Country Bridge Solutions

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Abstract

Local councils face the growing challenge, as road authorities, of maintaining and eventually replacing ageing bridges on regional and local roads.

The NSW Government is developing an innovative and cost effective solution to enable regional councils to replace bridges on their roads.

Roads and Maritime Services is undertaking this ambitious project by utilising its expertise and collaborating with local government to address the task of replacing its deficient bridges.

The project will deliver benefits to businesses, industry and the communities of NSW by improving access, replacing deficient assets, and aligning government and industry to deliver a fit for purpose solution.

It is considered that this solution will be applicable to regional councils in other states of Australia.

Introduction

Our country bridges are critical infrastructure in regional communities, connecting our towns, bringing our communities together and allowing the growth of national and state economies.

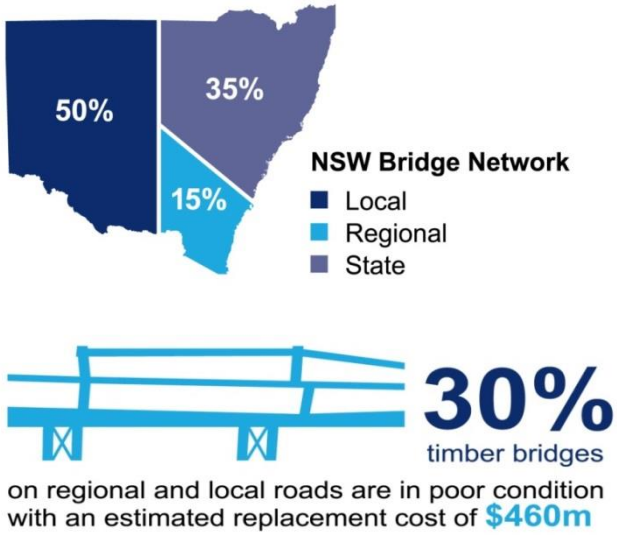
The NSW Government is seeking to partner with regional councils to develop an innovative and cost effective bridge replacement system to better connect rural communities and to create regional employment opportunities.

Local councils face the growing challenge, as road authorities, of maintaining and eventually replacing ageing bridges on their regional and local roads.

Country Bridge Solutions will:

- Provide regional and rural councils with simple and easy to build bridge solutions developed by expert bridge and construction engineers from Northern Regional Office and Bridge Engineering of RMS
- Deliver cost savings through the use of standardised prefabricated bridge components
- Use existing council resources and regional manufacturing capability to replace and build bridges

- Assist council staff during investigation, design, construction and maintenance through the provision of technical guides
- Promote regional economic growth through local employment opportunities



Country Bridge Solutions (CBS) targets the smaller bridges having a maximum 12m span length and AADT of maximum 1000 vehicles per day.

Typical three span timber beam bridge, Butterfactory Lane, Grafton

The solution

The project was delivered in two phases:

Phase 1: Development

- Liaison with local government
- Development of draft designs
- Development of draft guides

Phase 2: Proof of Concept

- Selection, design and construction of pilot bridge
- Feedback into design and guides
- Finalise design and guides
- Provide CBS to local government

Phase 1 commenced in August 2014 with workshops held with 39 councils and eight industry organisations.

The feedback from these meetings indicated that local government wanted an adaptive, robust design that, once constructed, required little maintenance during its life. The requirement to design for higher loads to meet the 'last mile' needs of the road network was also an objective.

Liaison with local government continued throughout the project, including advice and guidance from the IPWEA (NSW) Roads and Transport Directorate and the Bridge Working Party.

Based on feedback from the workshops, Roads and Maritime Services refined its initial concept design for a prestressed concrete modular bridge system.

CBS is designed in accordance with AS5100 and includes the following features:

- Design loading: SM1600
- Design life: 100 years
- Designed for overtopping during floods
- Low performance traffic barrier

It was important to develop a modular system that was simple to mass produce, easy to transport, easy and safe to construct, and economical.

The development of the double–T bridge deck modules is a critical component of the CBS design.

A prestressed concrete double-T cross section was selected as an efficient cross section. The partial prestressing was designed to result in minimal hog, so that the need for a topping deck slab was eliminated. The module depth was standardised to 600mm depth for all span lengths, in order to enhance performance. An innovative bridge bearing installation method has been developed for the project.

The draft designs included:

- Type 1: Two lanes with stitch pour for 8, 10, and 12m spans
- Type 2: Single lane with stitch pour for 8, 10, and 12m spans
- Type 3: Single Lane with butted joint for 8, 10, and 12m spans

Roads and Maritime Services also developed draft guides for bridge suitability and investigation, design, construction and management to assist councils during this phase.

The draft guides included:

- CBS Overarching Guide
- CBS Suitability and Investigation Guide
- CBS Design Guide
- CBS Construction Guide
- CBS Operation and Maintenance Guide

Phase 2, proof of concept, involved building a trial bridge.

A site in the Tenterfield local government area was selected to build the trial bridge on the basis of its suitability and in accordance with the draft Suitability and Investigation Guide.

The new Type1 Bridge (3 x 10m spans) replaced the existing timber beam bridge at Bookookoorara Creek on Mt Lindesay Road, 34km North of Tenterfield.

The site investigation was undertaken by Tenterfield Shire Council utilising the draft Suitability and Investigation Guide.

Roads and Maritime Services designed and constructed the trial bridge with Tenterfield Shire Council completing the approach roadworks. The bridge was equally funded by NSW and Federal governments and Tenterfield Shire Council.

The site identified for the trial bridge is a remote site that required a spread footing design to accommodate the uneven granite foundations.

Construction commenced in March 2016 and the crew demobilised from the site in early August 2016.

Construction of the spread footings took some additional time due to site conditions; however the erection of the precast abutments, wing walls, pier headstocks and deck completion were completed in six weeks. The unit rate costs for the superstructure are particularly competitive.

The Bookookoorara Creek trial bridge, August 2016

Following completion of the trial bridge Roads and Maritime Services led two workshops. The first workshop captured feedback from the construction crew and council. The second workshop was then held with the design team and considered this feedback while reviewing the designs and guides prepared for the project.

The standard designs and guides have now been finalised and are available for local government.

While the CBS superstructure will remain the same for each bridge location, the design of the bridge substructures should consider the unique characteristics of each site location.

CBS may not be suitable for all bridge sites and configurations, the guides (especially the investigation section of the CBS Suitability and Investigation Guide) may be used for any type of bridge and site.

Conclusion

Roads and Maritime Services has undertaken this ambitious project by collaborating and utilising its expertise to assist local government address the task of replacing its deficient bridges.

The project has presented an opportunity for Roads and Maritime Services to work together with local government to produce a result that meets the challenging task of replacing ageing bridge assets.

The designs available include:

- CBS Type 1: Two lanes with stitch pour for 8, 10, and 12m spans
- CBS Type 2: Single lane with stitch pour for 8, 10, and 12m spans
- CBS Type 3: Single Lane with butted joint for 8, 10, and 12m spans

The supporting guides include:

- CBS Overarching Guide
- CBS Suitability and Investigation Guide
- CBS Design Guide
- CBS Construction Guide
- CBS Operation and Maintenance Guide

Local government is encouraged to utilise this valuable resource.

www.rms.nsw.gov.au/business-industry/partners-suppliers/lgr/country-brige-solutions.html

References

Roads and Maritime Services policies, procedures, and guidance notes.

Australian Bridge Design Code AS-5100

Acknowledgements

- NSW Roads and Maritime Services
- IPWEA NSW Roads and Transport Directorate, Bridge Working Party
- Tenterfield Shire Council
- NSW local government contributing councils

Author Biography

David Andrews BE(hons1), MBA, FIEAust, CPEng., NER

David commenced his career as a junior local government engineer at Dumaresq Shire Council and progressed to the Director of Engineering Services for Clarence Valley Council in regional NSW.

Throughout his career David has designed and built many small bridges and was awarded the Engineers Australia National Local Government Medal in 1993 for the development of a suspended scaffold system for safe bridge maintenance.

David is the founder and current chairman of the IPWEA (NSW) Roads and Transport Bridge Working Party. He joined Roads and Maritime in 2009 where he is the Senior Project Development Manager for major projects including several Bridges for the Bush projects in Northern Region.

David is the Project Director for the ambitious Country Bridge Solutions project.

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Wije Ariyaratne has an undergraduate engineering degree from the University of Ceylon, a Master of Engineering degree from the University of NSW, and a Graduate Diploma in Business Management from the Deakin University. He is a Fellow of Engineers Australia and an Adjunct Professor of Engineering at the University of Technology Sydney.

He has over 44 years of service with the Roads & Maritime Services of NSW and its predecessors. He has a very wide experience in bridge engineering covering design, construction, and maintenance of bridges.

In 1996, he pioneered the development of a Non-destructive Dedicated Bridge Proof Load Testing Facility - the only such facility in Australia, to test bridges suspected to be under capacity to carry Higher Mass Limit (HML) vehicles. Determining the load capacity of such bridges by non-destructive load testing RMS was able to reduce the number of bridges estimated to be strengthened or replaced.

He represents Road and Maritime on a number of national committees such as Standards Australia, Austroads, and other industry liaison groups and currently chairs the committee revising AS5100 Bridge Design Code. He is also an Industry Advisory Net member of University of Technology Sydney, University of Western Sydney and University of NSW, Member of Australian Structural Health Monitoring and Member of Advisory Panel for CRC on Bridges and Structures. At present, he is an industry partner on a number of ARC Linkage Research projects on bridges. He has forty one (40) technical presentations to his credit.