

TO	<ul style="list-style-type: none"> ➤ Corridor Managers ➤ Asset Managers ➤ Structures Representatives ➤ Performance Managers 	<ul style="list-style-type: none"> ➤ Project Managers ➤ Project Engineers ➤ Civil Team Leaders ➤ Contractors
FROM	General Manager Technical Standards	
DATE	14/06/2020	
SUBJECT	Track and Civil Code of Practice – Section 9 Structures – Technical Note ETN-09-03 (v1.0)	
TITLE	ETN-09-03 FFU Transom & Deck Panel Technical Note	

1. References

- a) CoP Section 9 “Structures”.
- b) ETE–09–01 “Structures Inspection Standard.
- c) FFU Structures Inspection Standard ETE 09 01
- d) Synthetic Sleeper Reference - Installed in 1980~94 & Projects List 2003-14.
- e) Installation Manual, Sekisui Chemical Co. Ltd.
- f) Sekisui Material Safety Data Sheet
- g) Sekisui – FFU Synthetic Sleeper: Railway Technology – State of the Art (Catalogue).
- h) Sekisui – FFU Synthetic Wood: Railway Technology – Working Guidelines (Catalogue).

2. Background

Fibre-reinforced foamed urethane (FFU) transoms and panels are designed and manufactured by Sekisui Chemical Co. Ltd of Japan and distributed in Australia by Delkor Rail Pty Ltd.

The FFU components would provide an alternative material to timber for transoms and panel decks for steel bridges on the ARTC network. They have equivalent material characteristics to that of timber and they are specifically designed for individual axle loads and bridge configurations with up to 50 year design life.

This technical note outlines the application, design, installation and repair procedures for FFU products until all the structures standards are updated to include FFU products.

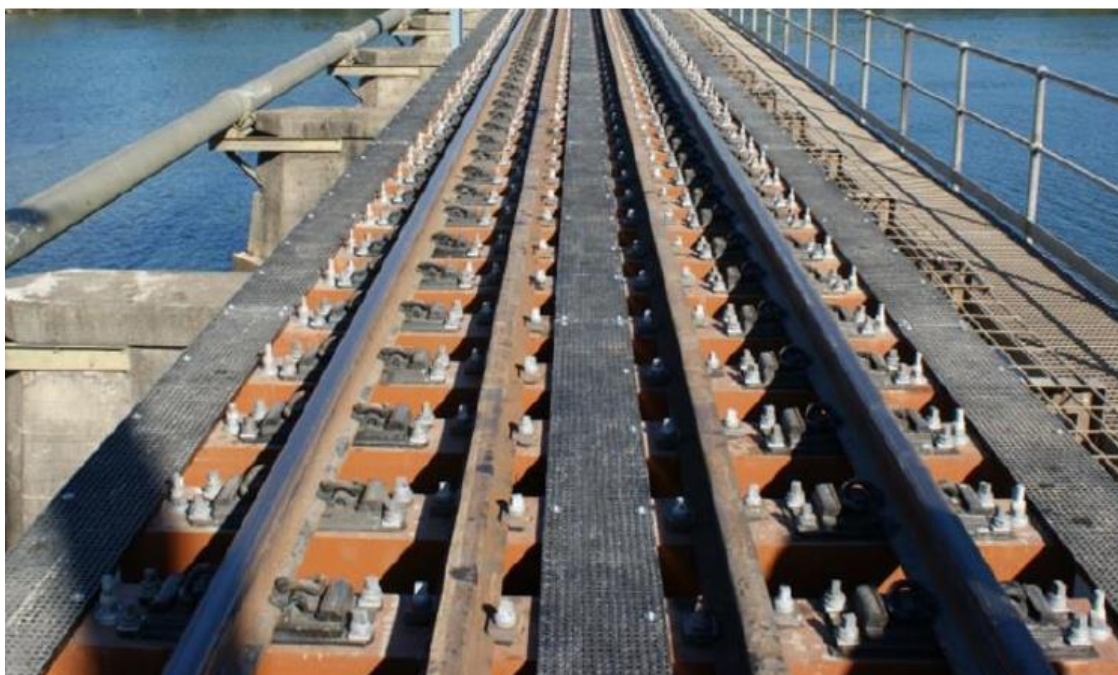


Photo 1: FFU Transoms installed on Minnamurra Underbridge, Sydney
(courtesy of Sydney Trains)

3. Objective

The object of the Technical Note is to provide guidance on the procurement, installation and repair of FFU transoms and deck panels until all the Structures Standards are updated.

FFU products are intended for use as underbridge transoms and decks only. ***FFU transoms must not be used for spot re-transoming as they may lead to potential track problems associated with the effects of differences in elastic modulus between timber and FFU.***

4. Product Information

The FFU products are manufactured by pultrusion and composed of rigid polyurethane resin with continuous glass fibre reinforcement.

Some of the advantages of FFU products are listed below:

1. Thickness, width, length and profile are all modifiable within 1mm accuracy.
2. FFU products can be pre-drilled for fixations and transom boxes and painted a variety of colours.
3. Excellent mechanical strength with minimal variance.
4. Comparable weight to 250 x 180 x 2800mm timber transom:
 - a. FFU ≈ 90 kg; Timber ≈ 90 kg; Concrete ≈ 300 kg.
5. Very low coefficient of water absorption.
6. Screw spikes have a high pull out strength and also retain strength and integrity after repeated use.
7. Excellent resistance to weather.
8. Highly repellent against pests, meaning there is no need to apply antiseptics and therefore FFU products causes less environmental harm than timber.

5. Supplier Company

Delkor Rail Pty Ltd (Australian Distributor via Sekisui Chemical Co).

Contact: George Stamboulis.

Email: george@delkorrail.com.

Phone: + 61 2 97092918.

Mobile: 0411357116.

Address: 74 Harley Cres, Condell Park NSW, 2200 Australia.

6. Application

The Technical Note applies to all ARTC Business Units for the design, installation and repair of FFU transoms and deck panels on the ARTC network.

7. Design

All designs are undertaken by Sekisui. FFU transoms are designed to mimic the physical and material characteristics of timber transoms.

FFU deck panels will necessitate specific design for individual bridges. As such, the full design brief must detail axle mass, speed, track alignment, deck dimensions, ballast depth, holding down bolt and their locations, ballast kerb requirements, support system, etc.

FFU products are designed to achieve a high level of manufacturing precision that can eliminate the need for onsite modifications. They can be cut to specified precision, predrilled, pre-cut and prepacked. To facilitate this, the purchaser must provide supplier with accurate survey and rail alignment data.

The purchaser must provide the supplier with fully completed FFU DESIGN CONDITION form for transoms, sample attached in Appendix 2, including axle mass, speed, rail offsets, product dimensions, packers and holding down bolt size and locations if they are required to be pre-drilled by manufacturer.

Line	Axle Mass (t)	Speed (kph)
Hunter heavy haulage lines (New bridges)	35	>80
Hunter heavy haulage lines (Existing bridges)	30	>80
All other lines	25	>80
Lines requiring specific approval of Corridor Manager	23	>80

Table 1: Axle masses for FFU transoms

8. Installation and Repair Methodology

All installation and repair of FFU products shall be carried out in accordance with the manufacturer's manual, "Installation Manual, Sekisui Chemical Co. Ltd". Project Manager to provide a copy of the manual to the contractor undertaking the work.

FFU transoms should be installed as detailed in Appendix 1.

Screw Spike Dimension	Hole Dimension	Note
22 dia x 150mm long	17 dia x 140mm deep	Standard screw spikes with Fe6 washer
24 dia x 150mm long	19 dia x 140mm deep	Standard screw spikes with Fe6 washer
24 dia x 165mm long	19 dia x 150mm deep	Standard screw spikes with Fe6 washer

Table 2: Recommended hole dimensions for screw spikes

FFU transoms can be manufactured with slip prevention. Instructions for the location and the dimensions of the slip protection (sand based) should be given to supplier.

Delkor will assist with site inspection and training for the procurement, installation and maintenance of FFU products on as required basis.

9. Quality

Both the supplier, Delkor, and the manufacturer, Sekisui, are certified to ISO9001. Supplied products must be thoroughly checked against drawings to ensure they are dimensionally accurate and free from defects. Any defective product will be replaced at the expense of the supplier. Installed products are to be quality assured by the ARTC Project Manager.

10. Traceability of FFU Products

FFU products are manufactured from non-naturally occurring materials. The manufacturing process and conformance testing records for each batch of FFU products shall be supplied by the manufacturer and retained by the corridor manager. The corridor manager shall maintain traceability records of all FFU products used in their corridor.

11. Inspection

The inspection frequency of FFU transoms and panels is the same as for steel bridges. All inspections must conform to the requirements of Structures Inspection Standard ETE-09-01 and intervention levels specified below.

Bridges – FFU Products			
Transoms and Deck Panels	Coating Chipping	> 25mm in diameter	D
		≤ 25mm in diameter	M
		> 5mm deep	D
		≤ 5mm deep	M
	Cracking	>50mm	B
		10 to 50mm	C
		< 10mm	D
	Cracks radiating from fasteners	Any	D
	Crushing at support	Any	C
	Fire / Ultraviolet Radiation damage	Any	C
	Accidental / intentional damage	Any	C
	Excessive wear	Any	C

Table 3: Intervention levels

Special Inspection

Start Date	Number of inspections	Frequency
3 months after installation	4	3 months

Table 4: Special inspection frequency

Structures Representatives to report any ongoing performance issues to National Bridges & Structures Engineer for investigation.

12. Safety & Environment

Sekisui's FFU MSDS is registered in Chemwatch which is available as an application on the ARTC Intranet home page.

ARTC's Environment Policy must be adequately adhere to.

Ensure any on-site modifications to FFU products does not contaminate local environment. Any off-cuts, shaves, vacuumed duct, etc. must be appropriately disposed of.

13. Disposal

Sekisui is developing methods for the recycling of FFU products and is currently working on two methods:

1. Repair and refurbishment of used FFU products.
2. Reformation of FFU offcuts and sawdust to be used as packing materials for FFU transportation.

These methods are not fully established yet and may require the waste FFU products to be returned to supplier.

For the purposes of disposal FFU products should be treated as industrial waste similar to fibreglass and other fibre-reinforced plastic products. The NSW Environmental Protection Agency classifies fibreglass materials as General Solid Waste (Non-Putrescible) in its Waste Classification Guideline Part 1.

14. Logistics and Cost

At present, the lead time on the transoms is estimated at 10-15 weeks for delivery to Australia. Orders to be placed through Delkor and must include completed design condition form and any survey drawings, gasket sizes, epoxy and adhesive requirements.

15. Technical Support

Contact: Peter Prasad, ARTC National Bridges & Structures Engineer. M: 0428 423 143.

APPENDIX 1

Showing FFU transom assembly details

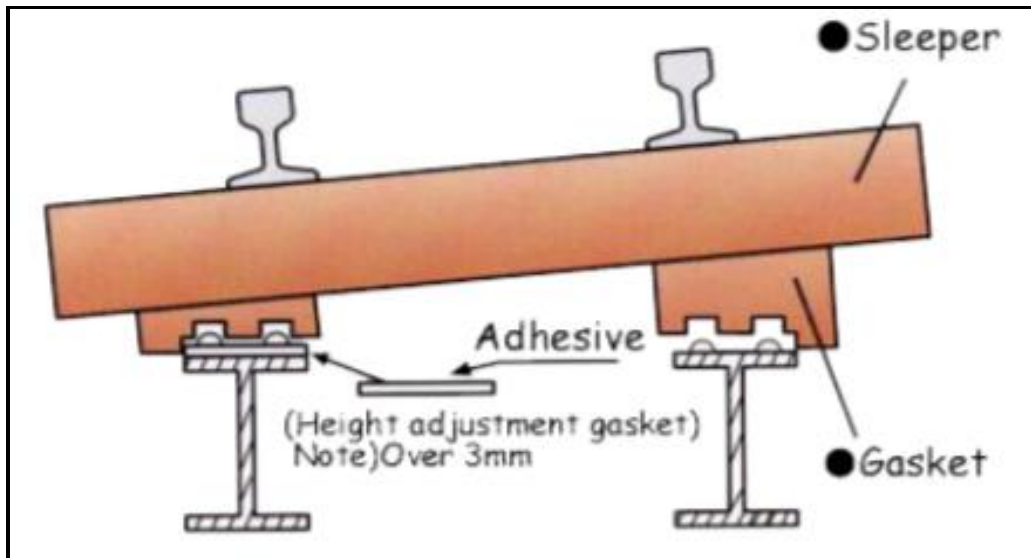


Figure 2: FFU transom height adjustment assembly details

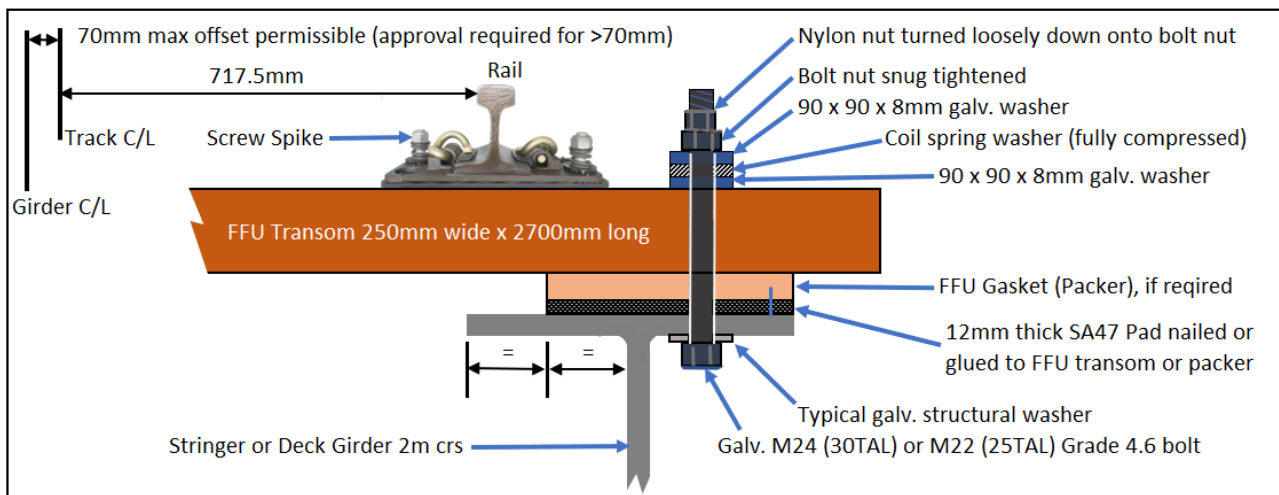


Figure 3: FFU transom holding down bolt assembly details

APPENDIX 2

Showing sample of typical DESIGN CONDITION form for ordering transoms



The following is the design condition for FFU Transom application for this project.

A) Track Condition

Type of Rail	
Gauge	
Distance between sleepers	
Dimensions of Baseplate	
Distance of Girders	
Width of Girder	

B) Train Condition

Vertical load	
Maximum Speed	

Here, impact speed ratio α is set as 0.5.

C) Bridge Condition

Thickness	
Width	
Length	