NEW EQUIPMENT & SYSTEM APPROVAL PROFORMA

Ref: *12/26738*

Note: the prompts given below are only a guide to the information required for approval. Dependent on the type of equipment or system that requires approval delete any section that is not applicable or include additional information if necessary. Mandatory fields are marked with an asterisk (*).

1 **Equipment or System to be approved** *

Carbonloc Engineered Fibre Composite Panel and Fabricated Products (including railway bridge transoms, track sleepers, bridge beams and bridge decking)

2 **Originator** *

Name: Dr Gerard van Erp Company: Carbonloc Pty Ltd

3 **Introduction** *

Carbonloc produces Carbonloc engineered fibre composite panels and designs and manufactures a range of fabricated products utilising the panel. ARTC and Carbonloc Pty Ltd (formerly LOC Composites) have been working on the development of a fibre composite transom for several years. In November 2007 twenty-two fibre composite transoms were installed on the Up Main underbridge at Farley at 195.606km on the Main North line. Since that time the fibre composite transoms have been subjected to significant train traffic and their performance has been monitored and found to be excellent. Carbonloc bridge beams have been extensively tested and approved by Qld Main Roads Department. Carbonloc bridge decking has been widely used by Qld Main Roads, Brisbane City Council, Redlands City Council, Railcorp NSW and Manninghan Shire Council Vic. Carbonloc wishes to offer these products to ARTC and is seeking type approval for Carbonloc engineered fibre composite panels and associated products.

4 **Determination of Need** *

It is widely recognised that high quality hardwood timber is becoming scarcer as the population of good hardwood trees in harvested areas reduces. Over recent decades there has also been a general deterioration of timber transom/sleeper/beam/decking quality in Australia. Associated with the declining resource and quality of the timber product there has been strong upward pressure on the price of hardwood products. In particular good hardwood transoms and bridge beams have been particularly difficult to obtain.

The Carbonloc engineered fibre composite railway products developed by Carbonloc Pty Ltd have proven to be a viable alternative to traditional hardwood timber. They offer comparable weight and workability, greatly improved durability, high strength, ease of transportation and lower energy consumption during manufacture. Additional information is included in the technical report appended to this application.

5 **Significant Change or Not** *(as determined by the Manager Standards)* *

This change in equipment or system is assessed as SIGNIFICANT

6 **Review Panel** *(as determined by the Manager Standards)* *

- John Furness - Manager Standards
- Peter Prasad - National Bridges & Structures Engineer
- Gregory Riches - Delivery Manager - Hunter Valley
- Denis Snowden - WHS Co-ordinator

7 **Safety**

From a safety perspective the Carbonloc engineered fibre composite panels and associated fabricated products are very similar to hardwood timber. Proposed Inspection Frequencies and Defect Intervention Levels are listed in Appendix A. Handling and safety instructions and MSDS are included as Appendix B and C respectively.

8 **Performance and Suitability**

Carbonloc engineered fibre composite panels are fire, insect and termite and water resistant. They can be cut and drilled like hardwood timber and are similar in weight to hardwood. Whilst there are currently no Australian Standards or ARTC standards for fibre composite transoms, the current railway products have been designed by experts in the field in close collaboration with the University of Southern Queensland in Toowoomba with adherence to relevant Australian Standards for loading conditions and European Code for the design of fibre composite structural elements. An independent Consulting Engineer (Dr Nick Stevens) was engaged to conduct a theoretical, laboratory and in-track verification of the new transom. Monitoring of the transoms in service was conducted in December 2007 initially and again in November 2008. Laboratory testing of the transoms was undertaken at the University of Queensland and finite element analysis of the transoms as installed has been completed. This work concluded that the transom design satisfies the requirements of AS5100, the Australian bridge design code, for a design axle load of 300 kN and that the calculated fatigue life of this transom exceeds 50 years. Copies of these test reports are attached.

The Carbonloc bridge beams have been subjected to a similar process and test reports are attached. Carbonloc bridge decking has been extensively tested to Australian Standards and test results are attached.

The materials used in the Carbonloc engineered fibre composite panels have been widely used in industry for many years and are accepted as harmless to the environment. The panels and products can be 100% recycled. They exhibit excellent durability with expected life in excess of 100 years in the natural environment. Their functional life is dependent on the design of the fabricated products but in all cases a design life in excess of 50 years is applied. Carbonloc engineered fibre composite panels offer considerable environmental advantages due to the low embodied energy in the panels, the use of bio waste products in their manufacture and their recyclability. All products are designed with consideration of the required electrical performance. The base panels are highly non-conductive in their nature.

(i)	**Use in other rail networks** Carbonloc engineered fibre composite panels have been widely used in fabricated products in many applications as described in Section 3 above. The fibre composite transoms have not yet been used in other rail networks. However a much larger version of the fibre composite transom is used by Qld Main Roads as a replacement for hardwood bridge beams. As part of a Qld Government funded project these bridge beams have been subjected to an extensive testing program by an independent third party and they have exceeded the specifications. A copy of the test report is attached.
(ii)	**Use in the ARTC network** Twenty two fibre composite transoms are installed on the Up Main underbridge at Farley at 195.606km on the Main North line.
(iii)	**Issues arising from usage of the equipment/system** WPH&S - appropriate protective equipment is required when working with these products similar in nature to that required for working with timber. Fabricated products may contain reinforcing elements that should not be cut or drilled. Where this is the case, zones where drilling & cutting are not permissible will be clearly marked permanently on the product.
(iv)	**Changes required to infrastructure or systems for use of the equipment** Apart from changes to ARTC inspection standard / procedure there is no changes required to the infrastructure or systems for use of the equipment. During installation standard wood working tools such as drills and saws have to be replaced with tools suitable to cut and drill composites. These tools are readily available from a number of suppliers.
9	**Reliability** Extensive testing by the University of Southern Queensland has shown that the fabricated products display highly repeatable performance measures that correlate very consistently with the design parameters. These results are shown in the attached test reports. Extended fatigue testing by both the University of Southern Queensland and the University of Queensland demonstrate the excellent fatigue performance of Carbonloc transoms and bridge beams with service life expectancy in excess of 50 years under the respective loading regimes. Test reports are attached for further reference.
10	**Maintainability** The fibre composite transoms are easily maintainable and will fit in with current maintenance regimes. No special training is required for the installation or inspection of these products as current techniques are appropriate.
11	**Approval** * Carbonloc engineered fibre composite panels and associated fabricated products designed and manufactured by Carbonloc Pty Ltd.
12	**Conditions of Approval** * Carbonloc engineered fibre composite panels and associated fabricated products must be designed, manufactured and supplied by Carbonloc Pty Ltd.

13	**Does the Originator accept the additional Conditions of Approval as set by the Review Panel:**	Yes	☑	No	☐	N/A	☐

14	**Sign off**			***ARTC office use only***
	Review Panel:			
	John Furness	signature on file	Date:	12/06/2012
	Peter Prasad	signature on file	Date:	14/06/2012
	Gregory Riches	signature on file	Date:	4/06/2012
	Denis Snowden	signature on file	Date:	12/06/2012

Approved by ARTC Operational Safety & Environmental Review Group 12 June 2012 subject to the condition that full engineering design being required for bridge beams and decking.