



Waimakariri Gorge Bridge

MAY 2025



Construction Manual

DISTRIBUTOR





Rakaia Gorge Bridge

Index

THE SYSTEM	3	NIUBRIDGE	13
The System comprises of:	3	Key Features	13
Advantages	3	Table 1: T44 Single Lane NiuBridge Attributes	14
Purpose	4	Table 2: SM1600 Single Lane NiuBridge Attributes Table	14
Sustainability	4	Table 3: T44 Double Lane Attributes Table	15
Preservation Treatment	5	Table 4: SM1600 Double Lane Attributes Table	15
Manufacturing Standards	5		
Design Standards	5	NIUBRIDGE INSTALLATION	16
NIUDECK	6	Standard Inclusions	16
Key benefits	6	Fixing	16
Pedestrian / Cycle / Rail Trail	7	Fasteners	16
Dimensions	8	Installation	17
Manufacturing Specification	8	Camber	17
Design Details	8		
Deflection	8	ORDERING DELIVERY SAFETY	18
Standard Thickness Section Properties	9	DECK WEARING SURFACE	19
Skew Decks	10	Multi-Layered Aggregate System	19
Cantilever	10	Asphaltic Concrete	19
Distributor Beams	10		
Panel Layout	10	PRODUCT PERFORMANCE TESTING	20
Fasteners & Fixings	10	QUALITY & PRODUCT CERTIFICATION	21
NIUDECK INSTALLATION	11		
Installation	11		
Camber	12		

The System

The NiuDeck and NiuBridge System is a comprehensive Engineered Wood Product bridge building system, providing a cost-effective solution for new bridge construction as well as refurbishment of existing structures.

The system utilises the structural advantages of a high strength sustainable plantation resource with veneer treatment, manufactured under the controls of a Type 5 ISO 17065 JAS-ANZ product certification scheme, ensuring a system of choice for designers that delivers significant design life advantages over alternatives.

THE SYSTEM COMPRISES OF:

NiuDeck: Heavy duty plywood decking system.

NiuBridge: Lightweight high performing modular system for single spans up to 15m.

NiuKerb: Prefinished plywood kerbing system.

NiuDeck is the premium heavy duty plywood decking system with a proven track record. e.g. Rakaia Gorge Bridge; Waimakariri Gorge Bridge; Matoitoi Bridge, Wairoa. NiuDeck's unequalled performance stems from a unique combination of utilising veneer treatment on a high strength softwood resource under the tight controls of a third party audited JAS-ANZ ISO 17065 Type 5 quality management system.

Niubridge is a modular light weight bridge building system for all spans up to 15m. NiuBridge is suitable for installation on a variety of existing substructures including timber, heritage masonry, steel and concrete. NiuBridge is also ideally suited for installation on precast spread footing abutment systems, as well as the conventional piles and abutments. Whether installed onto existing or new substructures, NiuBridge is the ideal cost-effective solution with fast and simple installation, providing a flexible modular system that can incorporate site specific requirements, without compromising the systems integrity.



NiuBridge and Niudeck are the next generation in timber bridge construction, capitalising on the advantages of natural timber which is not subject to fatigue failure, unlike other materials.

ADVANTAGES

- Fully protected from decay and termites through Alkaline Copper Quaternary (ACQ) H4 or H5 "Veneer Treatment" preservation with 100% penetration.
- 50-year treatment warranty.
- Significantly reduced installation time and cost.
- Allows cantilevering to widen bridges and accommodate guard rail and footbridges.
- Suitable for NZTA HN-HO-72 or Austroads T44 or AS5100 SM1600 loadings.
- Flexible design options and custom design service.
- Light weight; minimal crane size required.
- Sustainable plantation resource (PEFC Chain of Custody).
- Low embodied carbon.
- Exceptionally low embodied energy, manufactured with hydro power and wood waste heat.

PURPOSE

The purpose of this construction manual is to provide guidance on specifications and construction requirements for installation of all elements of the The System.

This document is of a general nature and should be read in conjunction with the detailed “project specific” documents including, but not limited to, Drawings, Contracts, Project Specifications and Safe Work Method Statements.

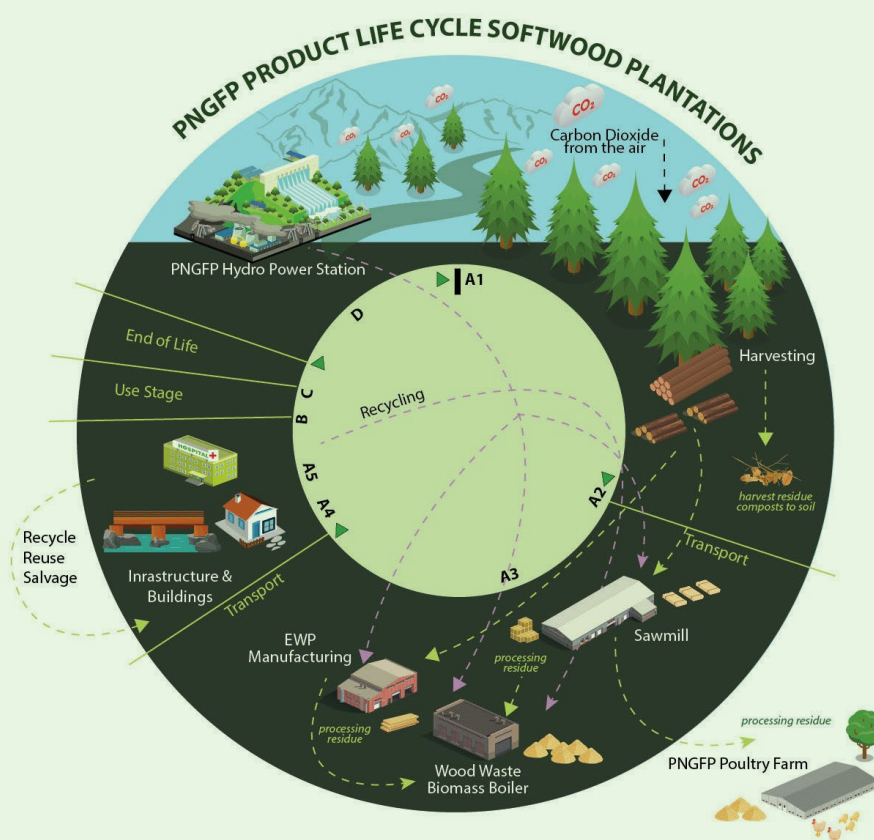
Typical installation arrangements that are contained in the NiuBridge standard drawings do not constitute site specific site layout drawings; these drawings need to be provided by the consulting engineer for the project. Any differences between the site-specific documentation and this guide need to be referred to a PNGFP representative by the relevant authorised personnel.

SUSTAINABILITY

Celebrating 70 years of manufacturing in PNG this year, PNG Forest Products has long been an industry leader in Engineered Wood Products and is committed to building a better future through sustainable manufacturing practices. All timber is sourced from renewable pine plantations managed by the PNG Forest Authority, with a focus on minimising waste to achieve maximum utilisation of the wood fibre.

The manufacturing facilities in Bulolo are powered by PNGFP’s own four hydro power stations with a combined output of 22MW with all surplus power fed into the grid. This renewable power source combined with all steam for the kilns, driers and hot presses generated by a wood waste boiler results in an extremely low carbon footprint.

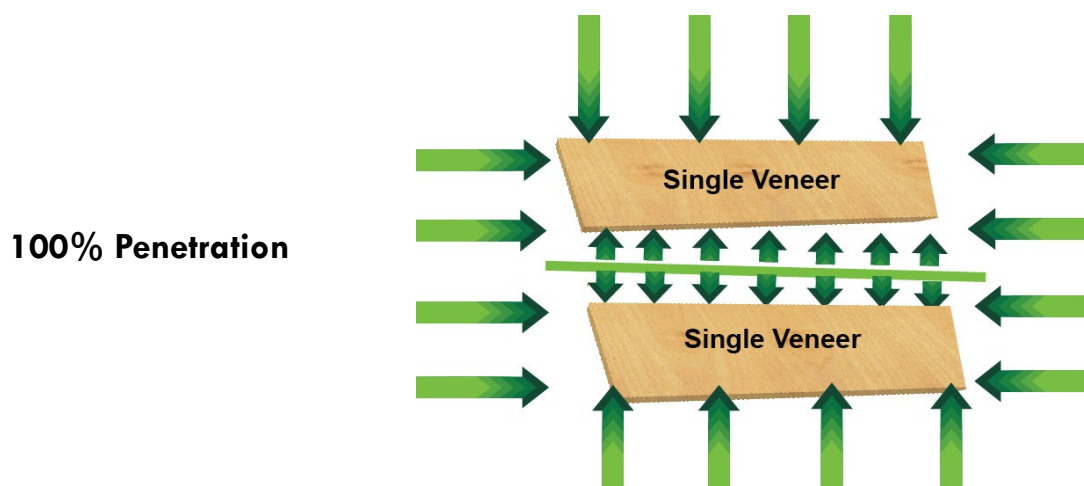
Our combination of renewable timber resources processed with sustainable hydro power and wood waste heat, makes PNGFP’s engineered wood products a unique low carbon footprint option.



PRESERVATION TREATMENT

The NiuBridge system utilises the veneer preservation treatment method to ensure complete protection from termites, rotting and fungal decay. Veneer treatment is the only way to ensure complete penetration and that any unsealed cut panels will not decay. Hence, minimising failure risk and thereby maximising design life expectation.

Veneer preservation treatment method is where the individual sheets of veneer are preservative treated before being fabricated into plywood to ensure 100% penetration. Standard retention level is hazard class H4, but H5 is available on request.



The rotary veneer peeling process provides the added benefit when compared to sawn timber, by enabling preservative treating of any heartwood via penetration of the preservation solution into the “peeler checks.” By comparison, sawn timber heartwood is generally considered not treatable.

The treated veneers are then bonded with a permanent phenolic resin which is often referred to as “A” bond or Marine “A” or Structural bond. Structural “A” bonds require rigorous testing after submersion in boiling water for 72 hours, or 6 hours under high pressure steam to ensure a high-quality bond.

MANUFACTURING STANDARDS

- AS/NZS 2269:2012; Plywood – Structural.
- AS/NZS 4357:2005; Structural Laminated Veneer Lumber.
- AS/NZS 1604.1:2021; Preservative-treated wood-based products.

DESIGN STANDARDS

- AS 1720.1:2010; Timber structures – Part 1: Design Methods, Section 5 Plywood.
- AS 5100.2:2017; Bridge Design.
- 92 Austroads Bridge Design Code.
- HN-HO-72 NZTA Bridge Manual.



NiuDeck

NiuDeck is a purpose designed and engineered heavy plywood decking system primarily used for re-decking traditional timber road bridges, which can also be used with a variety of supporting structures. NiuDeck is also suitable for footbridge, wharf and rail deck applications.

Manufactured using a proven durable glue system together with 100% “veneer” preservation treatment method, the product is well designed for adverse climatic conditions of bridge applications, ensuring a long design life.

Developed as a sustainable alternative concrete and traditional sawn timber, NiuDeck is manufactured from sustainable plantation pine that is processed with hydro-electric power to the highest quality standards. NiuDeck’s versatility allows for either in situ installation on existing or new sub-structure together with off-site manufacturing.

Off-site manufacturing provides the additional benefits and efficiency of bridge building in a controlled environment delivering cost effective accurate structures that are delivered to site in kit form ready for rapid installation minimising community disruptions.

KEY BENEFITS

- Used with a variety of substructures, steel, timber, glue laminated timber (GLT).
- Increased safety.
- Lower environmental risk.
- Speed of construction in a factory environment is higher than on site.
- Minimises delays due to weather.

Available in a range of sizes, NiuDeck offers the engineer a cost-effective solution for a wide variety of applications complying with a range of design loadings. In addition, a custom design service is available to handle the most challenging applications.



NiuDeck

PEDESTRIAN / CYCLE / RAIL TRAIL

NiuDeck is ideally suited for most footbridge, cycle and rail trail applications and is available in range of panel sizes starting at 2400 x 1200 x 27mm. Larger custom panel sizes are available on request, to suit specific design applications.



DIMENSIONS

- Variable length up to 12m.
- Standard width 1200mm.
- Non-standard widths from 900 to 3600mm.
- Standard thicknesses from 27mm to 251mm (other thicknesses available on request).

MANUFACTURING SPECIFICATION

- “A” Bond (AS/NZS2269).
- Veneer grade “C” and “D” (AS/NZS2269).
- Preservation treatment to Hazard Class H4 (AS/NZS 1604.1) by veneer treatment method. (Hazard Class H5 available on request).
- Density of approximately 650 Kg/m³ when shipped.
- Moisture content between 8 to 15% when shipped.
- Length Tolerance +/- 2mm.
- Width Tolerance +/- 2mm.
- Thickness Tolerance +/- 4%.

DESIGN DETAILS

The following values are recommended when designing NiuDeck structures to comply with AS1720.1 Timber Structures-Design Methods, Section 5 Plywood.

Designers are encouraged to design with longevity in mind, by elimination of moisture traps and sealing exposed timber elements.

Characteristic Properties	Bending	Shear
Stress Grade (parallel/perpendicular)	F14/F14	F14/F14
Bending strength (f_b) (parallel/perpendicular)	36MPa/36MPa	4.8MPa/4.8MPa
Moisture factor (AS1720.1) k_{19}	0.8	0.8
Assembly factor (AS1720.1) g_{19}	1.0	0.4

DEFLECTION

Reduction factor k_g of 0.75 is adopted to allow for significant shear deflections due to a low shear modulus and span to depth ratios of less than 10:1.

STANDARD THICKNESS SECTION PROPERTIES*

Thickness (mm)	I longit (x10 ⁶ mm ⁴)	Z longit (x10 ³ mm ⁴)	I trans (x10 ⁶ mm ⁴)	Z trans (x10 ³ mm ⁴)
56	8.6	303	6.3	216
84	28.4	663	22	505
112	66.8	1168	52.8	908
140	129.9	1816	103.6	1427
150	166.9	2143	134.6	1703
155	188.05	2319	151.8	1847
167	223.4	2609	179.6	2062
195	355.1	3546	285.6	2811
205	401.5	3823	335.2	3154
223	529.6	4627	426.9	3676
238	636.5	5197	533.1	4299
251	753.6	5852	608.2	4656

*For one metre wide.

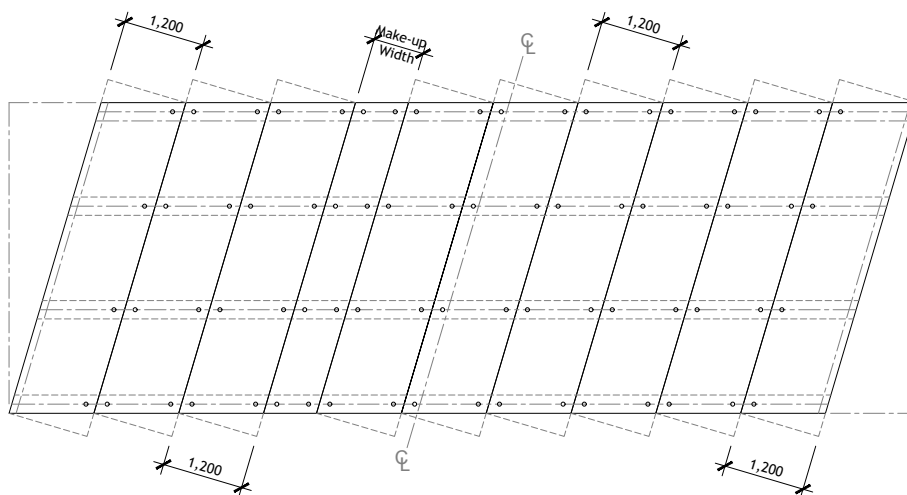
Waikare Gorge Bridge: NiuDeck's design flexibility allows it to be used in Bailey Bridge applications.





SKEW DECKS

Skew decks are where the panels are laid at an angle other than perpendicular. The section properties listed in this manual are applicable when the NiuDeck panels are laid perpendicular to the girders. Analysis is required to alter these section properties aligned with the cross-grain direction thus increasing or decreasing the effective span.



PLAN VIEW

CANTILEVER

NiuDeck's superior strength properties allow deck widths to be extended by the use of cantilevers for either highway traffic or pedestrian traffic.

DISTRIBUTOR BEAMS

Load distributors are recommended to be attached to the underside, between and parallel to the girders, to control differential deflection of adjacent panels. Minimising differential deflections reduces the tendency for the seal to crack at the joins.

PANEL LAYOUT

Expansion gaps of approximately 2mm to 4mm between panels.

FASTENERS & FIXINGS

- Designers should consider the potential for bi-metallic corrosion between the preservative treatment and fasteners and other components of the bridge.
- The minimum corrosion protection for fasteners shall be a heavy hot dipped galvanised coating. However, in coastal or environments with prolonged periods of elevated moisture content (> 18%), 316 stainless steel fasteners are recommended.
- It is also recommended that all fasteners be coated in grease before installation.
- Fixings should minimise moisture penetrations and potential traps where possible.

INSTALLATION

To ensure correct installation of the product, we recommend the following instructions be strictly adhered to:

- Supporting structure needs to be sound prior to installation of NiuDeck.
- Changing the thickness or width of the NiuDeck product from the approved design during the installation process is not allowed, unless a variation to the design is obtained and signed off by the design engineer.
- Docking to length of both NiuDeck during the installation process is allowed, however any saw cut done by hand, chain saw or circular saw needs to be a minimum distance of 25mm from any visible sacrificial* screws. If screws cannot be located, then it is recommended to cut the NiuDeck with a concrete saw.
- NiuDeck needs to be fixed at each girder with a minimum of 2 bolts or equivalent fastener system (one per side). If using bolts M24 is recommended for extra longevity with a minimum 100 x 100 x 16mm washer size. Larger 300 x 100 x 16mm washers across adjacent panels is preferable.
- Alternative fixing of panels to girder or NiuBridge module to abutments/headstock, can be done by prefabricated steel straps and/or brackets.
- Panels with widths of between 900mm and 1200mm are to be located in the center of the deck with at least 3 x 1200mm panel widths away from the abutments.
- Ensure deck panels are evenly supported by the girders.
- Coat the tops of the girders with a bituminous seal or equivalent, for protection from moisture that may seep through, between the deck panels.
- No need for additional preservative treatment on drill holes or cut edges due to the 100% veneer penetration.
- Fill holes with epoxy or equivalent.

*Sacrificial screws are used in the manufacturing process.





CAMBER

Camber (approximately 1%) can be built into the NiuDeck panels at installation time via differing height girders or packing corbels. Additional camber can also be obtained by shaping the bitumen deck wearing surface.



NiuBridge is an integrated high performing engineered wood product superstructure system, purpose designed for all single span applications up to 15m. Suitable for installation on a variety of existing substructures including timber, heritage masonry, steel and concrete, NiuBridge is also ideally suited for installation on precast spread footing abutment systems, as well as conventional piles and abutments.

KEY FEATURES

- Single span length up to 15m.
- Compliant to T44 or SM1600 loading.
- Light weight.
- Rapid installation.
- Pedestrian bridge designs, including cantilevered options, available on request.
- Non-standard lengths and widths available on request.

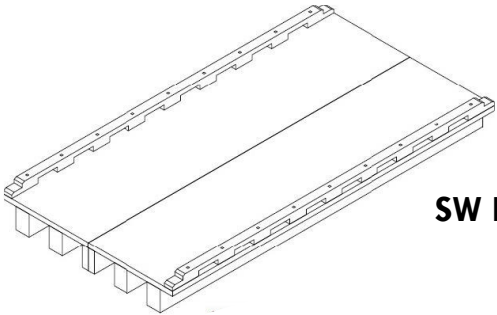




NiuBridge

TABLE 1: T44 SINGLE LANE NIUBRIDGE ATTRIBUTES

Span (m)	Lane Width: Inside Kerbs (m)	Overall Width: Outside Kerbs (m)	Module Width (m)	Deck Thickness (mm)	Girder Depth (mm)	Kerb Width (mm)	Kerb Depth (mm)	Approximate Module Weight* (tonne)
6	4.2	4.6	2.3	108	300	200	216	3.5
8	4.2	4.6	2.3	108	300	200	216	4.5
10	4.2	4.6	2.3	108	360	200	216	5.8
12	4.2	4.6	2.3	135	470	200	216	8
15	4.2	4.6	2.3	135	470	200	216	9.6



SW ISOMETRIC VIEW

TABLE 2: SM1600 SINGLE LANE NIUBRIDGE ATTRIBUTES TABLE

Span (m)	Lane Width: Inside Kerbs (m)	Overall Width: Outside Kerbs (m)	Module Width (m)	Deck Thickness (mm)	Girder Depth (mm)	Kerb Width (mm)	Kerb Depth (mm)	Approximate Module Weight* (tonne)
6	4.2	4.6	2.3	108	540	200	216	4.3
8	4.2	4.6	2.3	108	540	200	216	5.5
10	4.2	4.6	2.3	108	610	200	216	7.2
12	4.2	4.6	2.3	135	790	200	216	10.1

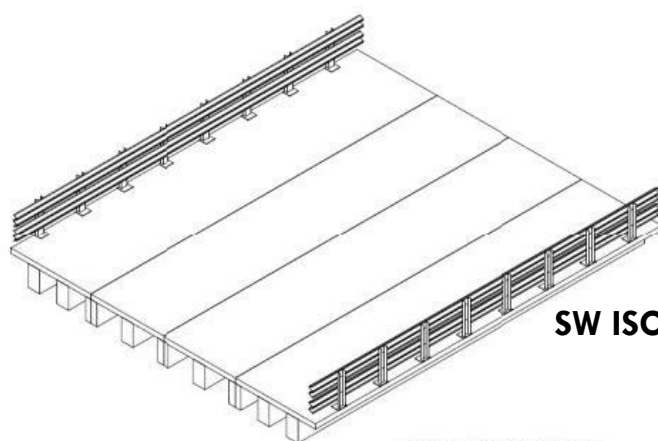
*Includes a 2 coat bitumen seal.



NiuBridge

TABLE 3: T44 DOUBLE LANE ATTRIBUTES TABLE

Span (m)	Lane Width: Inside Kerbs (m)	Overall Width: Outside Kerbs (m)	Outer Module Width (m)	Inner Module Width (m)	Deck Thickness (mm)	Girder Depth (mm)	Approximate Outer Module Weight (tonne)	Approximate Inner Module Weight (tonne)	Approximate Total Weight (tonne)
6	7.76	8.16	2.4	1.68	108	342	3.8	3.2	14.1
8	7.76	8.16	2.4	1.68	108	342	4.9	4	17.9
10	7.76	8.16	2.4	1.68	108	445	6.4	5.3	23.3
12	7.76	8.16	2.4	1.68	135	555	8.8	7.2	32.1



SW ISOMETRIC VIEW

TABLE 4: SM1600 DOUBLE LANE ATTRIBUTES TABLE

Span (m)	Lane Width: Inside Kerbs (m)	Overall Width: Outside Kerbs (m)	Outer Module Width (m)	Inner Module Width (m)	Deck Thickness (mm)	Girder Depth (mm)	Approximate Outer Module Weight (tonne)	Approximate Inner Module Weight (tonne)	Approximate Total Weight (tonne)
6	7.76	8.16	2.4	1.68	108	342	4.7	3.9	17.1
8	7.76	8.16	2.4	1.68	108	342	6	4.9	21.8
10	7.76	8.16	2.4	1.68	108	445	7.8	6.4	28.4
12	7.76	8.16	2.4	1.68	135	555	10.9	9	39.9



STANDARD INCLUSIONS

- Elastomeric bearing pads.
- Impact angles.
- Girder end and edge brackets.
- Bitumen deck wearing surface with a minimum thickness of 30mm.
- Module jointing hardware (sealant and bolts).

FIXING

- Supporting structure needs to be sound prior to installation of NiuBridge.
- NiuBridge needs to be fixed at each girder end to the abutment or headstock with a suitably designed fastening system taking into consideration site-specific details. Possible methods include:
 - Pre-fabricated brackets bolted to the side of the girder.
 - Through tie down bolts located adjacent to each girder on the downstream side; M24 bolts are recommended with a 100 x 100 x 16mm washer.
- Ensure NiuBridge modules are placed on the elastomeric bearing pads which are evenly supported by the sub-structure.



FASTENERS

The minimum corrosion protection for fasteners shall be a heavy hot dipped galvanised coating. However, in coastal environments or where there will be prolonged periods of elevated moisture content (> 18%), it is also recommended that 316 stainless steel fasteners be used.

It is also recommended that all fasteners be coated in grease before installation.



INSTALLATION

Whether the NiuBridge system is installed on an existing or new substructure (timber, steel or concrete), the typical installation process is as follows. For further information please refer to the detailed NiuBridge installation guide:

- Ensure substructure is sound and suitable to accommodate NiuBridge.
- Place elastomeric pads (if specified) on headstocks, corbels or abutments.
- Place the downstream NiuBridge modules on the headstocks and/or abutments.
- Secure downstream module to the abutment/headstock with the specified fastening system.
- Place adjacent module(s) on the headstocks and/or abutments.
- Install and tighten module joining bolts, ensuring a tight join between the modules.
- Secure module to the abutment/headstock with the specified fastening system.
- Complete longitudinal deck jointing.
- Install and tighten tie down bolts.
- Install additional barriers if required.
- Install (or patch if pre-applied) deck wearing surface.

CAMBER

Camber can be built into the supporting structure. Additional camber can also be obtained by shaping the bitumen deck wearing surface.





The sequencing and timing of delivery needs to be coordinated by the main contractor, in consultation with PNGFP's distributor, iBuilt. Some key items that need consideration are:

- Site access and timing.
- Traffic control.
- Transportation requirements.
- Crane size and reach.

It is the responsibility of the contractor installing NiuBridge to ensure that all lifting and installation is undertaken in accordance with a Safe Work Method Statement that complies with all relevant laws, safety regulations and codes of practices.

Stage	Task	Responsibility
Order Detail	Confirm details of the NiuBridge product and any options e.g. pre-installed deck wearing surface	Customer / iBuilt
Project Schedule	Project schedule to be agreed on, allowing sufficient time for manufacture and shipping	Customer/PNGFP/ iBuilt
Site Preparation	Ensure site is accessible for cranes and delivery vehicles	Customer
Lifting Equipment	Organise suitable lifting equipment to unload delivery vehicles and for installation	Customer
Delivery	Coordinate delivery sequence with site requirements	Customer / iBuilt
Delivery	Site traffic control	Customer
Installation	Installation process	Customer

SAFETY

- Requirements and regulations must be observed at all times, including transportation, lifting, handling, storage and installation.
- Responsibility of contractor to provide Safe Work Method Statements that comply with all relevant laws and regulations.
- Must use nominated PPE as detailed in the MSDS statement.
- All lifting must be done by qualified operators and strictly in accordance with all relevant health and safety standards.
- Care must be taken during any lifting operation to prevent any damage e.g. spearing due to forklift tyres or edge damage due to lifting chains/straps.

Deck Wearing Surface

NiuDeck and NiuBridge require a durable deck wearing surface to be installed to ensure that the designed service life is achieved. In order to maximise the life of the deck wearing surface, the entire bridge structure must be tight to minimise movement under load.

The traditional deck wearing surfaces are either a multi-layered aggregate system or asphaltic concrete. The weight of this surface needs to be considered in the design load of the bridge.

The deck wearing surface needs to extend to the outer edges of the deck, to protect from both UV and mechanical degradation due to repeated moisture cycles, or sealed with an alternative sealant.

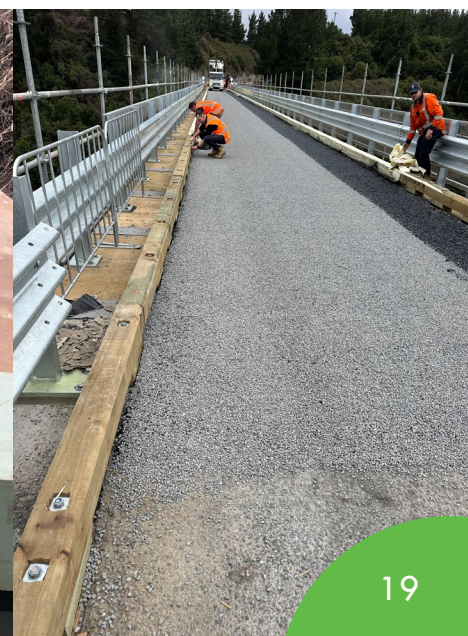
MULTI-LAYERED AGGREGATE SYSTEM

- Spray deck, ends and edges with a Cationic Rapid Set Emulsion (CRS) in accordance with the manufacturer's instructions.
- Apply and roll a 14mm chip layer to the surface with a non-vibrating roller.
- Spray a second coat of emulsion.
- Apply and roll a 7mm chip layer to the surface with a non-vibrating roller.
- Repeat layers for the desired thickness and durability.
- Remove excess loose chip from the final layer.



ASPHALTIC CONCRETE

- Spray deck, ends and edges with a Cationic Rapid Set Emulsion (CRS) in accordance with the manufacturer's instructions.
- Apply and roll a 7mm chip layer to the surface with a non - vibrating roller.
- Apply a minimum 30mm thick layer of asphaltic concrete.
- Roll with a non-vibrating roller and allow to cure.

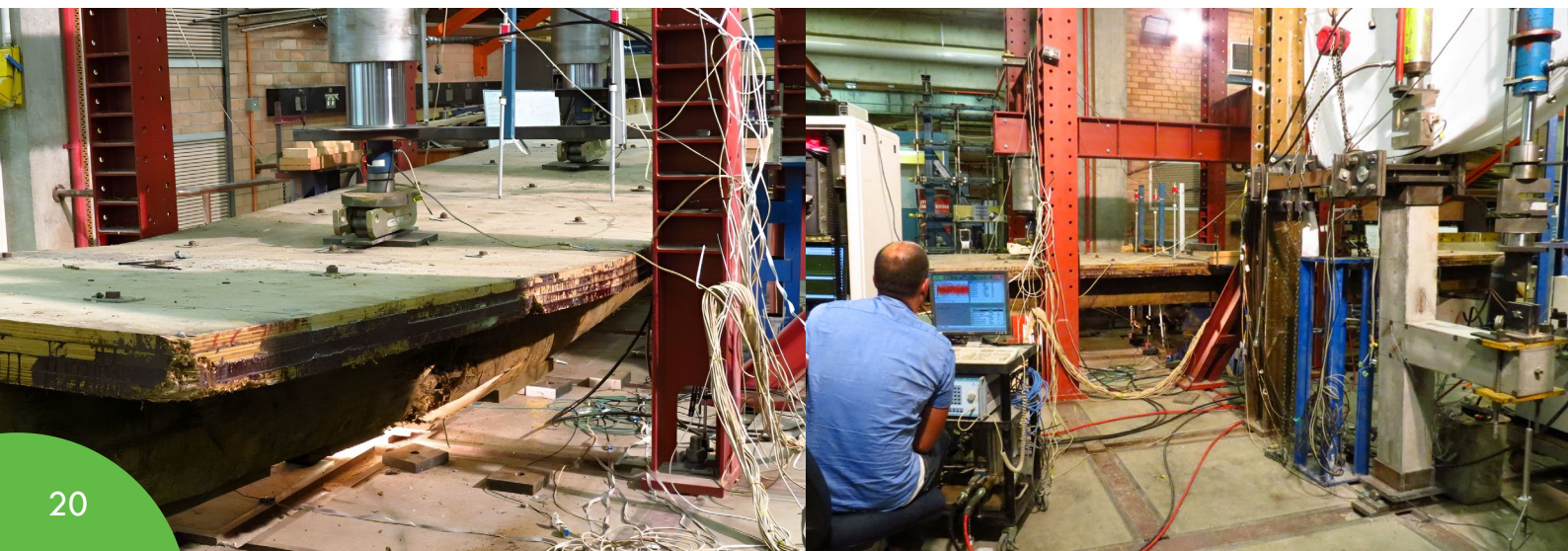




Product Performance Testing

PERFORMANCE TESTING

NiuBridge has undergone comprehensive structural testing of full-sized specimens at the University of Technology Sydney. The test results confirm that NiuBridge meets and exceeds the ULS requirements of both T44 and S1600 loading conditions.



Quality & Product Certification

PNG Forest Products Engineered Wood Products are certified by the Engineered Wood Products Association of Australasia (EWPAA) and carry the EWPAA JAS-ANZ brand. The EWPAA operate an ISO 17065 Type 5 third party product certification scheme that is accredited by the peak accreditation body JAS-ANZ. This means that any product branded with the EWPAA JAS-ANZ brand has been manufactured under an accredited third party audited, process-based quality control program that ensures the product meets the intended design criteria.



Rakaia Gorge Bridge





The Engineered Wood Products Association of Australasia Ltd.
certifies that

PNG Forest Products Ltd.

PO Box 88, BULOLO 423, Papua New Guinea

operates a Chain of Custody Management system that meets the
requirements of the

PEFC ST 2002:2020 Chain of Custody of Forest Based Products

PEFC ST 2001 -2020 PEFC Trademark Rules

Certificate Number: EWPAA-PEFC-COC-916

Certificate Type: Individual

Chain of Custody Method: Volume Credit

Scope of Certification

Wood based panels (050000)	Wooded buildings (090000)
Engineered wood products (040000)	Outdoor furniture (080000)
Sawnwood and treated (030000)	Indoor furniture (070000)
Roundwood (010000)	

Sites covered by this certificate

PNGFP - Bulolo (Head Office) : Huxley St, Bulolo, Papua New Guinea



Gavin Matthew, CEO EWPAA



Issue Date: 26 Jul 2024

Expiry Date: 21 Jul 2028

Last Recertification Date: 21 Jul 2023

Initial Certification Date: 22 Dec 2015

The contents of this certificate are valid as of the date of issue. This certificate must not be reproduced except in full.
To verify the currency of this certificate, visit the web pages linked below.

<https://www.pefc.org>

<https://ewp.asn.au/members>



The Engineered Wood Products Association of Australasia Ltd. certifies that

PNG Forest Products Ltd.

PO Box 88, BULOLO 423, Papua New Guinea

operates a quality control system that meets the requirements of the

EWPA Product Certification Scheme

EWPA certification involves regular inspections of the manufacturing process, independent testing of product compliance and periodic assessment of product performance in the marketplace.

Details of the certifications scheme are available at www.ewp.asn.au

Mill Number: 916 Issued: 31 Oct 2023

Certified Products

AS/NZS 2269.0:2012 Plywood Structural

Grade	Bond	Emission Class
F14	A Bond	Super E0

AS/NZS 2270:2006 Plywood Interior

Bond	Emission Class
D Bond	E0

AS/NZS 2271:2004 Plywood Exterior

Bond	Emission Class
A Bond	Super E0

AS/NZS 2272:2006 Plywood Marine

Grade	Bond	Emission Class
Standard	A Bond	Super E0

AS 6669:2016 Plywood Formwork

Grade	Bond	Emission Class
F17	A Bond	Super E0

Other Products

NIUDECK PCS-RU-Special Product-
Secondary Bonded Plywood and LVL-DTS
Provisions:2023

NIUBRIDGE PCS-RU-Special Product-
Secondary Bonded Plywood and LVL-DTS
Provisions:2023



Gavin Matthew, CEO EWPA



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Waimakariri Gorge Bridge

Construction Manual



PNCFF
NiuBridge
Engineered Wood Products

PNCFF
NiuDeck
Engineered Wood Products



I BUILT™
Engineered Wood Products

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