road bridge were made from timber produced by required tree-felling. The logs were dried and set aside with the local members of the Mens' Shed constructing them for installation. The Men's Shed team also brought their skills to bear producing bird nesting boxes for the local wildlife.

Fulton Hogan contributed in-kind support and materials for small projects requiring concrete and manpower to lay concrete paths and slabs for worthy causes like the local CWA, RFS and pre-school.

At all times our people were mindful that they were guests in the community, looking for ways to minimise the project's impacts - like limiting truck hauls prior to public holidays - as well as taking simple personal steps like not parking on the main street to minimise congestion.

Local events

- "Berry Merry Christmas"
- Berry Show Society/camping
- Shoalhaven River Festival
- NAIDOC Week 2015 & 2016
- Quakfest

Local clubs and associations

- Illawarra Titans Aboriginal Rugby League Club
- Shoalhaven Heads Cricket Club
- Berry Country Women's Association
- Berry LandCare

Local services

- Berry Community Preschool
- Berry Primary School
- Berry Fire and Rescue
- Shoalhaven Homeless Hub
- South Coast wildlife rescue



Planet Ark National Tree Day

Risk Management

Fulton Hogan takes a whole of business approach to managing risk. Starting with the smallest activity, each employee is encouraged to take a total project perspective, understanding where and how each activity locks in to the total project.

During the detailed design phase, each design package was subject to a safety in design review to ensure that issues with respect to safety during construction, operation and maintenance were addressed in the design.

High risk planning workshops were undertaken during construction to properly plan 'high risk work' and proactively identify and mitigate risks before work commenced, including for example work involving heavy lifts. Significant effort was invested in managing heavy vehicle compliance across the project, with a dedicated resource engaged to coordinate heavy vehicles on a daily basis and ensure that fatigue, maintenance, fitness for work, mass, dimension and loading requirements were met.

When significant periods of inclement weather were expected or prior to extended site shutdowns, site crews

were engaged in ensuring that site environmental and safety controls were properly in place to minimise environmental and public safety risks.

A Workplace Risk Assessment was developed for the site which comprehensively reviewed all activities across the project and specified controls in accordance with the safety hierarchy of controls, working from elimination through to administrative controls. The WRA was reviewed on a six month basis throughout the project.

Commercially, risks and opportunities were reviewed on a monthly basis during project commercial reviews and assessed using a probability adjusted PERT analysis.

Golden Rules were implemented on the project mandating minimum expectations in critical risk areas including working at heights, working in and around live traffic, plant and equipment maintenance, permit to work for high risk activities, working around bitumen, light vehicle operation and mobile plant competency.



Batter collapse at cut 2

Construction was managed according to the prevailing conditions identified along the route: to the north the route had potential geotechnical risks; the central component posed complexities of traffic staging; and south had bridges and moist ground to contend with as well as the 900m extension.

Focussing on the specific needs of the three zones, an optimal resourcing structure was developed with over and above usual headcounts. This provided a number of benefits:

- More people meant more capacity, enabling early delivery.
- Generous ratios of staff to activities, meaning less risk of fatigue as a higher level of man-power applied as required



Flooding on site following an East Coast low

- More eyes across processes and to apply to problem solving.
- More opportunities for staff to gain exposure to a live project, increasing their knowledge and experience, and growing their value to the company and to the industry.

Structuring into three teams drove efficiency, instilled a healthy competitive spirit and encouraged people to look for ways to innovate. Resourcing independent teams to suit the specific nature of their challenges compartmentalised risk: it ensured focus by allowing experts to concentrate on their area's challenges without being spread across the entire project.

Innovative approaches to project issues and the use and development of new technologies

Improving road users' safety through staged openings

Although always theoretically possible, a staged opening was never contemplated for the project. The original design did not include stages or Separable Portions. The project team recognised the inherent benefit to road safety that divided dual carriageway provides. Even a single carriageway with improved vertical and horizontal geometry has a positive impact. With this in mind, the project team challenged itself to find a way to complete and open significant sections of new highway ahead of time, typically targeting openings to occur prior to peak holiday travel periods. Rethinking the project into separable portions was the way forward.

Foxground bypass opens 14 months early

During construction a number of serious accidents occurred at the 'Foxground bends', a meandering section of the existing highway which included steep ascents/descents and changes in horizontal and vertical grade. Responding to this, Fulton Hogan looked to identify an opportunity to open the new dual carriageway highway early

to improve safety for road users. Fulton Hogan and RMS negotiated to create a Separable Portion amendment deed to open and hand over the new five kilometre section 'Foxground bypass' in April 2017, prior to Easter, which was in the busy school holiday period.

Fulton Hogan did not receive an acceleration incentive to open the Foxground bypass early. Highly motivated to find a way to eliminate a significant community risk as efficiently as possible, the team was empowered by the client's willingness to explore options beyond the contract.

Berry bypass opens twelve months early

Following the successful early opening of the Foxground bypass, the project team turned its focus to achieving an early opening of the Berry bypass. Berry was a notorious location for traffic delays during peak holiday periods as the existing highway runs right through the centre of the town. A major traffic switch would open a further five kilometres of new divided dual carriageway, but it would be more complex than the Foxground bypass given that half of the new divided dual

carriageway included augmentation of the existing highway, several property access changes, and local road interfaces.

Overcoming unforeseen events

Batter collapse

In March 2017, as the team was making final preparations to open the Foxground bypass ahead of the April 2017 deadline, a significant rainfall event occurred which destabilised a major cut batter under construction at the Toolijooa Ridge. Approximately half the annual rainfall total of 1.5m fell in two months. Tension cracking emerged on all three benches of the thirty-metre cut over for a distance of around 130 metres. The project team had to develop a safe yet efficient and economical redesign and reconstruction methodology that would enable the opening to proceed as planned prior to Easter in April 2017.

A dedicated recovery team was established involving RMS, SMEC PB JV, the Project Verifier and Fulton Hogan, to work in collaboration and develop a solution that would enable the Foxground bypass to open as planned prior to Easter whilst remedial work could continue through to June 2017.

The investment in relationships that create a culture of collaboration between all parties again proved itself a winner. Taking a no-blame, all-in approach, the team developed design options that were quickly agreed on by all parties. Risks were explored, understood and accepted and the repair work began in earnest. Saturated material was quickly removed and the ground stabilised, before a revised, softened 3:1 slope could be constructed. Achieving the desired April 2017 opening required certain completion work to run on a 24-hour cycle.

Acceleration of a major cutting at the north Berry interchange

Once the decision was made to deliver sections of the project early, the major cutting at Berry interchange needed a creative solution to accelerate its completion. Some of the challenges it created included double handling of material, crushing in the cut, out of hours work and adopting an alternative material extraction method using a surface miner. The surface miner was an alternative to traditional extraction methods for hard rock.

Given the proximity of the cut to sensitive receivers and the operational highway and the volume of rock involved, blasting was not viable. The surface miner extracted and pulverised rock material and side cast it into a windrow for reuse on the project with minimal reprocessing;

Inclement weather created innovation

Recovering from a period of significant inclement weather in June 2017, was a major challenge for the team. The effects on structures like the batter, and dealing with runoff whilst still maintaining the intent to deliver significant sections - if not the entire project - early required innovative and collaborative thinking from the team. The batter redesign and the development of the self-dosing sedimentation pond system were innovative responses to the unusually wet conditions facing the project.

Responsible and sustainable construction

Recycling and reusing materials produced on the site

All of the material from the Berry Interchange cutting was absorbed by the needs of the project. Clever planning and the ability to see more than just material to be dumped elsewhere led the team

to view the material from excavation as a cost-saving resource they already had on site. Minimal processing and haulage was required to turn waste into valuable fill to be utilised as needed.

Trialling a high efficiency self-dosing sedimentation basin on the project

Reducing plant and labour input, this returns to capacity more efficiently following rainfall events and improves discharged water quality. The Foxground and Berry bypass had over fifty sedimentation basins requiring maintenance throughout construction. Adopting this basin method on appropriate future projects it will significantly improve time and cost efficiency, improve safety outcomes for workers, and provide benefits for the environment. The trial was endorsed and supported by the NSW EPA and was the first of its kind in New South Wales.

Clever design

Developing a unique blend of heavily bound base

Changing pavement design to incorporate a uniquely blended heavily bound base material, which comprised a slow setting bound material with reduced shrinkage and high strength gain properties.

The design change resulted in a reduction in asphalt thickness (offset by increased heavily bound base thickness) which is not only a lower cost solution, but more efficient to place. This product also provided an environmental benefit as it incorporates a bi-product from steel production.

A modular design enabling reuse of the steel formwork system

Designing the highway bridges to have a consistent headstock, pier and column design (whilst meeting RMS urban design requirements) and designing a re-usable modular steel formwork system. The modular formwork system was reused across thirty separate spans on four bridge structures, significantly improving construction efficiency.

Efficient embankment design

The project team developed an innovative embankment foundation treatment. It not only met RMS design requirements but allowed for the embankment to be constructed using deeper layers resulting in a more efficient construction process.

Modifying design for efficiency

Aspects of the design were modified to improve construction efficiency without compromising on safety and quality

outcomes. Modifications included changing the median pavement design to allow it to be constructed using slip-formed concrete, and eliminating an extensive drainage system in a large rock cutting by substituting in a slip formed median drain.

Cloud based technology for site diaries

Implemented an iPad / cloud based electronic site diary system for use by all foreman and supervisors on the project. Adopting an agile approach, the system was enhanced during live use across the project. The system allowed timesheets and payroll data to be generated for approximately sixty-three directly employed wages personnel, eliminating the need to use paper timesheets.

Managing post opening activities

Staging post-opening works to enable completion of the stone mastic asphalt (SMA) wearing course

SMA cannot be placed during the winter, a process that has to happen during the warmer summer months. This involved complex contra-flow traffic staging and ramp closures and continued for several months after the dual carriageway was opened to traffic.

Protection of workers during the remaining post-opening completion works in a high-speed traffic environment.

The traffic staging required a change to the design so that the median wire rope barrier could be removed to create temporary crossovers of the dual carriageway, allowing a complete carriageway to be paved whilst motorists used the adjacent carriageway in a contraflow configuration. This arrangement provided a better safety outcome for both workers and motorists as it provided separation between work activities and motorists by using the permanent median wire rope barrier.

Committed to providing good community outcomes and experiences

Austral Park design changes produced better community outcomes

Fulton Hogan developed an alternate geometric design for Austral Park Interchange, eliminating an expensive high skew solution and replacing it with a traditional diamond interchange. This was achieved with a revised staging arrangement, which allowed the reconfigured interchange to fit entirely within the existing road corridor.

Urban design outcomes were improved by replacing the long skewed structure with a simple and efficient precast girder underpass. The large bridge was replaced by a more subtle local road underpass. Safety was improved through the use of standard ramp terminals, which also improved connections to, and speed control on, the local road network. Shorter connections reduced the extent of pavement works, reducing cost as well. Improved staging allowed us to maximise reuse of the existing highway and integrate it into the final interchange solution.

The team designed a 6-stage solution to manage the traffic switches required to integrate all elements of the interchange 'puzzle'. Tying old and new elements together while accommodating ten private property access points was a key challenge. Mixing old with new also created challenges around drainage and pavement construction - rarely able to be completed in any individual stage. Each realignment required night works for asphalt tie-ins to minimise traffic disruption. During one early stage, a partial new alignment opened to local traffic under the overpass - a significant change for locals that was communicated and managed seamlessly.

The final opening of the completed overpass brought together the final ties with all work finished 3 days after the final traffic switch.

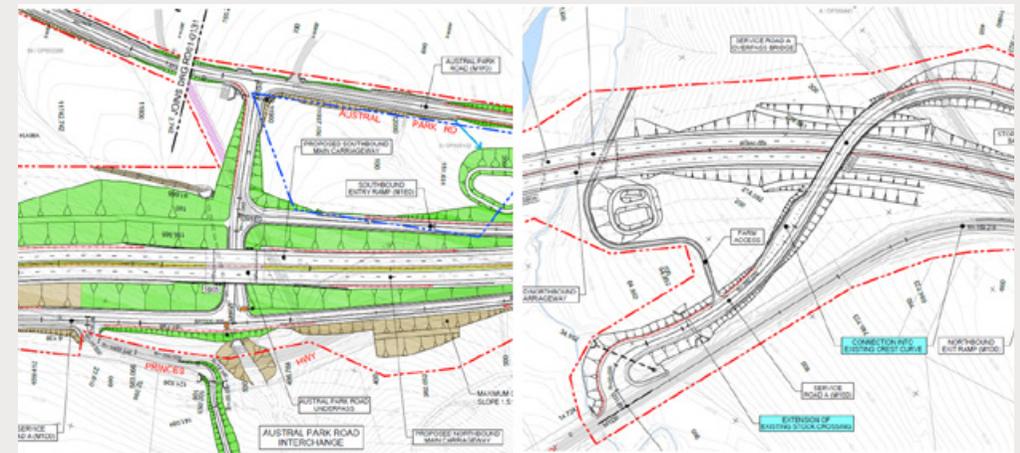
Open day logistics and public safety

Holding a community open day celebration attended by over 6,000 people in mid-June 2017 created logistical challenges for the team.

The 'Walk the Berry Bridge' event was a fantastic opportunity for people to walk through sections of the project and anticipate its successful completion. However, the team needed to change gears and manage large numbers of excited non-construction people, which they were able to do successfully by working yet again in close collaboration with their RMS client.

Early opening caused community concerns

Even though early opening of the road was desirable for all concerned, it had the potential to cause problems for local businesses. Community consultation to prepare the community and local business owners for the bypass to open twelve months earlier than expected was essential. Businesses needed time to prepare themselves for the new access so that they could prepare their customers and whatever else they needed to ensure their business could function. This was done with a targeted engagement approach that was responsive to concerns raised.



Original and final designs of the Austral Park Road Interchange

04.

Leadership and management of the project delivery

The RMS and Fulton Hogan project leadership team aligned themselves with the common goal of **Delivering a Community Legacy Built on 360 degrees of Excellence**, and underpinned this with the shared values of **Integrity, Courage, Teamwork and Enthusiasm**.



Resourcing the project for success

Projects are delivered by people. The Fulton Hogan team had robust debate about the structure of the project team during its initial phases. The project team (and the business) ultimately made a conscious decision to invest heavily in resourcing the project for three key reasons: (i) it would provide a structure capable of growing future leaders within the business (ii) it would provide a structure that would enable early completion to occur (iii) it would lead to improved safety, quality and environmental outcomes. This decision came at a significant premium but was recognised as an investment by the business.

The optimal resourcing structure was determined to split the construction work between a 'Civil' team and a 'Structures' team, each reporting to a separate Construction Manager. Within the civil team, the project was split into three geographical areas with their own unique challenges (Foxground had the major cutting and materials crushing operation), Broughton had complex traffic staging and interface with the existing highway, Berry had the

upgrade section and interface with the community. Within the structures team, the team was split between main carriageway (girder/plank bridges) and complex structures (overpasses typically voided slab or box girder) along with finishing concrete works. The General Superintendent reported directly to the Project Director and had four Superintendents aligning with the engineering structure and Foreman, Leading Hands all directly reporting through to them.

The objective was also to ensure that each manager within the chain had a maximum of six reports wherever possible.

Project team relationships

Forming a strategic partnership in a design and construct framework

Shortly following the award of the project, senior project representatives of Fulton Hogan and RMS agreed that the project was an opportunity to deliver design and construct projects collaboratively. Fulton Hogan and RMS jointly funded the engagement of a leadership and development coach and developed a program to establish a common vision for the project, establish common values and provide appropriate training to members of the wider project team. The objective was to reinforce those goals and provide the tools necessary to develop higher order leadership and communication skills.

Beyond Compliance

360 degrees of excellence

From an environmental and community perspective, the Fulton Hogan project leadership team developed a Beyond Compliance program designed to seed a generative culture of excellence within the team and deliver environmental



and community outcomes that were best practise. The Beyond Compliance program was supported through a project and business based reward and recognition program, using a scorecard system, to measure beyond compliance performance across the four project 'zones' during construction. Fulton Hogan credits the beyond compliance program with underpinning the projects outstanding environmental and community relations performance.

Succession planning and career development

Fulton Hogan prides itself on the commitment its people make to projects, and this project experienced a very low attrition rate. The project was resourced with sufficient capacity to provide redundancy within the team and to allow the development of future leaders. Fulton Hogan was able to develop future leaders through the project, including Project Directors, General Superintendents, Superintendents, Foremen and Engineers who have all taken the next step in their careers with Fulton Hogan.

Developing leaders

A Transformational Leadership program was rolled out to 50 project team members over two years, with participation by RMS, Fulton Hogan and the Project Verifier from Foreman level and above. Topics covered included leading high performance teams, building trust, motivation skills, effective communication, dealing with conflict and individual coaching. The decision to over-resource the project at the beginning has enabled Fulton Hogan to grow several new leaders within its business.

Some of those who have gone on to undertake greater responsibilities since this project concluded. These include:

- **Karen Williams**
Community Relations Manager
Karen has since been promoted to Regional Community Relations Manager.
- **Mitchell Tulloch**
Superintendent
Since completing the Foxground and Berry bypass, Mitchell has gone on to lead the successful mobilisation of a new project (Moorebank Intermodal Terminal Development) as General Superintendent.
- **Michael Phillips-Ryder**
Project Director
Since completing the Foxground and Berry bypass, Michael has gone on to lead the successful mobilisation of a new project (Moorebank Intermodal Terminal Development) as Project Director.

Leadership team

This sections set out the relevant names and biographies for the Fulton Hogan leadership team.

Andrew McRae General Manager (Eastern Region Construction)

Project Director for the project between September 2014 and December 2015, Andrew then accepted a position as the General Manager for Eastern Construction in February 2016. Andrew has over 25 years' experience in civil construction across the United Kingdom, Australia and New Zealand, including as Project Director for the Pacific Highway upgrade – Sapphire to Woolgoolga in NSW, and the Northern Gateway Alliance and Tauranga Eastern Link in New Zealand.

Michael Phillips-Ryder Project Director

Appointed Deputy Project Director in May 2016 before taking over leadership of the project as Project Director in July 2016, Michael oversaw the project through to completion. Prior to taking over as Project Director, Michael acted as Project Director for the completion of the adjacent Gerringong Upgrade where he was Commercial Manager for the project and part of the Senior Leadership Team. Michael has held senior project roles on major design

and construct road projects for ten years with a further four years' experience in the building industry.

Kevin Keays Regional Construction Manager

The Senior General Superintendent for the project from October 2014 to November 2016, Kevin then transitioned to a specialised role providing strategic advice for project field delivery across the Australian and New Zealand construction businesses of Fulton Hogan. Kevin has over 30 years' experience in civil construction, including thirteen years as a General Superintendent working on significant projects across Victoria, South Australia, Queensland and New South Wales including the Northern Expressway in Adelaide, the Pacific Highway upgrade between Sapphire and Woolgoolga in NSW, and the Australia Pacific LNG project in Gladstone, Queensland.

Mitchell Tulloch General Superintendent

During the crucial project close out phase, Mitchel oversaw two major traffic switches (Foxground Bypass opening and Berry bypass opening). Before taking over as General Superintendent, Mitchell was an Area Superintendent overseeing civil works for the complex upgrade section of the project.

Mitchell has over 12 years' experience in civil construction projects holding Foreman and Superintendent roles on major upgrades of the Hume Highway and Pacific Highway.

Michael Spencer

Construction Manager – Civil

Michael was the Construction Manager responsible for overseeing all aspects of civil scope for the project, which included earthworks, drainage and pavements from commencement through to March 2017. Michael has over twenty years' experience as a Construction Manager and Project Manager working across projects in Queensland and New South Wales including major road projects and mining infrastructure.

Joel Purcell

Construction Manager – Structures

Joel was the Construction Manager responsible for leading the delivery of the structures scope for the project, which included bridge and structural culvert construction. Joel has over fourteen years' experience in civil construction on projects across Queensland and New South Wales including road construction and mining infrastructure projects.

Barry Childs

WHS Manager

As Work and Safety Manager, Barry was responsible for safety across the entire project. Barry is a specialist with over 35 years' experience dealing with safety across a range of industries including civil and building construction, including eighteen years as an Inspector and Senior Inspector with WorkCover NSW.

Shannon Chisholm

Senior Community and Environment Manager

Responsible for ensuring overall compliance with environmental requirements and community relations. Shannon passionately led the project Beyond Compliance program, motivating the project team to achieve excellence in the areas of environmental management and community engagement. Shannon has over twenty years' experience in civil and building construction in Australia and internationally including Wembley Stadium, Channel Tunnel Rail Link and the Sydney Olympics building program.

Karen Williams

Community Relations Manager

Following her successful involvement in the community relations team on the adjacent Princes Highway Gerringong Upgrade, Karen managed implementation of the community

engagement strategy. This included management of stakeholder issues such as property works, traffic changes and briefing New South Wales government on project changes and events. Karen has 11 years' experience in community engagement and communications on major infrastructure projects in New South Wales, and her performance was recognised by both RMS and stakeholders.

Sam Leigh

Environment Manager

An experienced Environmental Manager with a portfolio working on major road upgrades in the Sydney metro area and significant motorway projects. Sam has demonstrated experience managing all facets of the environmental requirements associated with large infrastructure projects and proficiency in Roads & Maritime Services (RMS) specifications. Sam is also responsible for rolling out initiatives which have since been captured in state-wide publications, acknowledging their effectiveness and innovation.

Michael Marix-Evans

Engineering Manager (Bid and Design Manager)

As Bid Manager and Engineering Manager for the project, Michael was responsible for leading the tender pursuit and the detailed design phase of the project and was part of the

Senior Leadership Team during the initial stages of the project, contributing to strategic decisions for the delivery strategy. Michael has extensive experience and track record across a diverse range of significant civil and major infrastructure projects, including the Westlink M7 Motorway in NSW and the Gateway Upgrade project in Qld. Michael is currently the Pre-Contracts Manager for Eastern Region.

Sylvia Elvin

Quality and Completions Manager

Sylvia was the Completions Manager and Quality Manager during the close out phase of the project. Sylvia was instrumental in establishing systems and processes for ensuring that the necessary handover requirements of the contract were satisfied as work progressed. Sylvia has over fifteen years' experience on civil, marine and building construction across Australia and internationally including projects completed in the United Arab Emirates and Malaysia. Sylvia holds a Bachelor of Engineering, Master of Business Administration, a Diploma of Building and is a Member of Engineers Australia.

Generating a legacy for the construction industry

The legacy of this project is that it proves that a complex piece of infrastructure can be delivered under a hard dollar design and construct model, in an environmentally sensitive area and through and around a sensitive community, safely, ahead of time and under budget. It is possible to deliver these projects collaboratively if there is genuine alignment on culture, values and goals.

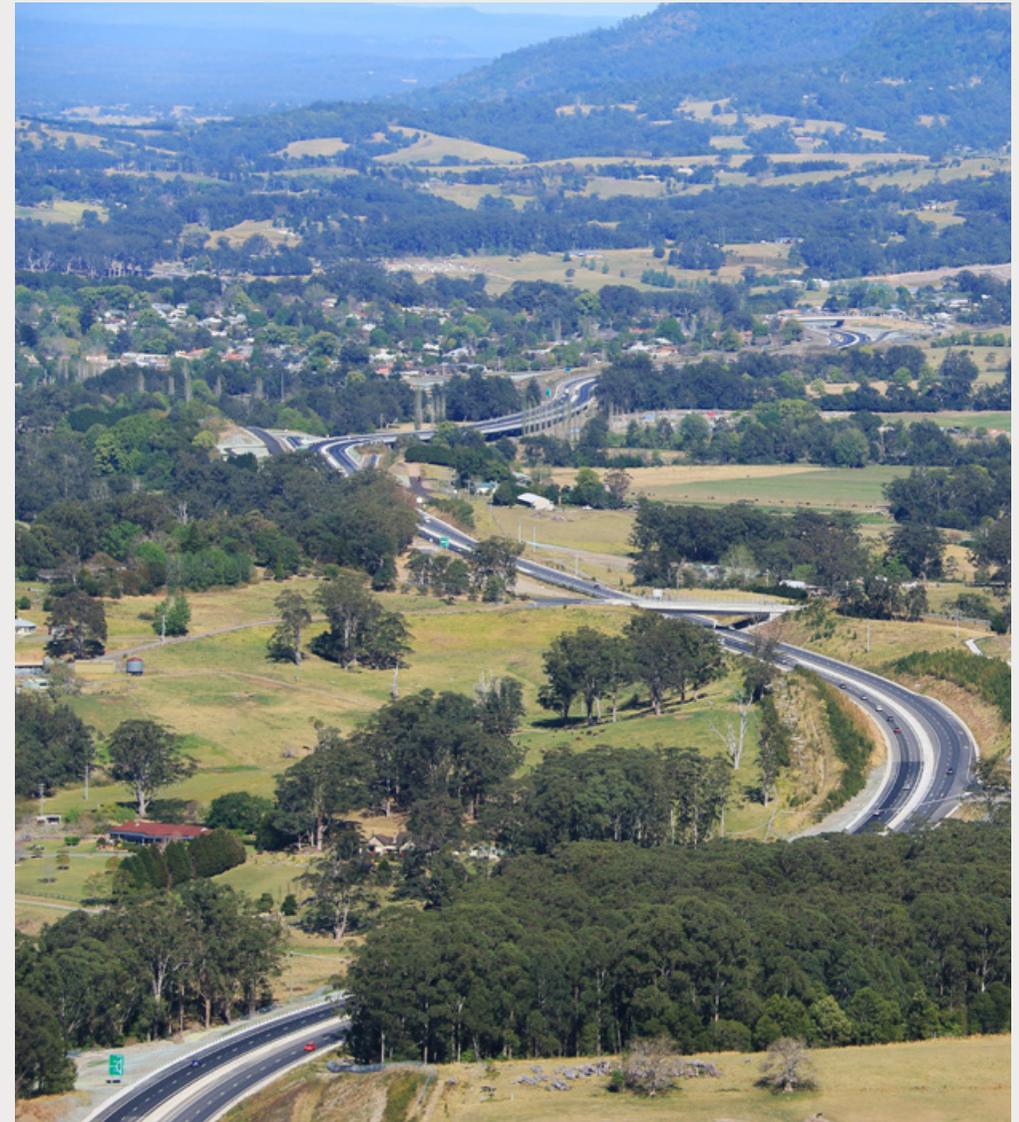
We look to create, connect and care for communities we work in. We seek to create community legacies through the projects we leave behind and the interactions we have. We engage with local suppliers to provide, as much as possible, the necessary services, support and materials to minimise the need for transportation.

The project has significantly enhanced the capability of the Illawarra and Shoalhaven region in terms of resourcing and employment outcomes for major construction projects. A significant skills base has been developed through a directly employed workforce (which are now working on

other major projects in the Shoalhaven region) and enhanced capability in key local businesses. The project exceeded indigenous employment targets.

From a community perspective, the project has left a positive impression on the Berry community. The project has invested in the local community through sponsorship and various in kind projects and has enhanced the reputation of the industry within the impacted community.

The project also successfully trialed an innovative new sedimentation basin design that drastically improved safety and environmental outcomes. The new basin design is now a proven innovation that can be applied to future projects.



Looking south toward Tindalls Lane Bridge

Entrant's contribution in the design process

Fulton Hogan's extensive past experience working in collaborative relationships with RMS enabled the team to fast track an optimised design program, change management system and subsequent approvals. This ensured the project team could commence construction on time and with confidence, armed with a mature construction design, commencing initial structures and earthworks according to the contract program.

Design change management was conducted using Design Technical Notes, a highly effective method of explaining and justifying design change requests. Design Technical Notes was distributed on the iTWOcx document management system, which ensured there was a clear recorded workflow at every stage of design change proposals, including RMS approval.

Fulton Hogan took the opportunity, as the design and construct contractor to introduce a number of value engineering initiatives that provided significant time and cost benefits to both Fulton Hogan and RMS without compromising on the safety or quality of the final product, including:

- Considered several alternate bridge designs including precast headstocks and a significant alternate for the 600m long Berry bridge (incrementally launched box girder) which resulted in a reduction in bridge length but was ultimately never pursued;
- Deleted a span from the Broughton Creek Crossing No. 3;
- Significant reductions in retaining walls, including a 750 m2 retaining wall in its entirety;
- Deleted a traffic stage and a significant temporary side track by accelerating construction of the Tindalls Lane overpass and using the bridge for highway traffic this eliminating the temporary diversion;
- Proposed an alternative foundation treatment which enabled earthworks to be constructed in a maximum of a single 800mm layer (as opposed to standard 300mm layers) in certain locations significantly derisking the earthworks program;



Super-T girder installation at Broughton Creek bridge three

- Introduced an alternate drainage design eliminating significant quantities of stormwater drainage by introducing a slip formed voided concrete drain in the central median of the 900m rock cutting at Toolijooa Ridge;
- Standardisation of headstock designs to enable the re-usable steel modular formwork system to be used;
- Substituted a four metre high 220m long concrete noisewall for a noise mound constructed from earth fill;
- Substituted a significant five cell culvert and local road underpass culvert for a single span plank bridge significantly reducing the projects environmental footprint and with considerable safety, time and cost benefits.

Workplace Health and Safety

Managing a complex project in difficult terrain, adjacent to a live highway presented many challenges for the project team. Fulton Hogan strives to move beyond compliance in Workplace Health and Safety, and Fulton Hogan's leadership team pioneered a number of initiatives to achieve this.

Change management was recognised as an important part of ensuring consistent adherence to Workplace Health and Safety standards.

After a few minor incidents and near misses, the Project Team developed a Restart Card and process in order to better assess and respond to site changes (such as weather, supervision, new subcontractors and traffic).

As a result, the Restart Card was a slimmed down version of a pre-start assessment to the working day, and

was used to help personnel refocus after breaks (such as lunch) and reassess changes in their environment.

An incident involving a truck body rollover prompted the Project Team to initiate a 'Tip Over Risk Assessment' procedure, creating a 'learning' to be incorporated into the existing system.

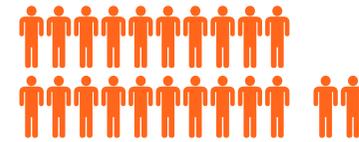
Inconsistency between necessary industrial instruments and overarching safety requirements resulted in difficulties for the Project Team when developing a response to extreme heat conditions. As a result, a Heat Policy was designed and applied to the entire site. This provided clear and consistent guidance on how to manage working in temperatures exceeding 35 degrees Celsius.

At **Fulton Hogan**, personal focus and vigilance around safety are emphasised as everyone's responsibility, along with encouraging people to speak up whenever they see something that could pose a risk to safety and wellbeing on site.

Safety stats

2.3
million

Total Person
Hours Worked



94.7%¹

Total Zero
Harm Days



1.86

Total Recordable
Injury Frequency Rate



0.00

Lost Time Injury
Frequency Rate



1.86²

Medical Treatment
Injury Frequency Rate

¹ Days without first aid, medical treatments, lost time injuries.

² The Mean MTIFR for FSC Accredited companies for a scheme was 7.95 between July and December 2014.

Planning and control of design and construction operations

Quality and Completions Management

Completion and handover for a major highway takes a lot of planning and a lot of effort, with completion usually one of the last things to be done. However, at Fulton Hogan we believe planning for completion starts right from Day 1. After all, what we've agreed to deliver needs to match what's actually delivered and include the variations considered, approved and integrated along the way. Our disciplined approach to implementing and managing this process enhances our ability to efficiently arrive at project completion with robust and verifiable records of every element ready for handover.

When implemented at the start of a project Fulton Hogan's innovative Completion Matrix provides ongoing streamlined snapshots of all aspects of the project's construction elements. Accurate summary reports can be easily created with links to increasingly detailed records from a variety of manual and online systems. The Completion Matrix functions as an easy entry point into the project records allowing users to choose to view as much or as little as they need.

A powerful project management methodology, the Completion Matrix enables construction of assets to be tracked, recording their specification and location data, and documenting every aspect of delivery including defect rectifications and acceptance processes. Coupled with the Handover Report's visual representation of its information structures, the Completion Matrix creates an accessible, comprehensive and accurate record of the project's assets that can be transferred to the client's own asset register for ongoing management and maintenance.

Fulton Hogan was able to demonstrate the key benefits of the system on the Foxground to Berry bypass project and, following the decision to create two separable portions, the existing Completion Matrix was easily cloned to create a second template of all the required assets and activities. RMS and the Verifier acknowledged the benefits this methodology brought to the project as it required negligible additional material to be sourced to complete handover processes at each of the early stages of completion.



Disciplined Completion Management processes, implemented early, support seamless handover.

Fulton Hogan was able to demonstrate the key benefits of the system on the Foxground to Berry bypass project and, following the decision to create two separable portions, the existing Completion Matrix was easily cloned to create a second template of all the required assets and activities.

Industrial relations

Leveraging its self-performance capability in bridgeworks and pavements, Fulton Hogan directly employed a workforce which peaked at sixty-three. Additionally, there was a peak project management team of 110 and peak subcontract workforce of over 300 per day working on the project. In total, over 3,500 personnel were inducted and worked on the project between 2015 and 2017.

Demonstrated safety engagement and good communication with the workforce led to improved IR outcomes. In developing sound communication protocols with the direct labour and subcontractors on site to convey the Safety aims message, IR matters were proactively addressed and no issues escalated into disputes.

The project was subject to both the Federal Building Code 2016 and the New South Wales Government Code of Practice for Procurement: Building and Construction. Although challenging at times the project was delivered without any significant industrial relations issues and nil downtime.

Training and development

Fulton Hogan found that the depth of capability, skills and resources available to complete major projects in the Illawarra, Shoalhaven and South Coast was limited. The challenge was therefore to enhance the capability of the available workforce and resources in the area to promote local investment and avoid costly alternative of sourcing subcontractors and workforce from outside of the region. The approach was to directly employ a core workforce to self-perform critical elements such as bridges along with around seventeen leading hands who would direct the workforce and subcontractors at the workforce and subcontractors at the workforce. This would also provide a future pool for developing Foremen. The project rolled out targeting training in civil construction and front line management to field personnel to improve skill sets.

In terms of collaborative contracting and the project leaderships vision for a design and construct project delivered with an alliance culture, the challenge was to recalibrate the wider project teams experience on recent design and construct projects (which had been challenged or adversarial) and encourage a culture of collaboration. This was achieved by rolling out a bespoke training program to over fifty

project management personnel in transformational leadership and setting a common goal and agreeing common values.

Indigenous employment and training

Approximately 106 of our people identifying as having Aboriginal or Torres Strait Islander heritage worked on the project during construction, across a range of roles including construction workers, apprentices and office administrators. In addition to in-house training programs the project provided indigenous employees with training in:

- Certificate III and IV of Civil Construction
- Certificate IV of Civil Construction Supervision
- Certificate IV of Business Administration
- Environmental Awareness Training
- Microsoft Word, Excel and PowerPoint training
- First Aid
- Diploma of Frontline Management & Leadership
- Diploma of Quality Auditing



110
person
Project
Management
team



3500
personnel
worked on the
project between
2015 - 2017

