AUSTRALIAN CONSTRUCTION ACHIEVEMENT AWARD

# Pacifico – Acciona and Ferrovial JV

## WARRELL CREEK TO NAMBUCCA HEADS


*"Creativity is thinking up new things. Innovation is doing new things."*

*- Theodore Levitt*

# Contents

# 1. ORGANISATION

### Organisational profile

Pacifico is an Acciona Ferrovial Joint Venture (JV) established to deliver the Warrell Creek to Nambucca Heads (WC2NH) section of the Pacific Highway upgrade on the Mid-North Coast of NSW. The Project's major construction began in February 2015 and is on track for an early completion, by the end of Mid 2018. The project is jointly funded by the NSW and Australian Governments.

Pacifico is the Joint Venture organisation which has been established to deliver this project. As this is the first time the Joint Venture has been formed within Australia, establishing the company's profile, vision, culture, structure and operating systems was an extensive exercise which began back in mid-2014.

Pacifico aimed to ensure that they established themselves as a tier 1 contractor locally, particularly whilst working on the Pacific Highway upgrade project. Subsequently, a local team of experienced industry professionals was established. This included Engineers, Foremen, and department managers. This local team complemented the skills and experience of the two parent companies personnel from Acciona and Ferrovial. Pacifico also elected to engage their own blue collar workforce for the Project.

A number of key decisions were made by Pacifico at the beginning of the Project, one of which was to ensure they developed a professional team that would be capable of achieving their own expectations for the project, and setting high benchmarks in order to achieve this.

# 2. SCOPE OF WORK

The WC2NH project consists of the detailed design and construction of 19.6 kilometres of a new four lane divided road on the Pacific Highway between the northern end of the existing Allgomera deviation south of Warrell Creek and the southern end of the Nambucca Heads to Urunga Pacific Highway upgrade project west of Nambucca Heads. The project includes:

- Two grade-separated interchanges at Warrell Creek and Bald Hill Road, south of Macksville, and north facing ramps at North Macksville,
- Longitudinal bridges across Upper Warrell Creek, Williamson Creek, Warrell Creek, the Nambucca River floodplain (two) and the Nambucca River,
- Overbridges on Cockburns Lane, Rosewood Road, Albert Drive, Scotts Heads quarry access road, Bald Hill Road, Old Coast Road South, Mattick Road and Old Coast Road North,
- An underpass of the North Coast Rail Line at Cockburns Lane,
- Local roads and drainage and fauna crossing structures.

# 3. PROJECT LEADERSHIP TEAM

**Guillermo Ripado (Ferrovial) - Project Director**

Guillermo is a highly experienced project director with a distinguished 15-year career in construction. He has a proven track record of successfully managing large and complex infrastructure projects.

Guillermo has taken responsibility for a succession of challenging construction projects in Europe, including the A$2.2 billion Heathrow Airport Terminal T2A in London, UK and the A$720 million M4 Kinnegad – Kilkock Toll Motorway in Dublin, Ireland.

**Manuel Gil (ACCIONA) – Operations Manager**

Manuel is a seasoned Operations Manager with over 20 years' experience working on the construction and development of roads in Spain, Germany and Australia.

Manuel has been instrumental in mobilising the design and construction teams from the WC2NH ECI tender through to the delivery stage of the project. This has included ensuring the constructability of the Nambucca River Bridge through the use of U girders, in order to reduce the number of girders when compared with the traditional solution of T girders. This innovation reduced the cost and improved the program as well as minimised the impact to the community of Macksville during the construction of the Nambucca River Bridge

**Justin McCarthy (ACCIONA) – Construction Manager**

Justin has more than 17 years' civil construction experience, gained primarily on road and bridged projects with Tier one companies within Australia and the UK.

Throughout the WC2NH project Justin has maintained open and honest communication with the client to deliver, track and support project outcomes, and mitigate risk through early identification and communication of arising challenges. His management and guidance for all site-based operations, and leadership of the construction team has been integral to the project's success.

**Ash Tawfik (Ferrovial) – Quality Manager**

Ash is a highly experienced Quality Manager with significant experience in delivering previous roads projects for government clients in both metropolitan and regional areas. Extremely diligent, he works proactively to ensure all aspects of project quality align with relevant standards to facilitate on-time, on-budget delivery while maintaining safety for all personnel and the community.

Ash has taken responsibility for a succession of challenging construction projects in Australia, including the A$2 billion Ichthys Project Onshore LNG facilities, Darwin and the A$550 M M2 Upgrade Project, Sydney .

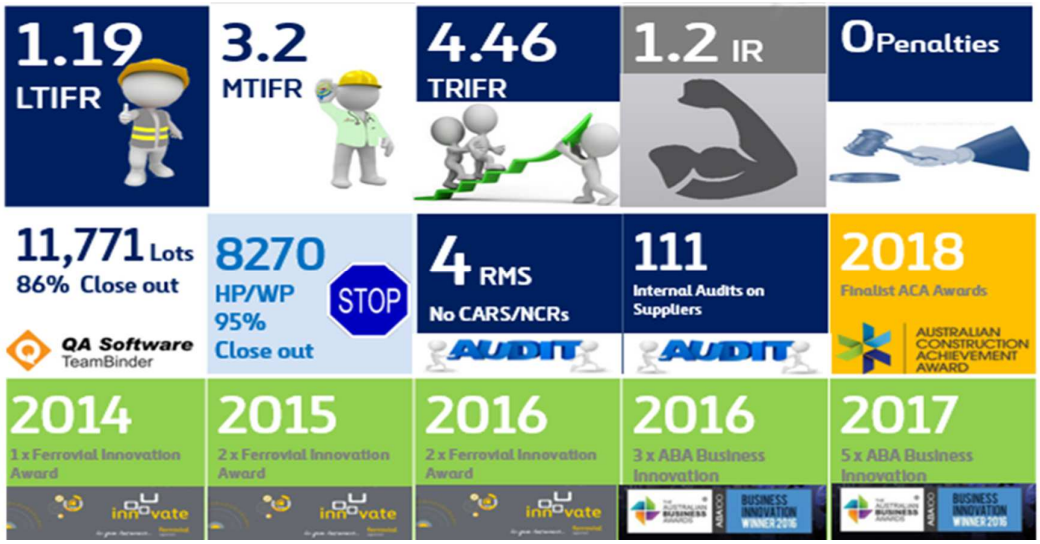
# 4. OUTCOMES ACHIEVED AGAINST PLANNED TARGETS FOR KEY PROJECT PARAMETERS

The key deliverables of the project were identified early and extended across a number of areas, with a key focus on innovation, safety and quality. Overall, the Early Contractor Involvement (ECI) process allowed the team to work with the client to develop and implement innovative and efficient design solutions to reduce the overall construction and operations budget through robust scheduling for timely completion and measured risk management.

Key high level deliverables included;

| **Key deliverables** | **Project successes** |
|---|---|
| Innovations to provide cost effective value for money solutions | The WC2NH ECI process supported collaboration with RMS as the team developed and implemented innovative and efficient design solutions to reduce the overall construction and operations budget. Introduction of a new precast girder section allowing for a greater span with fewer beams than standard super T construction achieved a reduced requirement of deck elements, reducing bridge maintenance significantly. |
| Improving Efficiency in Construction Methodology | Fabrication of precast elements such as full-width precast transfloors reduced project risk while accelerating construction. This approach also provided employment for the local community through a pre-cast facility established in Macksville for the production of all precast girders. |
| Significant Hydraulics and Hydrology issues to be addressed | Spans of up to 46m using a two-stage post tensioning process were used in the design to minimise impact on the watercourses. |
| Capability and capacity for planning & design of highway and associated civil works for a rural highway | Collaboration throughout the ECI process has allowed for a better understanding of the client's philosophy, leading to development of an urban design that is integrated with other sections of the road. |
| Environment | To assist pre-construction planning and on-site construction management, environmental site constraints were consolidated on a series of map-based plans for clarity. |

| | |
|---|---|
| Community | Through respecting and prioritising the needs of the local community, a number of alternatives were considered in consultation with RMS beyond those proposed during the development of the project to explore environmental, community relations, and traffic impact improvements. |
| Quality | Throughout the project we have demonstrated our commitment to raising standards through continuous improvement of the quality plans. Developed the innovative mobility systems to provide accessibility and efficient processes on-site. |
| Safe work practices | Over 2 million-man hours worked to 31/12/16 with 500 days Lost Time Injury Free. Consistent achievement of 'Green Lights' awarded by RMS on their safety 'traffic lights' dashboard. |
| Project achievements - design - | The team was able to ensure we satisfied of the client's requirements for the detailed design development of a new post tensioned girder solution for Nambucca River Bridge (U Max Girder). This girder system required detailed consultation and verification to provide full compliance with RMS' requirements as it was a new system for RMS. This included full planning and assessment of future jacking and bearing replacement, construction and maintenance techniques and durability for all elements. |



In addition to this, as per the original project objectives identified by Roads and Maritime Services, the client wanted to achieve the following;

- Develop solutions for the ultimate grade separation of the Pacific Highway and local roads including consolidation of accesses by the use of service roads
- Achieve safer driving conditions on the highway for travel speeds of 110km/hr
- Have acceptable roadway capacity for traffic volumes 30 years after opening
- Develop a dual carriage road that accommodates all vehicles up to and including B-Doubles, with capacity to be upgraded to three lanes in each direction in the future
- Provide acceptable access to properties
- Maintain highway access during flood conditions
- Integrate input from local communities into the development of the proposal (refer to community engagement strategy)
- Provide connections from the upgraded highway to the key centres of Warrell Creek and Macksville
- Develop delay management strategies to minimise disruption to local and through traffic and maintain access to affected properties and land during construction
- Provide transport infrastructure that is complimentary with surrounding land use
- Ensure the proposal outcomes achieve value for money
- Develop solutions that facilitate the staged construction of the proposal
- Effectively identify and manage WHS risk and hazards for the project, including both construction and maintenance hazards
- Where risks and hazards cannot be eliminated through design, communicate residual hazards to responsible parties for management during construction and maintenance.
- Efficiently manage road users impacts during construction
- Provide a dual carriage road with the potential to reduce crash rates to 15 crashes per 100 million vehicle kilometres travelled over the project length.

We feel that the entire Project Team has worked together to deliver a successful project for the client that will create value for the local community and make our roads a safer place for all Australians.

# 5. COMPLEXITY, DIFFICULTY AND OPTIMISATION OF THE CONSTRUCTION TASK

The focus of the Pacifico team is to ensure improvement in the construction process through creativity and innovation that would lead to improvement in the financial performance.

Two of the Innovative design and construction solution that have been implemented at the project were as follow :

- USE Twin U girders : First time to be used in the Australian market
- Underpass Under North Coast Railway (Pergola)

**USE Twin U girders**

Use of aesthetically harmonised and efficient twin U girders in the Warrell Creek To Nambucca Heads project in New South Wales in dramatic contrast to Super T girders used elsewhere on the Pacific Highway. Our design reduces the required number of girders from 558 to 166, thereby optimising cost and lessening the impact of maintenance regimes.

Structurally efficient, the standardised 'family' of structures accelerated the work program through innovative support features that simplify erection and provide greater stability. The use of precast slabs provide the same safe platforms than the Super T girders for construction. In addition, the design supports the achievement of urban design and landscape aesthetic requirements across the alignment and results in a form which characterises the regional context.

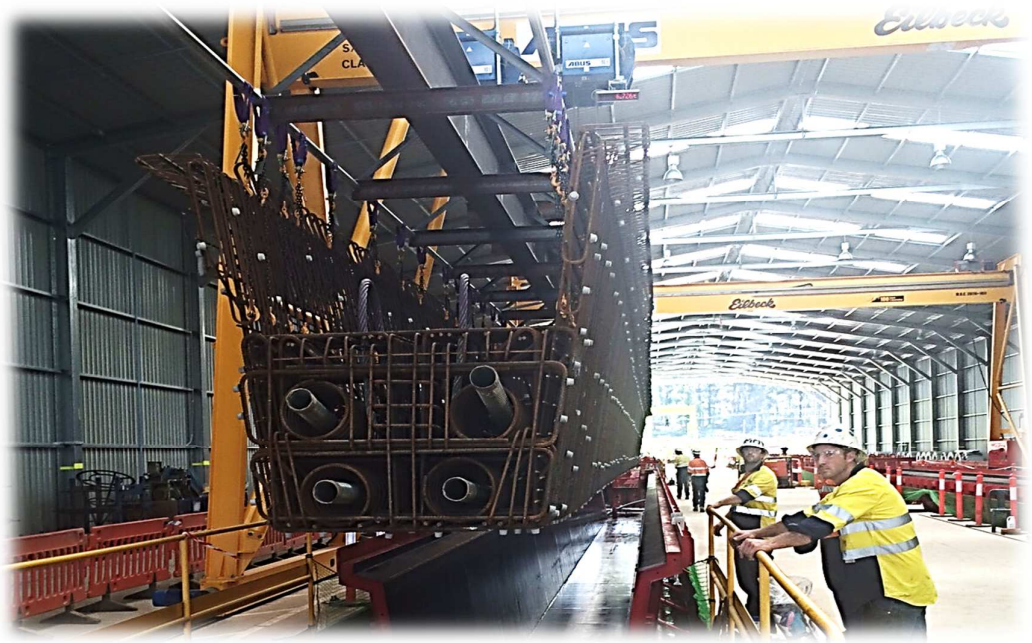
The superstructure for the bridges used in Warrell Creek to Nambucca Heads Project are the beam and slab type, and consist of prefabricated twin U girders (2250mm deep for river bridges and 1600 deep for overpasses) with 90mm thick precast transfloor slab and a 210mm thick insitu overlay.

The 2250mm deep U girders typically span 41.5m with a maximum of 45m, and the 1600mm deep U girders span 32m as simple supported structures. The 41.5m span length was chosen for the 2250mm deep U girders on the basis of matching the span length at the existing Lower Warrell Creek Bridge, and the required clear navigational channel width when the piers are skewed.

The precast U girders are fully post-tensioned with four tendons in the bottom flange. In order to limit the transfer stresses due to prestressing, the precast U girders are complemented by reinforcements to carry applied loading during service and ultimate limit states.

One of the advantages of post-tension versus prestressing is that you can stage the post-tension. One of the more frequent issues with prestressed girders is the management of the hog. Hog is a positive deflection caused in the girder due to the bending force created by the stress of the strands (similar effect if the girder is prestressed or post-tensioned). If the whole stress is applied to the girder and the girder is not ballasted with the permanent loads, the hog increases and could cause some deformations incompatible with technical requirements.

In this case, it is only required to post-tension half of the tendons for lifting reasons. With half of the post-tension done, the girder is removed from and handled outside of the casting mould. The second stage of post-tension will be done once it is sure that the ballasting with permanent loads is close (about 2-3 weeks).




**Execution:**

Among the advantages of a dramatic reduction of the number of precast members for erecting a bridge span, is the number of special transports to be carried out. This minimises the disturbances to the motorists, highway stakeholders and community in general.

Aligned with this goal, the precast yard was located in order to optimise the girder transport runs, and, when possible, use the new alignment as the main route for delivering the girders. The proposed and current location complied with all the requirements from the Project Deed and is consistent with the Conditions of approval.

According to the construction wet programme (that takes into account potential wet weather affecting the construction of the substructures), four girders per week are required.

The first decision was to determine the number of production lines in order to comply with the technical specifications. It was decided to establish two lines of production, based on a three day cycle for manufacturing four girders from Monday to Saturday.

Due to post-tension, some tasks are required post-production such as: second stage of post-tension; grouting of the tendons; finishing the infills for covering the post-tension anchorages; and prepare and attach the epoxy mortar pads for bearings.

One of the most challenging factors was the timeframe for the establishment of the precast yard. The Warrell Creek to Nambucca Heads project is a Design & Construct contract. The contract was signed in July 2014 and the design phase lasted 6 months. The decision of self-perform was taken in November 2014 and the requirements from the project were to have manufactured the first girders in October 2015.

Eleven months for transforming a swamp paddock into a five hectares precast yard, up and running, was a very big challenge for the project.

This challenge was especially difficult to achieve because of the innovation in the design of the girders. Every single component was required to be tailor made for this project. There were no straddle carriers in the industry to handle this kind of girders. There were no moulds in the industry to cast this kind of girders. Also gantry cranes and dimension of the shed was designed considering the unique conditions of this type of girders.

Fortunately, the Client, Road and Maritime Services, was aligned with our decision and supported the establishment of the precast yard. The solution adopted was compliant with all permit and conditions in accordance to the Minister Conditions of Approval for this project.

Once the facility was ready to manufacture, the next challenge was to have the right workforce on board for running the yard as per the project requirements: on time; and complying with quality, community, environment and safety specifications. The establishment of the precast yard was finished on time, in October 2015.

Another big challenge was to identify the right workforce. 50 employees with experience in precast manufacturing were hired and allocated to the project. The workforce was key in the whole process as well as the expertise of Ferrovial Agroman establishing this type of precast facilities. A robust training and tutoring program in relation to the manufacturing process was put in place.

A learning curve of 12 weeks was needed for having the precast facility in peak production, achieving the goal of four girders casted every week. Peak production was achieved in January 2016.

## Outcome

The standard approach of using Super T's would have required 415 special transports. The figures associated with our innovative solution of the U-girders are:

- 14 girders delivered along new alignment, that means internal transport with no disturbances to third parties;
- 72 girders delivered only crossing the Pacific Highway under traffic control, with minimum disturbances to motorist and community;
- 80 girders delivered along the Pacific Highway through Macksville. This needed less than 20% of the special transports (over size over mass) required with standard solution.

As a result of the above, environmental, community and commercial benefits are obvious:

- Optimisation of delays and travel time to Pacific Highway motorists;
- Reduction of fuel consumption and CO2 footprint;
- Reduction in time spent in erection of superstructures;
- Optimization of materials used for bridge superstructure construction.

## Underpass Under North Coast Railway (Pergola)

As part of the works to be undertaken by Pacifico for the design and construction of the Pacific Highway Upgrade – Warrell Creek to Nambucca Heads, a review of the design was undertaken in consultation with RMS, with a particular focus on the area at Upper Warrell Creek which was a **Bridge Over Upper Warrell Creek and North Coast Railway** in the tender design.

The Pacifico proposed **innovative design** which lowered the vertical alignment to pass under the North Coast Railway consisted of :

**Bridge Over Upper Warrell Creek**

- Two carriageways on a single substructure with provision for a future structure to provide a 3rd lane of the Pacific Highway in each direction

**Underpass Under North Coast Railway (Pergola)**

- Two carriageways running under the North Coast Railway widened to cater for a future 3rd lane of the Pacific Highway in each direction

**Cockburns Lane Overbridge**

- Single span of 41.67m crossing over the northbound and southbound carriageway with provision for a future wall abutment to accommodate a 3rd lane of the Pacific Highway in each direction

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This new structure, referred to as Railway Underpass, presents the following advantages when comparing with the Tender Design:

- Alternative detailed design offers improved operational outcomes compared to the tender design through grade reduction, with design standards agreed in consultation with RMS (including agreement to reduce median width) ;
- Reduced environmental impact than the tender design, reducing clearing of threatened flora and providing improved operational noise and visual outcomes for nearby residents.
- Safer to construct as there will be fewer interfaces with the railway
- Alternative detailed design offers Construction benefits as:
    - No need to construct the 2 piers with additional piling close to the railway with limited track possessions
    - The average length of the UWC bridge columns would decrease from 20m to 10m
    - Deletion of large headstock over the existing railway track and 16 no. 46m long beams. Associated constructability and logistic benefits would be achieved by deleting the need to erect the headstock over the railway track and the long beams.
    - There is no need for a second stage of stressing for the beams once the deck is finalised.
    - Less geotechnical treatment at abutments.
- The alternative detailed design would require less out of hours work and, therefore, less noise and amenity impacts on the approximately 10 residences in the vicinity.
- The alternative design would reduce maintenance costs.

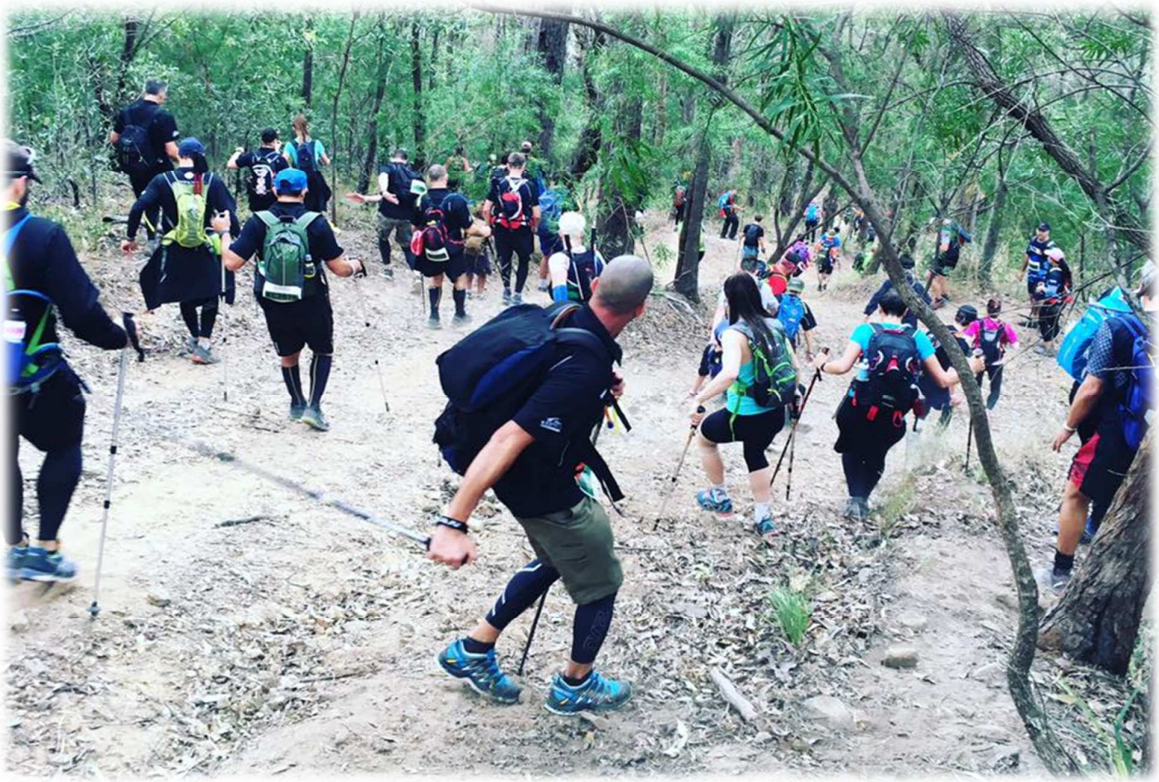
# 6. EXCELLENCE IN LEADERSHIP

Pacifico acknowledge that it is the actions of the leaders and the way in which the leaders communicate and engage with the Project Team that determines the integrity and effectiveness of that leadership.

The project leadership team took the initiative with developing a Leadership Framework which encompasses the tactical level approach to implementing the aligned collective goals through the lifetime of the project. The framework started with developing a leadership management plan for which the Senior Leadership Team (SLT) used to create the leadership environment and culture on the Project to allow the Wider Project Team to deliver against the collective milestones of project success.

The following are the selected collective goals which will be covered under this submission:

- Vision for Supervision Program
- Team building (Kokoda Challenge)
- Health and wellbeing program
- Pacifico Innovation Program
- Behavioural Based Safety (BBS)
- Community open day - Nambucca Bridge walk



**Vision for Supervision Programme:**

Vision for Supervision is a leadership development program which focusses on:

- ✓ Personnel leadership
- ✓ Safety leadership
- ✓ Quality commitment
- ✓ Environmental leadership.

Pacifico established four groups of 30 project personnel, from varying backgrounds and employers and are training them through each of the modules as part of the program.

Once complete, the Pacifico Supervisors wore blue hard hats to enable them to stand out in the field works and also feel proud to be a Pacifico Supervisor.

Pacifico Supervisors share a vision beyond just their work area, helping others to plan works with activity leaders to ensure a coordinated interaction between the work groups.

- ✓ Promote communication between all personnel.
- ✓ Have a planned approach to all works, ensuring safety, environmental, community and quality is recognised as key.
- ✓ Present our site as a tidy, respected and safe site.
- ✓ Ensure that time is always taken to ensure safe construction methods and execution of any work.
- ✓ Work as a team, at all times by helping others and ensuring that all areas and disciplines are always working together.
- ✓ We are Proud to be a Pacifico Supervisor

## Team building (Kokoda Challenge)

As part of the leadership programme, the SLT wanted to select an usual team building activity. The purpose was to select something to challenge the team, something can create leaders and remain with the team forever.

9 teams of 4 each, plus support crews (40 staff), participated in the Kokoda challenge. it is commonly referred to as the toughest team endurance event in Australia: 96km of winding tracks through the Gold Coast hinterland, 5,000m of vertical elevation to climb (and descend!) and 13 checkpoints to get through.


*"Some people fell, rolled their ankle, injured their knees, suffered tremendous blisters and even crawled up a mountain with their bare hands (rumour says this one was wearing a swim suit and no poles!). But they all kept going until they couldn't walk any more, they were shivering with cold, exhausted, or someone in their heads said: "Stop, this is getting ridiculous". But despite all this I felt that the team spirit was there! Some people swapped teams and kept going, some support crews ended up supporting other teams too and it didn't matter because we all had the same objective, give our 100% and get through it. I witnessed some real leaders who told their teams to keep going as they had only 16 km left, and how hard were those 16km… but they finished, and they are proud." L. Guillermo Ripado Project Director*

Before the event:

- ✓ The teams trained for 8 months before the challenge on a monthly and weekly basis in the last 3 months.
- ✓ Team meeting with their support crews
- ✓ Information and planning sessions for the challenge
- ✓ 9 Pacifico teams started, 5 teams completed the challenge.


## Health and wellbeing program:

There's lots of people in this construction industry who spend so much time working and don't check their health and it's too late sometimes to take an action. The project leadership team have committed to look after their employees and have done monthly campaigns such as follow:

- Health check blood pressure and cholesterol (completed)
- Skin cancer check monthly campaign (completed)
- Witness the fitness by professional fitness trainer 3-month program till December 2016.


## Pacifico Innovate:

Pacifico launched their internal innovation program for good ideas such as:

- ✓ Value for Money
- ✓ Improvement to construction processes
- ✓ Improvement to the way we perform an activity on site
- ✓ Best Practices Safety, Quality, Environment and Community
- ✓ Something you have already implemented in the project

Ideas reviewed on 2 monthly basis and awards issued to the winning idea with the most vote by the leadership team.

## Behavioural Based Safety (BBS)

At the heart of the Alliance's leadership and culture was the recognition that people are key to achieving desired health, safety and overall project outcomes and thus Pacifico implemented a Behavioural Based Safety (BBS) Programme driven by positive leadership and a continual improvement culture where individuals are empowered to make decisions and enact them.


Core elements of the BBS programme include:

- Ensuring all workers are aware that safety is the core value and will never be subordinate to other business requirements (including time and cost).
- Establishing and encouraging an open door policy across the site and ensuring that business leaders regularly communicate with all members of the team
- Ensuring that communication channels between all facets of the Project remain open.
- Recording health and safety statistics for the Project and publishing the statistics across the site.
- Commencing all formal meetings with a discussion on health and safety.
- Providing immediate feedback to team members on both desired and "at-risk" behaviours.
- Providing opportunities for peer-to-peer observation, discussion and training.
- Training observers in hazard identification.
- Sharing knowledge of people-based safety principles.
- Involving all key stakeholders in the program including employees, supervisors and subcontractors.
- Using correct behaviours as the basis for the reward and recognition of individual or team safety excellence.

## Community open day - Nambucca Bridge walk

Pacifico leadership team's major milestone was to open 14 kilometres of the 20 kilometres Warrell Creek to Nambucca Heads upgrade which includes bypasses of Macksville and Nambucca Heads in time for the 2017 Christmas holiday traffic.

RMS with the support of Pacifico planned a special open day to celebrate the Macksville and Nambucca Heads bypass with the local community.

The project facilitated a once in a lifetime opportunity to walk on the new bridge over the Nambucca River before it opened to traffic, with the support of the Nambucca District Band who played at the opening of the Macksville bridge in 1931 and service club sausage sizzles.

A fantastic community celebration was arranged at the new Nambucca River bridge walk on Saturday 16 December prior to the Monday opening which saw almost 4,000 people walk the bridge and enjoy the amazing views.

The NSW Minister for Roads participated in the celebrations and announced that the bridge would be named the "Phillip Hughes Bridge" in honour of the late local cricketer.