



Engineering Standard

Track

CRN CS 230

SLEEPERS AND TRACK SUPPORT

Version 1.4

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Document control

Revision	Date of Approval	Summary of change
1.0	August, 2011	First Issue. Includes content from the following former RIC standards: C 2501, C 3108, C 3109, C 3110, C 5200, BI 1126, TS 3101, TS 3306, TS 3341, TS 3342, TS 3397, CSI 018, CTN 04/06, CTN 04/17, TS 20 540 3 01
1.1	January, 2012	5.2.4.1 - Correction of tolerances for timber and steel sleeper spacing in open track; 5.4.4.1 - Correction of tolerances for concrete sleeper spacing in open track; Appendix 1 - Addition of approved steel sleepers and components
1.2	June, 2016	Various Correction of typographical and grammatical errors; Minor wording changes for consistency and minor corrections; Changed "Principal Civil Engineer" to "Principal Track and Civil Engineer"; 2.1 Updated to remove standards publication dates; included note regarding use of latest versions of standards; 2.2 Corrected titles of CRN reference documents; 5 Added reference to Appendix 4.; 5.3.1 Changed requirements for steel sleeper selection to match changes to CRN CP 233; 5.3.2 Deleted shoulder thickness as a dimensional requirement; 5.3.4 Deleted reference to sleepers with additional holes; Table 10 and new Table 11- Changed requirements for hole punching and spacer selection (includes content from CCT 15/09); 5.8 Inclusion of requirements for steel turnout bearers - not previously documented; 5.9.1 Expanded requirements for sleeper plates on class 5 lines; 5.9.3 Expanded requirements for sleeper plates on class 5 lines; 5.9.6.3 Removal of expansion switches – not a current CRN asset; 5.9.7.2 Inclusion of fastening requirements for steel sleepers at insulated joints; 9.3 Addition of requirement for all sleepers to be tamped when renewing in steel; 10 Damage Limits deleted; 10 Repair Standards renumbered; Appendix 1 Added statement regarding need to seek advice from PCE before ordering certain products; Added space for and comment regarding Product Approval Numbers; Changed steel sleeper approved products to match product approval; Appendix 2 Added space for and comment regarding Product Approval Numbers; Appendix 4 New appendix - "Approved special configurations" (includes content of Waiver CCW 12/001, CCW 12/007 and CCW 15/022)
1.3	December, 2016	Appendix 4 - "Approved special configurations" (includes content of Waiver CCW 15/016)
1.4	November, 2017	See Summary of changes below

Summary of changes from previous version

Section	Summary of change
Appendix 1	Updates to supplier details, product numbers and drawings.

Contents

1	Scope and application	4
2	References	4
2.1	Australian and International Standards	4
2.2	CRN documents	4
2.3	Other references	4
2.4	Definitions	5
3	Engineering authority	5
4	Design & performance criteria	5
4.1	Track configuration	5
4.2	Sleepers and bearers	5
4.3	Fastening assembly design	6
5	Allowable configurations	6
5.1	Selection of sleeper type	6
5.2	Timber sleepers	7
5.3	Steel sleepers	10
5.4	Concrete sleepers	13
5.5	Concrete guard rail sleepers	15
5.6	Timber turnout bearers	15
5.7	Concrete turnout bearers	16
5.8	Steel turnout bearers	17
5.9	Fastening systems	18
6	Prohibited configurations	23
7	Mixed configurations	23
7.1	Mixing concrete and timber sleepers	24
7.2	Mixing steel and timber sleepers	24
7.3	Mixing resilient and non-resilient fastenings	25
8	Changing configurations	26
9	Acceptance standards	26
9.1	General	26
9.2	Sleeper plates	26
9.3	Installation of steel sleepers	26
10	Repair standards	27
10.1	Timber sleepers and bearers	27
10.2	Concrete sleepers	27
10.3	Fastenings	27
Appendix 1	Approved sleeper and fastening products	28
Appendix 2	Approved repair processes	34
Appendix 3	Sleeper boring patterns	35
Appendix 4	Approved special configurations	36

1 Scope and application

This Standard establishes functional and design requirements, approved configurations, acceptance standards, repair standards for sleepers, turnout bearers, and sleeper fastenings. It also includes requirements for concrete guard rail sleepers and fastening requirements for transoms

It is applicable to all Country Regional Network (CRN) main line and siding tracks.

2 References

2.1 Australian and International Standards

AS 1085.3 – Railway Track Material Part 3: Sleeper plates

AS 1085.8 – Railway Track Material Part 8: Dogspikes

AS 1085.13 – Railway Track Material Part 13: Spring fastening spikes for sleeper plates

AS 1085.14 – Railway Track Material Part 14: Prestressed Concrete Sleepers

AS 1085.17 – Railway Track Material Part 17: Steel Sleepers

AS 1085.18 – Railway Track Material Part 18: Screwspikes and threaded inserts

AS 1085.19 – Railway Track Material Part 19: Resilient fastening assemblies

AS 1214 – Hot-dip galvanized coatings on threaded fasteners

AS 1444 – Wrought alloy steels - Standard, hardenability (H) series and hardened and tempered to designated mechanical properties

AS 3818.2 – Timber - Heavy structural products - Visually graded; Part 2: Railway track timbers

Unless otherwise specified, all references relate to the latest standard versions, including amendments and relevant superseding standards.

2.2 CRN documents

CRN CS 200 - Track System

CRN CS 210 – Track Geometry and Stability

CRN CS 220 - Rail and Rail Joints

CRN CS 240 – Ballast

CRN CM 211 – Track Geometry and Stability

CRN CM 223 – Rail Adjustment

CRN CM 231 – Sleepers and Fastenings

CRN CP 231 - Timber Sleepers and Bearers

CRN CP 232 - Concrete Sleepers

CRN CP 233 – Steel Sleepers

CRN CP 234 – Concrete Bearers

CRN CP 235 – Steel Turnout Bearers

CRN CP 237 – Resilient Baseplates

2.3 Other references

Nil

2.4 Definitions

Definitions of terms used in this standard may be found in CRN Engineering Standard CRN CS 200 "Track System".

3 Engineering authority

Design and selection of infrastructure detailed in this standard for use on the CRN may only be undertaken by persons who have been granted appropriate Engineering Authority by the Principal Track and Civil Engineer

4 Design & performance criteria

4.1 Track configuration

The configuration of track elements, including sleepers, turnout bearers, and sleeper fastenings is specified in CRN CS 200.

4.2 Sleepers and bearers

This standard has been developed in consideration of the following criteria:

4.2.1 Loading

- Service loads (and dynamic response) including effects of track alignment, maintenance standards, and traffic task.
- Resistance to impact loading (e.g. wheel flats).
- Rail seat loads, sleeper bending moments, rail to sleeper pressure and sleeper to ballast pressure.

4.2.2 Materials

- Sleeper material, type and spacing.
- Sleeper acceptance, inspection and testing requirements, and assessment of effectiveness prior to insertion in track.
- Sleeper life and treatment (e.g. timber preservatives).
- Deterioration of the sleeper material (e.g. rust, concrete reactivity, fungal rot, white ant attack).

4.2.3 Interfaces with other rail infrastructure

- Track circuit requirements.
- Support of point switching equipment where necessary.

4.2.4 Support Requirements

- Track support conditions and deflection criteria.
- Required track modulus.

4.2.5 Performance requirements

- Need to provide resistance to the lateral buckling of the track.
- Need to provide effective support, positioning and restraint of the rail (in conjunction with the rail fastening system).

- Geometric requirements including the length and orientation of bearers in points and crossings structures.

4.3 Fastening assembly design

The factors to be considered in determining rail to sleeper fastening assembly design should include the following:

Loading

- Service loads (and dynamic response) including effects of track alignment, maintenance standards, and traffic task.
- Attenuation of vertical impact loads and vibration.
- Pressure transmitted to the sleeper rail seat, for example the need for sleeper plates on timber sleepers.
- Need to control damage to sleepers by rail seat abrasion.
- Need to restrain longitudinal forces from train movement and thermal effects

Interfaces with other rail infrastructure

- The need to provide electrical insulation where required to enable track circuits to work or to avoid current leakage.

Support Requirements

- Required track modulus.

Performance requirements

- The need to provide effective support, positioning and restraint of the rail (in conjunction with the sleepers and bearers).
- The need to hold rails to gauge and at the correct inclination when subjected to lateral forces caused by vehicle curving, track alignment irregularities and wheelset steering and hunting.
- The need to provide lateral and torsional restraint (in the horizontal track plane) to the rail against buckling in hot weather.
- The need to provide rail longitudinal creep resistance when the rail is subjected to thermal loads and vehicle braking and traction forces.

5 Allowable configurations

Note: Approved non-standard configurations are documented in Appendix 4.

5.1 Selection of sleeper type

Sleeper type shall be selected in accordance with the Track class detailed in CRN CS 200. Approved alternative sleeper types for each Track class are detailed in Table 1. Selection of a different sleeper type may impose requirements for fastening type, rail welding, ballast depth or fastening type. These requirements are detailed in the track element standards referenced in CRN CS 200.

Track Class	Sleeper Type	
	Preferred	Approved Alternatives
Main Line		
1	Steel	Concrete, Timber
2	Steel	Timber
3	Steel	Timber
3G	Steel	Timber
5	Steel	Timber
Sidings		
1	Steel	Timber
2	Steel	Timber
3	Steel	Timber

Table 1 – Selection of sleeper type

Concrete sleepers may be installed on Class 2, 3 and 5 lines where rail has been upgraded to 53 or 60kg.

Concrete sleepers may be installed on a face in road level crossings on Class 2, 3 and 5 lines. Where used for this purpose they shall be installed with 53 or 60kg rail.

Alternative sleeper materials may only be used with the approval of the Principal Track and Civil Engineer.

Mixing of sleeper types shall only be permitted in accordance with the requirements of Section 7.

5.2 Timber sleepers

Where timber sleepers have been selected for track maintenance or renewal, the following requirements shall apply.

5.2.1 Selection

For existing applications in ballasted plain track, detailed in CRN CS 200, sleeper size shall meet the requirements of Section 5.2.2 and the standard spacing shall be as detailed in 5.2.4.

For the design of new lines, the beam on elastic foundation (BOEF) analysis may be used to determine sleeper size and spacing

All new timber sleepers shall meet the requirements of CRN Engineering Specification CRN CP 231 “Timber Sleepers and Bearers”.

5.2.2 Size

5.2.2.1 Standard sleeper size

Dimensions and acceptance tolerances for timber sleepers shall be in accordance with the requirements of Table 2.

Parameter	Dimension (mm)	Acceptance Tolerance (mm)
Length	2 440	+75 - 0
Width	230	+25 - 0
Depth	130	+10 - 0

Table 2 – Timber sleeper dimensions

5.2.3 Use

5.2.3.1 New timber sleepers

Sleepers shall be cut from timber species nominated in Groups 1 and 2 of Table 3.

Approval is required from the Principal Tack and Civil Engineer to use species from Group 3.

Treated sleepers are not approved for use.

Group	Common Name	Botanical Name
Group 1	Ironbark Grey	E. Siderophloia
	Ironbark Grey	E. Paniculata
	Ironbark Grey	E. Drepanophylla
	Ironbark Red (Broad Leaved)	E. Fibrosa
	Ironbark Red (Narrow Leaved)	E. Crebra
	Ironbark Red	E. Sideroxylon
	Gum Slaty or Box Slaty	E. Dawsonii
	Box White	E. Albens
Group 2	Box Grey	E. Microcarpa
	Box Grey	E. Moluccana
	Tallow Wood	E. Microcorys
	Gum Grey	E. Punctata
	Gum Grey	E. Propinqua
	Gum Forest Red	E. Tereticornis
	Mahogany White	E. Acmeniodies
Group 3	Gum River Red	E. Camaldulensis
	Blackbutt	E. Pilularis

Table 3 – Approved timber species

5.2.3.2 Recycled timber sleepers

Recycled timber sleepers (i.e. sleepers that have previously been used in track) may not be used on main lines with the following exceptions:

- Sleepers are fitted with plates for resilient fastenings, and
- Sleepers have been assessed as having a minimum remaining life of 5 years at the new location, and
- The connection between the plates and the sleeper is sound with no evidence of plate movement.

Recycled sleepers may be used in crossing loops and in sidings under the following conditions:

- Sleepers have been assessed as having a minimum remaining life of 5 years at the new location.

5.2.4 Spacing

5.2.4.1 Spacing in open track

The spacing is defined as the distance between the centrelines of the sleepers. Timber sleeper spacing shall be in accordance with Table 4.

Track Class	Sleeper Spacing (mm)	Acceptance Tolerance (spacing or skew) (mm) (Note 1) (Note 2)	Tolerance Limit No. of sleepers/rail length (m)
ALL Track (mainline & sidings)			
1	600 ^(Note 3)	± 20 ^(Note 4)	25/15 (±50mm)
2	600 ^(Note 3)	± 20 ^(Note 4)	25/15 (±50mm)
3/3G	623 ^(Note 3)	± 20 ^(Note 4)	24/15 (±50mm)
5	610 ^(Note 3)	± 20	25/15 (±50mm)

Table 4 - Timber and steel sleeper spacing

- Note 1 Installation tolerance for new track or face resleepering of track sections
 2 Skew is the variation from square from one side of the sleeper to the other
 3 Except at rail joints (See Section 5.2.4.2)
 4 Up to 50mm for spacing to allow for missing a thermit weld (only over two sleepers)

5.2.4.2 Spacing at rail joints

Spacing of sleepers at rail joints in plain ballasted track shall meet the requirements detailed in Table 5.

Rail (Kg/m)	Design Spacing (mm)	Acceptance Tolerance (mm)
53 Insulated	430	± 20
53 Mechanical	510	± 20
Bonded Insulated Joints (any rail size)	600	± 20
All Others	510	± 20

Table 5 – Timber and steel sleeper spacing at joints

On certain lighter sections of track where angle fishplates are used, it may be necessary to adjust the sleeper spacing at joints to ensure dogspikes can be correctly located at the fishplate.

All sleepers shall be flat adzed when used with sleeper plates.

5.2.4.3 Spacing at bridge ends with ballast log

Spacing of rail support (sleepers, abutment and transoms) at transom topped bridge ends shall be adjusted in accordance with Table 6

Track Class	Design Spacing (mm)	Acceptance Tolerance (mm)
All classes – New bridge structures	600	± 20
All classes – Existing bridge structures	600 preferred up to 900 subject to approval of Principal Tack and Civil Engineer	± 20

Table 6 - Support spacing at bridge ends

5.2.5 Boring requirements in timber sleepers, transoms and bearers

Sleepers, transoms and bearers shall be bored to match the track plates used in the approved configuration. The patterns for sleeper plates using dogspikes, lockspikes, dogscrews and lockscrews are detailed in Appendix 3.

Hole sizes shall be as detailed in Table 7. Holes shall be bored completely through the timber.

Fastening type		Hole diameter (mm)
Dogspikes		21 ± 0.5
Lockspikes		16 ± 0.5
Dogscrews		17 ± 0.5
Lockscrews		14 ± 0.5
Screwspikes	27 mm dia	25 ± 0.5
	24 mm dia	18 ± 0.5
	22 mm dia	18 ± 0.5

Table 7 – Fastening hole diameters

5.2.6 Proximity of plates to sleeper and bearer ends in turnouts

The outer end of sleeper plates shall, normally, be located no closer than 200mm to the end of timber sleepers or bearers. The Civil Maintenance Engineer may approve a reduction to no less than 50mm in constrained situations at turnouts and special trackwork.

5.3 Steel sleepers

Steel sleepers are approved for installation in all classes of track in CRN. Steel sleepers are not approved for use in curves ≤ 200m radius. The steel sleeper design in AS 1085.17 is not valid in this range.

Where steel sleepers have been selected for track maintenance or renewal, the following requirements shall apply.

5.3.1 Selection

There are four types of steel sleepers as detailed in Table 8 below.

The sleeper type chosen for installation will depend on the operational requirement as detailed in CRN CS 200 and the current and future requirements for track circuiting.

Sleeper type shall be selected in accordance with Table 8.

Steel Sleeper Type	Application	Insulation	Approved configurations
1	Class 1 lines with ≥ 10MGT per year of 25t axle load traffic where NO track circuits are or may be provided	No	M8.5 (OneSteel)
1C	Class 1 lines with ≥ 10MGT per year of 25t axle load traffic where track circuits are or may be provided.	Yes	M10 (OneSteel)
2	All lines where type 1 sleepers are not required and where NO track circuits are or may be provided	No	M7.5 (OneSteel)
2C	All lines where type 1 sleepers are not required and where track circuits are or may be provided.	Yes	M8.5 (OneSteel)

Table 8 - Selection of steel sleeper type

Only approved products shall be used as sleepers, fastenings and insulators. Approved products are detailed in Appendix 1. Alternatively the steel sleeper system, including fastenings, may be approved by the Principal Track and Civil Engineer if it complies with the requirements of CRN Engineering Specification CRN CP 233 "Steel Sleepers".

5.3.2 Size

The sleepers shall be designed to conform to the dimensions detailed in Table 9.

Parameter	Dimensions
Length	2500 mm
Width (at base)	250 - 260 mm
Width (at seat)	150 - 160 mm
Depth	95 - 100 mm

Table 9 - Steel sleeper dimensions

5.3.3 Use

Steel sleepers may be installed:

- In a face in long sections or in a full curve,
- Interspersed with timber sleepers as PRS
- As replacements for isolated timber sleepers

Conditions may be applied to their use. These are detailed in this section

Steel sleepers are different to timber and concrete sleepers. They rely on the ballast in the sleeper "pod" to add to their effective mass. Because of this the amount of and degree of compaction of the ballast in the pod is critical to the sleeper's in-service performance

Steel sleepers shall be insulated where track circuits are present e.g. at approaches to level crossings with active protection.

Where one or more rails are to carry signalling current then both rails shall be insulated. Insulated sleepers shall comply with the insulation requirements specified in CRN CP 233.

Even with insulators fitted, contamination by conducting material around the fastenings or under the rail can cause signalling problems. This includes locations:-

- where contaminants regularly invade the track area (coal, minerals, mud, clay, dirt etc)
- locations where the track is continually wet

Where these conditions exist in track circuited areas, steel sleepers shall not be used.

Steel sleepers are not recommended for use in locations where corrosion/ chemical damage is likely to be a problem. Such locations may include:-

- Slag ballast
- Areas of frequent sanding (e.g. steep grades)
- Areas of high salinity
- Continually wet or moist areas such as some tunnels or some types of level crossings
- Areas where corrosive materials invade the track area (coal, minerals, mud, clay dirt etc.)

Steel sleepers are not recommended for use in the following situations

- Where the ballast/ formation is poor and where deflection under load is high
- At locations where track dynamic forces are high, such as at joints or where the inherent rail surface condition is poor.

In such situations the stable bond between the sleeper and the ballast cannot be maintained.

Steel sleepers shall not be used as transoms

Steel sleepers shall not be used at mechanical rail joints (i.e. one sleeper each side of the joint).

Steel sleepers that have been welded, cut or otherwise altered from an approved design shall not be used.

Steel sleepers that have been bent or otherwise damaged by derailment or extraction process may be reused on sidings and lines carrying <3MGT (on curves >1000m radius and tangent rack) subject to the following requirements:

- Engineering inspection and assessment in accordance with CRN Engineering Manual CRN CM 231 "Sleepers and Fastenings".
- They may be installed at intervals no closer than 1 in 2.

Where steel sleepers are to be reused the extent to which their fatigue life has been used up shall be considered. Guidelines for the assessment of fatigue life are contained in CRN CM 231.

Gauge widening is not required for steel sleepers used in low radius curves.

The following interfaces are not permitted within the body of curves < 600m radius:

- 100% steel sleepers with timber sleepers or a timber steel mix
- steel sleepers and concrete sleepers

The full extent of any curves shall be resleepered in all cases (e.g. all timber, all steel, all concrete, all interspersed timber and steel etc.)

5.3.4 Compatibility with rail type

Steel sleepers shall only be used with rail sizes up to and including the size for which they have been designed and tested in accordance with CRN CP 233. Spacers may be used to provide adjustment so that more than one rail size can be accommodated.

Current approved steel sleeper types are able to accommodate variations in rail size as detailed in Table 10 and Table 11 below:

	Sleeper type (OneSteel configuration)			
	M10	M8.5	M7.5	
	M10 NI 60 M10 I 53	M8.5 NI 53 M8.5 I 53	M7.5 NI 53	M7.5 NI 47
Punched for foot size	146	146	146	127
Used without spacers for	60kg 53kg (+ equivalents)	60kg 53kg (+ equivalents)	60kg 53kg (+ equivalents)	50kg 47kg (+ equivalents)
Used with spacers for		47kg (+ equivalents)	50kg 47kg (+ equivalents) 41 kg (+ equivalents) 31kg (+ equivalents)	

NI = Non insulated

I = Insulated

Table 10 - Hole punching and spacer selection in plain track

	Sleeper type (OneSteel configuration)	
	M10	M8.5
	M10 I 53	M8.5 I 53
Used without spacers for	60kg 53kg (+ equivalents)	60kg 53kg (+ equivalents) (NOT 100AS (1928))
Used with spacers for		100AS (1928) 47kg (+ equivalents) 41 kg (+ equivalents)

Table 11 - Hole punching and spacer selection at Bonded Insulated Joints

The term “equivalent” in Table 10 and Table 11 above relates to equivalent rail foot sizes as detailed in CRN CS 220. The selection of lock in shoulder, insulator (where required) and spacers (where required) is largely dependent on rail head dimensions. Selection of combinations of sleeper, lock in shoulder, insulator and spacers for individual rail sizes is detailed in CRN CM 231.

Where sleepers are to be used for rail sizes less than 47kg/m, then the sleeper systems to be used shall be adjustable to accommodate future rail upgrading to 53kg/m (or larger size) unless otherwise approved by the Principal Track and Civil Engineer.

Steel sleepers shall not be interspersed with concrete sleepers

Steel sleepers may only be interspersed with timber sleepers in LWR track where they are in accordance with a specific strategy developed in accordance with the guidelines in Section 7 and approved by the Principal Track and Civil Engineer.

5.3.5 Spacing

Steel sleepers shall be spaced in open track in accordance with the requirements of Table 4 and at rail joints in accordance with Table 5.

5.3.6 Anchors

Steel sleepers are attached to the rail with resilient fasteners that provide resistance to rail creep. Steel sleeper resilient fasteners typically provide at least equivalent creep resistance to fair type anchors. Fair type anchors shall be replaced against timber sleepers after PRS to restore the pre-existing anchor pattern or, a minimum of one in three sleepers anchored (including both fair type anchors or resilient fasteners) whichever is greater.

5.4 Concrete sleepers

Where concrete sleepers have been selected for track maintenance or renewal, the following requirements shall apply.

5.4.1 Selection

There are two types of concrete sleepers

- Heavy Duty - suitable for heavy freight tonnages and axle loads up to 30tonne or for providing greater lateral stability
- Medium Duty -suitable for general use with axle loads ≤ 25 tonne.

Only approved designs shall be used. Approved designs are detailed in Appendix 1

For existing applications, all new concrete sleepers shall meet the requirements of CRN Engineering Specification CRN CP 232 “Concrete Sleepers”.

5.4.2 Size

The sleepers shall be designed to conform to the dimensions detailed in Table 12.

Parameter	Heavy Duty	Medium Duty
Length	2390 - 2500mm	
Width (at base)	220 - 255 mm	
depth (centre of rail seat)	230mm maximum	180mm maximum
Rail seat area (flat surface)	28800mm ²	28800mm ²

Table 12 - Concrete sleeper dimensions

5.4.3 Use

Concrete sleepers are only approved for installation with 53 and 60kg rail.

On sharp curves <400m radius where Pandrol e3003 clips are installed, heavy duty insulators shall be used for new installations and for replacement of insulators. Heavy duty insulators are not required with 'Fastclip' installations.

Where concrete sleepers are used as replacement sleepers within existing sections of concrete sleepers they shall reasonably match adjacent sleepers in dimensions and capacity.

Where concrete sleepers are installed adjacent to turnouts with timber bearers, a transition zone of eight (8) timber bearers or sleepers is required between the concrete sleepers and the toe of the points.

To improve the stability of track approaching transom top bridges, where concrete sleepers are installed adjacent to transom top bridges, twenty (20) Heavy Duty concrete sleepers shall be installed.

Concrete sleepers may only be interspersed with timber sleepers where they are in accordance with a specific strategy developed in accordance with the guidelines in Section 7 and approved by the Principal Track and Civil Engineer.

5.4.4 Spacing

5.4.4.1 Spacing in open track

Concrete sleepers shall be spaced in accordance with the requirements of Table 13.

Track Class	Sleeper Spacing (mm)	Tolerance (spacing or skew) (mm) ^(Note 1)	Tolerance Limit No. of sleepers/rail length (m)
Design Spacing			
ALL mainline track	600	± 20 ^(Note 2)	25/15 (±50mm)
Maximum spacing (Sidings ONLY)			
≤25T Axle load	720	± 20	21/15 (±60mm)
>25T Axle load	600	± 20	25/15 (±50mm)

Table 13 - Concrete sleeper spacing

Note 1 Installation tolerance for new or face resleepering of track sections

2 Up to 50mm for spacing to allow for missing a thermit weld (only over two sleepers)

5.4.4.2 Spacing at bonded insulated joints in open track

Spacing of concrete sleepers at bonded insulated joints shall be 600mm (\pm 20mm).

5.5 Concrete guard rail sleepers

Concrete Guard Rail Sleepers are concrete sleepers that have been designed to allow attachment of guard rails inside the running rails in accordance with site specific designs.

Only approved designs shall be used. Approved designs are detailed in Appendix 1.

Selection, use and spacing shall be in accordance with similar requirements for concrete sleepers in Section 5.4.

5.6 Timber turnout bearers

The following requirements shall apply to the use of timber turnout bearers

5.6.1 Selection

The size and spacing of timber bearers for points and crossing structures may be designed using the beam on elastic foundation analysis (BOEF) similar to that used for sleepers, however the following additional considerations may be necessary:

- Allowance for additional length of timber bearers over standard sleepers.
- Allowance for centrifugal forces through curved pairs of rail.
- Allowance for forces and moment induced from points motors and other such equipment

For existing applications, all new timber turnout bearers shall meet the requirements of CRN CP 231

5.6.2 Timber bearer size

Dimensions of timber turnout bearers shall be selected as follows:

Width – 250mm

Depth – 150 and 180mm for general application
200mm for bearers on which points motors will be attached.

Boxed heart timber bearers are only approved for use in depths of 180mm and 200mm.

Length – The minimum length of timber bearers shall be calculated as the measurement from the “Outside” gauge face to “outside” gauge face at the point at which the bearer is to be installed + 1.2m. The length shall be rounded up to match the next available size for the selected bearer depth in Table 14

The minimum dimensions for turnout switch and crossing timbers shall be in accordance with the requirements specified in Table 14.

Width (mm)	Depth (mm)	Standard Timber Lengths Turnouts and Crossovers (m)
250	150	2.8, 3.0, 3.2, 3.4, 3.6, 3.8
	180	2.8, 3.0, 3.2, 3.4, 3.6, 3.8, 4.0, 4.2, 4.4, 4.6, 4.8, 5.0, 5.2, 5.4, 5.8, 6.0, 6.2, 6.4
	200	2.8, 3.0, 3.2, 3.4, 3.6, 3.8, 4.0, 4.2, 4.8, 5.0, 5.2,

Table 14 – Timber turnout bearer dimensions

The dimensional tolerances shall be in accordance with Table 15.

Parameter	Tolerance
Length	+ 50 mm / - 0 mm
Width	+ 25 mm - 0 mm
Depth	+ 10 mm / - 0 mm

Table 15 – Tolerances on timber bearer dimensions

5.6.3 Usage

5.6.3.1 New timber turnout bearers

Turnout bearers shall be cut from timber species nominated in Groups 1 and 2 of Table 16.

Treated bearers are not approved for use.

Group	Common Name	Botanical Name
Group 1	Ironbark Grey	E. Siderophloia
	Ironbark Grey	E. Paniculata
	Ironbark Grey	E. Drepanophylla
	Ironbark Red (Broad Leaved)	E. Fibrosa
	Ironbark Red (Narrow Leaved)	E. Crebra
	Ironbark Red	E. Sideroxylon
Group 2	Box Grey	E. Microcarpa
	Box Grey	E. Moluccana
	Tallow Wood	E. Microcorys
	Gum Grey	E. Punctata
	Gum Grey	E. Propinqua
	Mahogany White	E. Acmeniodies

Table 16 – Approved timber species

5.6.3.2 Recycled timber bearers

Recycled timber bearers (ie bearers that have previously been used in track) may not be used on Class 1, 2, 3 or 3G main lines.

Recycled bearers may be used in Class 5 track and in crossing loops and in sidings in all classes of track under the following conditions:

- timbers have been assessed as having a minimum remaining life of 5 years at the new location..

5.6.4 Spacing

Nominal spacing of timber turnout bearers shall be 600mm. Variation of spacing to suit turnout requirements is permitted up to a maximum of 700mm (except at mechanical joints or mechanical insulated joints where the maximum is 600mm). Spacing shall not be less than 500mm.

5.7 Concrete turnout bearers

5.7.1 Selection

Only approved designs shall be used. Approved designs are detailed in Appendix 1

For existing applications, detailed in CRN CS 200, all new concrete turnout bearers shall be designed and manufactured in accordance with the requirements of CRN Engineering Specification CRN CP 234 "Concrete Bearers".

5.7.2 Concrete bearer size

Limiting dimensions of concrete turnout bearers shall be selected as follows:

Width –	240 – 300mm
Depth –	220 – 300mm
Length –	Varies 2.5m to 7.5m

The dimensional tolerances for approved designs shall be in accordance with Table 17.

Dimension	Tolerance
Length	+ 10 mm / - 5 mm
Width	± 3 mm
Depth	± 3 mm

Table 17 – Tolerances on concrete bearer dimensions

5.7.3 Spacing

Nominal spacing of concrete turnout bearers shall be 600mm. Variation of spacing to suit turnout requirements is permitted up to a maximum of 700mm. Spacing shall not be less than 500mm

5.8 Steel turnout bearers

5.8.1 Selection

Only approved designs shall be used. For existing applications, detailed in CRN CS 200, all new steel turnout bearers shall be designed and manufactured in accordance with the requirements of CRN Engineering Specification CRN CP 235 "Steel Turnout Bearers"

5.8.2 Steel bearer size

Limiting dimensions of steel turnout bearers shall be selected as follows:

Width –	250 – 300mm
Depth –	95 – 200mm
Length –	Varies 2.5m to 7.5m

The dimensional tolerances for approved designs shall be in accordance with Table 18.

Dimension	Tolerance
Length	+ 10 mm / - 5 mm
Width	± 3 mm
Depth	± 3 mm

Table 18 – Tolerances on steel bearer dimensions

5.8.3 Spacing

Nominal spacing of steel turnout bearers shall be 600mm. Variation of spacing to suit turnout requirements is permitted up to a maximum of 700mm. Spacing shall not be less than 500mm

5.9 Fastening systems

Resilient or non-resilient fastening systems shall be selected to suit the sleeper type and in accordance with the following requirements

5.9.1 Non-resilient fastening assemblies

Non resilient fastening systems are only approved for use with timber sleepers.

The assembly generally consists of:

- Sleeper plates - These shall be double shouldered and shall provide a nominal rail cant of 1 in 20 towards the centre of the track (except in special circumstances such as turnouts), and
- Dogspikes - 2 (two) 22 mm round shank dogspikes (or approved equivalent) per sleeper plate, and
- Spring fastening spikes - 2 (two) 16mm lockspikes (or approved equivalent) per sleeper plate shall be used.

Note: Double shouldered sleeper plates are not manufactured for 31kg/m (60lb/yard rail). On Class 5 lines where 60lb/yard rail is installed, re-punched second hand single shoulder plates shall be used if available. If not available, or where sleepers are placed at rail joints where angle fishplates are used, sleeper plates cannot be installed. In such cases, dogspikes are driven directly into the sleeper. Lockspikes are not used.

Non resilient fastening assembly components shall be designed and manufactured to conform to the appropriate Australian Standard as detailed in Table 19.

Component	Standard
Fastenings— dogspikes (and equivalent fastenings) lockspikes (and equivalent fastenings) screw spikes	AS 1085.8 AS 1085.13 AS 1085.18
Sleeper plates	AS 1085.3

Table 19 – Australian standards for non-resilient fastening assemblies

Only approved fastenings and configurations shall be used. Approved non resilient fastenings are detailed in Appendix 1. Approved configurations are detailed in Table 21.

5.9.2 Resilient fastening assemblies

For timber sleepers and turnout bearers, the assembly generally consists of:

- Sleeper plates - These shall be double shouldered and shall provide a nominal rail cant of 1 in 20 towards the centre of the track (except in special circumstances such as turnouts), and
- Resilient rail clips - 2 (two) Pandrol clips (or approved equivalent) per sleeper plate, and
- Spring fastening spikes - 4 (four) 16mm lockspikes (or approved equivalent) per sleeper plate.

For steel sleepers, the assembly generally consists of:

- Lock-in shoulders, and
- Resilient rail clips - 2 (two) Trak-lok clips (or approved equivalent) per rail seat, and
- Spacers (where required), and
- Insulators (where required),

For concrete sleepers, the assembly generally consists of:

- Cast in shoulders - These are integral to the design of the sleeper, and

- Resilient rail clips - 2 (two) Pandrol clips (or approved equivalent) per rail seat, and
- Insulators, and
- rail seat pads.

For concrete turnout bearers, the assembly generally consists of:

- Base plates, and
- Screwspikes - 4 (four) 24mm screwspikes (or approved equivalent) per plate, and
- Resilient rail clips - 2 (two) Pandrol clips (or approved equivalent) per rail.

Resilient Fastening design shall be in accordance with the requirements detailed in AS 1085.19.

Resilient fastening assembly components shall be designed and manufactured to conform to the appropriate Australian Standard as detailed in Table 20.

Component	Standard
Fastenings— clips lockspikes screw spikes	AS 1085.19 AS 1085.13 AS 1085.18
Sleeper plates	AS 1085.3
Threaded Inserts	AS 1085.18
Cast-in components	AS 1085.19

Table 20 – Australian standards for resilient fastening assemblies

Only approved fastenings and configurations shall be used. Approved resilient fastenings are detailed in Appendix 1

Approved configurations for timber sleepers and turnout bearers are detailed in Section 5.9.3.

Approved configurations for steel sleepers are detailed in Section 5.9.4

Approved configurations for concrete sleepers are detailed in Section 5.9.5.

5.9.3 Fastenings for timber sleepers and bearers

Standard configurations of fastening assemblies for timber sleepers and turnout bearers are detailed in Table 21. Special arrangements apply for the fastening of chairs to A and B timber bearers in turnouts. These are detailed in Table 24.

Reformed plates are not approved for use in sleeper renewals on the CRN network

Track Class	Fastening Type No. per Plate/ Rail	Sleeper Plates BHP Dwg. No.	Lockspikes ^(Note 2) No per Plate
Non Resilient			
Main Lines			
1	2 Dogspikes ^(Note 1)	DF 30	2
2	2 Dogspikes ^(Note 1)	DF 10	2
3	2 Dogspikes ^(Note 1)	DF 10	2
3G		DF 30	2
5 (rail size 53. 47, 41kg) ^(Note 6)	2 Dogspikes ^(Note 1)	DF 10 (41,47kg) DF 30 (53)	2

Track Class		Fastening Type No. per Plate/ Rail	Sleeper Plates BHP Dwg. No.	Lockspikes ^(Note 2) No per Plate
5 (rail size 31kg) ^(Note 7)		4 Dogspikes ^(Note 1)	Nil	Nil
Sidings				
1		2 Dogspikes ^(Note 1)	DF 30	2
2		2 Dogspikes ^(Note 1)	DF 10	2 (curves only)
3		2 Dogspikes ^(Note 1)	Nil	Nil
Resilient				
Main Lines				
Class 1 and 2		2 Resilient E2003	DF 62 & cast plates	4
3		TBA		
3G		2 Resilient E2003	DF 62	4
ALL classes	For existing installations ONLY CANNOT be re-installed when sleeper is replaced	2 Resilient E1853	Reformed plates	2 lockspikes + 2 Gauge lockspikes (or approved alternatives) ^(Note 3)
Turnouts in ALL classes		2 Resilient	Appropriate baseplates	4
Transoms in ALL classes		2 Resilient E2003	DF 62 & cast plates	4 ^(Note 4)
Transoms in ALL classes		2 Resilient	Type ISP95098 plates	4 X 24mm screw spikes ^(Note 4)
Insulated Joints in ALL classes		Low profile clips e1627 (timber)	DF 62	4
Sidings				
ALL classes		2 Resilient E2003	DF 62	4
ALL classes	For existing installations ONLY CANNOT be re-installed when sleeper is replaced	2 Resilient E1853	Reformed plates	2 lockspikes + 2 Gauge lockspikes (or approved alternatives) ^(Note 3)
Turnouts in ALL classes		2 Resilient	Appropriate baseplates	4

Table 21 - Timber sleeper fastening configuration

- Note 1 Round shank dogspikes or approved alternative fastenings may be used. Approved alternatives are detailed in Section 5.9.7 and Appendix 1
- 2 Lockspikes (L6) or approved alternative fastenings may be used. . Approved alternatives are detailed in Section 5.9.7 and Appendix 1
- 3 Gauge lockspikes are approved for existing installations only and shall not be used in new installations. They CANNOT be re-installed when a sleeper is replaced.
- 4 In track circuited areas, where one of the spikes would cause shorting to the underframe of a steel underbridge, 3 (three) screw spikes per plate may be used on curves $\geq 300\text{m}$ radius, preferably with the two screw spikes on the gauge side of the rail.
- 5 Non resilient fastenings on transoms should be upgraded to resilient fastenings when transoms are renewed
- 6 Double shoulder sleeper plates shall be installed where 53, 47 or 41kg/m rail has been installed on Class 5 lines.

- 7 On Class 5 lines with 31kg/m (60lb/yd) rail, re-punched single shoulder sleeper plates shall be used if available. Otherwise sleeper plates shall not be installed and sleepers shall be cant adzed (1:20)

5.9.4 Fastenings for steel sleepers

Standard configurations of fastening assemblies for steel sleepers are detailed in Table 22.

Sleeper Design	Fastening Type No. per Plate/ Rail	Connection
All designs	2 Track-Lok	2 lock-in shoulders

Table 22 - Steel sleeper fastening configuration

5.9.5 Fastenings for concrete sleepers and bearers

Resilient fastening systems shall be used with concrete sleepers and bearers.

Conforming fastening systems shall use Pandrol E-2003 clips, Fastclip or other approved alternatives.

Rail pads of nominal 7.5mm thickness for E-clip fastenings and 10mm thickness for Fastclip fastenings shall be used.

Resilient fastenings are interchangeable for 53 and 60kg rail sections.

Standard configurations of fastening assemblies for concrete sleepers and turnout bearers are detailed in Table 23.

Sleeper Design	Fastening Type No. per Plate/ Rail
Medium Duty (Low Profile)	2 Resilient E2003 or 2 Fastclip FC1507
Heavy Duty	2 Resilient E2003 or 2 Fastclip FC1507

Table 23 - Concrete sleeper fastening configuration

5.9.6 Resilient fastenings on welded track (LWR and CWR) on bridges

5.9.6.1 Transom top steel openings with spans less than 18m (centre of bearings)

On bridges where resilient fastenings are installed, normal resilient fastenings shall be installed on the entire length of each span.

5.9.6.2 Transom top steel openings spans 18m long and greater, but less than 80m.

On bridges where resilient fastenings are installed, normal resilient fastenings shall be installed on one third of the span from the fixed end and Zero Load Restraint (ZLR) assemblies installed on the remaining two thirds of the span. Where spans are located on curves <400m radius, advice on fastening requirements shall be obtained from the Principal Track and Civil Engineer.

Provision shall be made for play at the movable end of a bridge for the guard rail "V" to expand and contract (depending on length). This can be achieved when using MDFC concrete termination sleepers by setting the lock-in shoulders 6mm clear of the nose end rail. ZLR assemblies are used to secure the guardrail nose ends, allowing limited movement.

5.9.6.3 Steel bridge spans >80m

Steel bridge spans longer than 80m should be considered for expansion switches.

On bridges where resilient fastenings are installed, normal resilient fastenings shall be installed on the entire length of each span.

5.9.7 Alternative and special configurations

5.9.7.1 Pandrol clips at insulated joints

Special low profile pandrol clips shall be used at insulated joints in 53 & 60Kg rails to eliminate contact between clips and fishbolts.

The clips are:

- For concrete sleepers and bearers - 'e'1629 or Fastclip FC1507
- For timber sleepers and bearers - 'e'1627

Clearances are compromised with the low profile clips in timber bearers with type PZ 147 and type 1 baseplates. Any clips that may become foul may be removed as long as sufficient fastenings remain in place to retain gauge security.

5.9.7.2 Steel sleepers at insulated joints

Use modified clip JB296 with insulation pad 2218 for steel sleepers around insulation joints. The lock in shoulder has various options depending on sleeper and rail size. Refer to sizing selection charts in CRN CM 231.

5.9.7.3 Approved alternatives to dogspikes and lockspikes

The Pandrol (AJAX) Dogscrow and Lockscrow are approved alternatives to dogspikes and lockspikes respectively. They may be installed with the approval of the Civil Maintenance Engineer.

The Dogscrow consists of a 19mm threaded shank with a 22mm shoulder below the flange. On top of the flange is a 6-lob head designed to fit an E24 drive socket.

The Lockscrow consists of a 16mm threaded shank with a flange and 6 lob head, the same as the Dogscrow. There are two types of Lockscrow:

- **Small flange** – for general use
- **Large flange** – for use with the automatic magnet pickup machine used by production gangs. This type cannot be used on rolled Pandrol plates because of the flange interferes with the rolled shoulder and does not sit flush on the plate.

5.9.7.4 Resilient baseplate assemblies

Resilient baseplate assemblies may be used as an alternative to standard base plates on timber sleepers, transoms and bearers, concrete sleepers and bearers and for direct fixation track applications in the following applications:

- bridges where noise and / or vibration reduction is required,
- ballasted track where noise and / or vibration reduction is required,
- direct fixation track where noise and / or vibration reduction is required, and
- at interfaces between ballast and non-ballasted track where graded changes in track stiffness are required

Only approved designs shall be used. Approved designs are detailed in Appendix 1.

All new Resilient Baseplate assemblies shall be designed and manufactured in accordance with the requirements of CRN Engineering Specification CRN CP 237 "Resilient Baseplates".

5.9.7.5 Holding down bolts for timber bearers

A & B Timber Bearer Fastening Type	
New Installations	
60kg/m steelwork	Screwspikes
Other rail sizes	Holding down bolts or approved equivalent swage fastenings
For Repair/ Replacement	
60kg/m steelwork	If the screwspikes are no longer able to provide adequate grip or if timber quality is suspect use holding down bolts or approved equivalent swage fastenings
Other rail sizes	Holding down bolts or approved equivalent swage fastenings
For non-interlocked points	
All rail sizes	Screwspikes

Table 24 – A & B Timber Bearer fastening configuration

5.9.7.6 Zero Load Restraint (ZLR) assemblies

Zero Load Restraint assemblies allow longitudinal rail movement whilst retaining gauge and limiting upward movement of the rail. They shall be used in accordance with Section 5.9.6. Approved designs are listed in Table 25 and detailed in Appendix 1.

When used in conjunction with resilient baseplate assemblies, special configurations are required to fit the dimensional restrictions of the baseplate.

Configuration type	Assembly	Components
Standard baseplates (with lockspikes or screwspikes)	Pandrol PMP 41027 for AS60kg rail	ZLR Cap 41027 Clip e2079
Alternative 1 resilient baseplates "Delkor Egg" resilient baseplates	Pandrol 12730 for AS60kg rail	ZLR Cap 12731 Clip e2079 Insulator IN55088 5 mm Rail Pad RP-65026

Table 25 - Zero Load Restraint assemblies

6 Prohibited configurations

The following configurations are not permitted for permanent works on CRN trackwork:-

- Non--resilient fastening systems with 60kg/m rail
- Non--resilient fastening systems with concrete sleepers or steel sleepers
- Steel sleepers mixed with concrete sleepers
- Resilient and non-resilient fastenings on the same sleeper
- Resilient fastenings on more than 1 in 3 sleepers in LWR track (unless a management strategy has been approved by the Principal Track and Civil Engineer in accordance with the requirements detailed in Section 7.)

7 Mixed configurations

There are some limitations and special requirements when configurations are mixed. They are applicable to existing track on the CRN network ONLY.

7.1 Mixing concrete and timber sleepers

Concrete sleepers may be interspersed with timber sleepers in accordance with the following guidelines. Interspersion:

- must be part of an approved line strategy, not ad hoc
- may only be used with Medium Duty sleepers, and on line sections where medium duty sleepers may be used
- must lead eventually to 100% concrete
- may be installed to a standard pattern of 1:2, 1:3 or 1:4 but with variation of one sleeper position to suit local conditions
- whole curves shall be resleepered and reasonable lengths of tangent track should be done to a consistent pattern
- is not suitable for jointed track beyond the limits detailed in Section 7.3.1 for timber sleepers.
- may be used in patterns of 1:3 and 1:4 in poor ballast conditions, but more than this may only be used in track where design concrete sleeper ballast depth is achieved and ballast is free draining.

7.2 Mixing steel and timber sleepers

Steel sleepers may be interspersed with timber sleepers in accordance with the following requirements:

Minimum tie patterns are detailed in Table 26. Denser tie patterns may be used to address sleeper fatigue and fastening failure issues.

Track Class	MGT/year	Curvature		
		< 400m Radius	<600m radius	>600m radius & tangent track
1		1 in 4 (Note 2)	1 in 4	1 in 4 (Note 3)
2	≥ 2	1 in 4	1 in 4	1 in 4 (Note 3)
	<2	1 in 4	1 in 6	1 in 6
3, 5		1 in 4	1 in 6	1 in 6

Table 26 - Minimum Tie Patterns for steel sleepers in timber sleepered track

- Note 1: A variation in the tie placement of one sleeper is still considered to be to pattern as long as the pattern is generally maintained (e.g. 1 in 4 would allow odd sleepers to be 3rd or 5th sleeper) excepting that clumping should be avoided.
2. Steel sleepers not recommended. Concrete sleepers preferred as they provide better lateral stability. If steel sleepers are installed, use a denser tie pattern.
3. may be extended to 1 in 6 if sleeper condition permits.

When undertaking planned PRS sleeper replacement shall be planned to meet “clumping requirements detailed in Table 27

Track Class	General Steel Sleeper Pattern	2 together	≥3 together
1, 2	1 in 2	Permitted	Permitted
	1 in ≥3	Not recommended	Prohibited
3,3G	1 in 2	Permitted	Permitted
	1 in ≥3	Permitted	Prohibited

5	1 in ≥ 2	Permitted	Permitted
Sidings	1 in ≥ 2	Permitted	Permitted

Table 27 – “Clumping” of steel sleepers

Where face renewal is normal practice at special locations such as level crossings, this practice is exempt from clumping requirements.

Single sleepers may be installed as required

A track length is considered “face resleepered” (not clumped) when the rail length with 100% steel sleepers reaches 110m on straights or the full curve (TP to TP) in curved track.

This also applies to shorter lengths of face resleepering on “whole” structures e.g. ballast top bridges and level crossings.

7.3 Mixing resilient and non-resilient fastenings

7.3.1 In track with Loose Rail

There are no restrictions on the installation of resilient fastened timber or steel sleepers mixed with non-resilient fastened timber sleepers in track with loose rail.

7.3.2 In LWR track

Sleepers with resilient fastenings must NOT be interspersed with timber sleepers with non-resilient fastenings in LWR where this would result in them being more frequent than 1 in 3 unless a management strategy has been approved by the Principal Track and Civil Engineer in accordance with the following guidelines.

- Where sleeper installation is part of a PRS program, rail adjustment of the rail section (110m minimum) shall be checked and corrected. Consideration should be given to conversion of LWR to CWR in these circumstances.
- Before achieving an average pattern of 1 in 2 resilient fastenings the rail length shall be converted to CWR.
- Where individual sleepers are being installed to replace failed sleepers, free up rail stresses in the local area by releasing adjacent non-resilient fastenings and anchors and destressing the rail (see CRN Engineering Manual CRN CM 223 “Rail Adjustment for method”). This should be done at Rail Neutral Temperature.
- Record locations so they are identified for special attention during Track Examination and Welded Track Stability Analysis
- Apply additional controls e.g. extra ballast, additional anchors etc., Reduce other Welded Track Stability issues to a minimum. See CRN Engineering Manual CRN CM 211 “Track Geometry and Stability” for guidance.

7.3.3 In CWR track

- Timber sleepers with resilient fastenings may only be interspersed with timber sleepers with non-resilient fastenings in CWR track where they are in accordance with a specific strategy and provided a consistent tie pattern is maintained (e.g. 1 in 2, 1 in 3 etc.).
- Where backcanting is evident in timber sleepers with non-resilient fastenings, replacement with -resilient fastenings shall meet the minimum tie patterns detailed in Table 28 to avoid clip breakage:

Tie Pattern	Limit of backcanting (mm)	
	DS Plates	Resilient Plates
1 in 3	3	5
1 in 2	6	10

Table 28 - Minimum resilient fastening patterns in backcanted track

Where backcanting is ≥ 8 mm, complete renewal in resilient fastenings may be required to prevent clip breakage.

8 Changing configurations

The following configurations are not desirable. Renewal strategies should be directed to their elimination:

- Timber sleepers on curves < 400 m radius on CWR track
- Non--resilient fastenings in timber sleepers on CWR track
- Resilient fastened track on transom topped steel bridges with spans >18 m that does not meet the requirements of Section 5.9.6 relating to the installation of Zero Load Restraint fastenings.

9 Acceptance standards

9.1 General

Acceptance standards for condition and installation of sleepers, bearers and fastenings shall be as detailed in Sections 5, 6 and 7. The following additional requirements apply.

9.2 Sleeper plates

Acceptance Standards for re-use of sleeper plates shall be as follows

- DO NOT use reformed pandrol plates, old pattern plates or single shoulder plates
- DO NOT use any sleeper plates with evidence of excessive corrosion, notch marks or oxyacetylene burn marks on the rail seat, shoulder or at spike holes.
- DO NOT use any sleeper plates with shoulders that are worn to a sharp edge.
- DO NOT use any sleeper plates with cracks
- DO NOT use any sleeper plates with plate underside concavity or convexity greater than 1mm.
- DO NOT use any sleeper plates with lockspike holes wider than 19 mm at bottom surface.
- DO NOT use any sleeper plates with dogspike holes wider than 25.5 mm at bottom surface.
- DO NOT use any sleeper plates with rail seat width greater than 150 (+1) mm.

9.3 Installation of steel sleepers

All sleepers in the area covered by a steel sleeper installation program shall be resurfaced at the completion of the installation process. This includes new and existing steel and timber sleepers.

Following resurfacing

- the height of the ballast in the sleeper pods shall be such that the gap between the underside of the sleeper deck and the ballast in the sleeper pod shall be ≤ 25 mm.
- The ballast within the sleeper shall be "tight"

- Deflection of steel and timber sleepers under normal traffic loadings should be consistent and no more than 5mm,
- There should be no cyclic top or line in evidence

The method of measurement is detailed in CRN CM 231

The ballast profile for steel sleepers shall meet the minimum standards in CRN Engineering Standard CRN CS 240 "Ballast". Extra ballast may be placed on the outside of the sleeper ends but shall be no higher than the superelevated rail height.

Track geometry shall comply with the geometry maintenance limits specified CRN Engineering Standard CRN CS 210 "Track Geometry and Stability".

10 Repair standards

10.1 Timber sleepers and bearers

Timber sleepers and bearers may be cross-bored (once only on each side of each rail) if they are otherwise sound.

10.2 Concrete sleepers

Cast in-situ shoulders may be replaced using an approved process. Approved processes are detailed in Appendix 2.

10.3 Fastenings

Sleeper fastening components may be repaired using an approved process. Approved processes are detailed in Appendix 2

Appendix 1 Approved sleeper and fastening products

Approvals for products (Appendix 1) and repair processes (Appendix 2) are dependent on both the manufacturer and supplier. If either changes, the product approval may no longer be valid. Seek advice from the Principal Track and Civil Engineer.

Product Approval Numbers are shown for all products approved by JHR CRN. Other products listed were approved for use on CRN prior to January 2012 and have been accepted by JHR CRN.

Product Approval No.	Common Item Name	Description	Standard/ Drawing	Manufacturer/ Supplier
Non Resilient Fastenings				
	Dogspike	Spike, track; round shank; 22mm shank dia; 119mm long; forged; steel (dogspike)	AS 1085.8 CV0046205	Greg Sewell Forgings ARSC
	Dogspike	Spike, track; round shank; 22mm shank dia; 119mm long; forged; steel (dogspike)	AS 1085.8 Dwg CV0046205	Greg Sewell Forgings ARSC
	Dogspike	Spike, track; round shank; 22mm shank dia; 119mm long; forged; steel (dogspike)	AS 1085.8 Dwg CV0046205	Greg Sewell Forgings
	Gauge Lockspike	Spike, track, square shank lock type L6, XS1070	AS 1085.13	Greg Sewell Forgings
	Lockspike	Spike, track, square shank lock type L1, , XS1070	AS 1085.13	Greg Sewell Forgings
	Dogscrew	DogScrew 22mm Shouldered; 9mm Thick Flange; Galvanised	Ajax Fasteners Dwg No SRSG19.135 19/10/04	Cold Forge Pandrol
	Lockscrew	LockScrew 16mm; Galvanised	Ajax Fasteners Dwg No TLSB16.125 10/11/03	Cold Forge Pandrol
	Screw spike	Spike, track Screw spike; 27mm dia 165mm long. For timber, galvanized	AS 1085.18 Dwg CV0024139 or 205A-374	Cold Forge
	Screw spike	Spike, track Screw spike; 24mm dia; 122mm long; galv; For half polymer/concrete sleepers and 90mm nylon insert; galvanized to as 1214	SRA Dwg 885-067b or Delkor Dwg HSR-602e	Cold Forge
	Screw spike	Spike, track Screw spike; 24mm dia; 165mm long; galv; For concrete sleepers; Galvanized to AS 1214	SRA W&W 205a-381b or Delkor Dwg HSR-602d	Cold Forge
	Screw spike	Spike, track Screw spike; 24mm dia		Cold Forge
	Washer, lock	25mm ID; 46mm OD; 6mm thick; high tension double helical spring type;fe6; Galvanized to AS 1214	Delkor Dwg DSW - 01	Cold Forge
	Screw spike	Spike, track Screw spike; 22mm dia; 150mm long; galv; For timber sleepers; city underground; Galvanized to AS 1214	RSA Consult. Dwg 885-066b	Cold Forge
Resilient Fastenings				
CRN 018	Track-Lok II Clip	Track-Lok II – for use with steel sleepers Part No. B296	Dwg 2116-14A or CRN CC000044	Liberty Onesteel

Product Approval No.	Common Item Name	Description	Standard/ Drawing	Manufacturer/ Supplier
CRN 018	Track-Lok II Clip	Track-Lok II – for use with steel sleepers at BIJs Part No. JB296	Dwg 2118-2A or CRN CC000291	Liberty Onesteel
CRN 018	Lock in shoulder	Track-Lok II – for use with steel sleepers Part No.2406 / 2410 / 2411	Dwg 2410-8 or CRN CC000046	Liberty Onesteel
CRN 018	Lock in shoulder	Track-Lok II - for use with steel sleepers Part No.2408	Dwg 2408-10B or CRN CC000074	Liberty Onesteel
CRN 018	Lock in shoulder	Track-Lok II – for use with steel sleepers Part No. 2409	Dwg 2409-10B or CRN CC000045	Liberty Onesteel
CRN 018	Lock in shoulder	Track-Lok II – for use with steel sleepers Part No. 2425	Dwg 2425-1B or CRN CC000284	Liberty Onesteel
CRN 018	Steel sleeper spacers	Track-Lok spacers - Part No. 2509	Dwg 2509-2B or CRN CC000048	Liberty Onesteel
CRN 018	Steel sleeper spacers	Track-Lok spacers - Part No. 2518	Dwg 2518-0A or CRN CC000289	Liberty Onesteel
CRN 018	Steel sleeper spacers	Track-Lok spacers - Part No. 2519	Dwg 2519-0A or CRN CC000290	Liberty Onesteel
CRN 018	Steel sleeper spacers	Track-Lok spacers - Part No. 2528	Dwg 2528-3B or CRN CC000287	Liberty Onesteel
CRN 018	Steel sleeper spacers	Track-Lok spacers - Part No. 2545	Dwg 2545-0B or CRN CC000050	Liberty Onesteel
CRN 018	Steel sleeper spacers	Track-Lok spacers - Part No. 2552 (gauge side), Part No. 2551 (field side)	Dwg 2551-3B or CRN CC000052	Liberty Onesteel
CRN 018	Steel sleeper spacers	Track-Lok spacers - Part No. 2554 (gauge side), Part No. 2553 (field side)	Dwg 2553-0B or CRN CC000051	Liberty Onesteel
	Pandrol Clip E series	Rail clip Type e2003; 20 mm dia; 106 mm l; 103 mm w; material XK 9261b; AS 1444;	Dwg e-21027	Pandrol
	Pandrol Clip E series	Rail clip E1600 series; timber sleeper insulated Joints; painted red; 16 mm dia; 100 mm l; 85 mm w; type e1627	Dwg e16-20002	Pandrol
	Pandrol Clip E series	Rail clip E1600 series; concrete insulated Joints; painted blue; 16 mm dia; 100 mm l; 85 mm w; type e1629	Dwg e16-20021	Pandrol
	Pandrol Clip E series	Rail clip E1829 series; 18mm dia; 98mm lg; 90mm w; 52.5mm 47mm heel; 54mm toe; steel; black; (non insulated joints on timber sleepers);	Dwg e18-20002	Pandrol
	Pandrol Clip E series	Rail clip e2079 series; 20mm dia; 106mm l; 102.5 mm w; material XK 9261b; AS 1444	Dwg e-21108	Pandrol
	Pandrol Zero Load Restraint (ZLR) Plate	Zero Load Restraint Plate 41027 to suit 60kg rolled steel sleeper plate and e2079clip.	PMP-41027	Pandrol

Product Approval No.	Common Item Name	Description	Standard/ Drawing	Manufacturer/ Supplier
	Pandrol Zero Load Restraint (ZLR) Cap	Plate, ZLR Cap 12731 to suit 60kg Delkor Cologne Egg	Pandrol 12730	Pandrol
	Fastclip FC1507	Pandrol fastclip; type FC1507; silico-manganese spring steel XK9261b with plastic toe insulator	Pandrol FC 1507 and Pandrol 8494	Pandrol
	Fastclip type FC1509	Pandrol fastclip; type FC1509; silico-manganese spring steel XK9261b with toe insulator 10293 (white) and Sidepost Insulator 10292 (white)	Dwg No 10291	Pandrol
	Sliding shoulder head	For concrete guard rail sleepers; e-clip fastening (multilok system); to suit 47-60kg rail	Amatek Rocla Dwg SSP 1456	Pandrol
	Rail clip, railway	Track; tunnel clips; scheridised;		Pandrol
	Rail Clip, Railway	'A' Clip for guardrails, SG Iron	Delkor S.85.745	Pandrol
Pads and Insulators				
CRN 018	Rail Insulated pad for steel sleepers	Track-Lok insulators – Part No. 2212	Dwg 2211-10A or CRN CC000054	Liberty Onesteel
CRN 018	Rail Insulated pad for steel sleepers	Track-Lok insulators – for use with BIJs Part No. 2218	Dwg 2217-8A or CRN CC000288	Liberty Onesteel
	Rail Insulator	Insulator, rail 2 piece: composite insulator in-55058 with a slope of 1 in 45; including cover Plate in-55057;125mm long x 54mm w; 53/60kg rail;	Pandrol In-55061	Pandrol
	Insulator, rail, concrete sleeper	Glass reinforced nylon insulator ;for use with concrete sleeper having pandrol e-clip fastenings;to suit 53/60kg rails	Pandrol In-55088	Pandrol
	Rail Insulator	Insulator, rail, concrete sleeper Dual function spacer/insulator for use with 47kg rail in 60kg rail seat;glass reinforced nylon;		Pandrol
	Rail Insulator	G.R.H. Insulator to suit insulated joint Assemblies; 108mm long x 40mm w x 20mm h; 53/60kg rail;	Pandrol In-55186	Pandrol
	Rail Insulator side post Fastclip	Pandrol side post insulator type 7551; for use with concrete sleeper having Pandrol Fastclip fastenings	Pandrol 7551	Pandrol
	Rail Insulator toe Fastclip	Pandrol toe insulator type 8494;for use with concrete sleeper having Pandrol Fastclip fastenings	Pandrol 8494	Pandrol
	Rail Insulator	Heavy duty insulator assembly type hda2; 8mm pad x 110mmw;	Pandrol In-55185	Pandrol
	Rail pad	Rail pad, railway Fabreeka/rubber;190mm lg x 170mm w x 7mm thk		Pandrol
	Rail pad	Grooved;HDPE plastic;180mm w x 186mm lg x 7.5mm thk; black; for 53/60kg rail/ concrete sleeper;		Pandrol

Product Approval No.	Common Item Name	Description	Standard/ Drawing	Manufacturer/ Supplier
	Rail pad	163mm wide x 180mm long x 7.5mm thick; HDPE.; Used with 53kg and 60kg rails	Pandrol RP-65184C	Pandrol
	Rail pad	190mm wide x 190mm long x 5mm thick; H.D.P.E.; Used with 53kg and 60kg rails	Pandrol RP-65026	Pandrol
	Rail pad	Pandrol HDPE rail pad; type 8853; for use with concrete sleeper having pandrol e-clip fastenings	Pandrol 8853	Pandrol
	Rail pad Fastclip	Pandrol HDPE rail pad; type 9154; for use with concrete sleeper having pandrol fastclip fastenings	Pandrol 9154	Pandrol
Sleeper plates				
	Sleeper Plate Screwspike	Screw spike; clip type; 146mm rail base; 1 in 20 cant; cat no 086s;	Pandrol isp95086	Pandrol Cold Forge ARSC
	Sleeper Plate Clip type	Clip type; 4hole; 146mm rail base; 1 in 20 cant; cat no 486;	Pandrol ISP95486	Pandrol Cold Forge ARSC
	Sleeper Plate dogspike	Double shoulder type; 127 mm rail base; 1 in 20 cant; Cat no 430;	BHP 2705 127dstb-df10	Pandrol Cold Forge ARSC
	Sleeper Plate dogspike	Double shoulder type; 146mm rail base; 1 in 20 cant; cat no 420;	BHP 2706 146dstb-df30	Pandrol Cold Forge ARSC
	Sleeper Plate Clip type	Clip type; 6hole; 127mm rail base; 1 in 20 cant;	Pandrol isp-95064	Pandrol Cold Forge ARSC
	Sleeper Plate Screwspike	Screw spike; clip type; 148mm Rail base; 1 in 20 cant; cat no 054	Pandrol ISP95054	Pandrol Cold Forge ARSC
	Sleeper Plate Clip type	Screwspike clip type; 148mm rail base; 1 in 20 cant; cat no 098s; bridge type;	Pandrol ISP95098	Pandrol Coldforge ARSC
	Sleeper Plate Clouth alternative 1	Clouth alternative 1; 60kg rail; cast Iron-rubber; sound damping, double Shouldered 1:20 cant, end holes at 130mm centres	Delkor RF 0. 02 192 CLA	Delkor
	Sleeper Plate Clouth alternative 1	Clouth alternative 1; 60kg rail; cast Iron-rubber; sound dumping, double Shouldered 1:20 cant, end holes at 95mm centres	Delkor RF 0.10.092 CL	Delkor
	Sleeper Plate Clouth alternative 1	Clouth alternative 1; 60kg rail; cast Iron-rubber; sound damping, double Shouldered 1:20 cant, side holes	Delkor RF 0.29.092 CLA	Delkor
Timber Sleepers				

Product Approval No.	Common Item Name	Description	Standard/ Drawing	Manufacturer/ Supplier
	Timber Sleeper	Sleeper, railway Timber; unbored; 230mm x 130mm x 2440mm ironbark or approved hardwood	AS 3818.2	
	Timber Sleeper	Sleeper, railway Timber; 230mm x 130mm x 2440mm lg; bored 47kg/80lb AS "A"; ironbark or approved hardwood	AS 3818.2	
	Timber Sleeper	Sleeper, railway Timber; 230mm x 130mm x 2440mm; Bored; 53kg new pattern; Ironbark or approved hardwood	AS 3818.2	
	Timber Sleeper	Sleeper, railway Timber; 230mm x 130mm x 2440mm; Bored for Pandrol fastenings	AS 3818.2	
	Timber Sleeper	Timber, Dog Screw, new pattern, 230mm x 130mm x 2440mm, Bored	AS 3818.2	
	Timber Sleeper	Timber, Dog Screw, Pandrol pattern, 230mm x 130mm x 2440mm, Bored	AS 3818.2	
Steel Sleepers				
CRN 018	M7.5 Non-insulated (AS47)	Steel – 7.5mm thick 1435mm gauge Non-insulated Track Lok II fastening system – Part No. 7.5SG12105TSS (NSW)	AS 1085.17 Dwg 12105-2A or CRN CC000286	Liberty Onesteel
CRN 018	M7.5 Non-insulated (AS53)	Steel – 7.5mm thick 1435mm gauge Non-insulated Track Lok II fastening system – Part No. 7.5SG2072TSS (NSW)	AS 1085.17 Dwg 2072-4A or CRN CC000060	Liberty Onesteel
CRN 018	M8.5 Non-insulated (AS53)	Steel - – 8.5mm thick 1435mm gauge Non-insulated Track Lok II fastening system – Part No. 8.512142TSS (NSW)	AS 1085.17 Dwg 12142-1A or CRN CC000061	Liberty Onesteel
CRN 018	M8.5 Insulated (AS53)	Steel - – 8.5mm thick 1435mm gauge Insulated Track Lok II fastening system – Part No. 8.5SG12125TSS (NSW)	AS 1085.17 Dwg 12125-1A or CRN CC000062	Liberty Onesteel
CRN 018	M10 Non-insulated (AS60)	Steel - 10mm thick 1435mm gauge Non-insulated Track Lok II fastening system – Part No. 10SG12126TSS (NSW)	AS 1085.17 Dwg 12126-1A or CRN CC000063	Liberty Onesteel
CRN 018	M10 Insulated (AS53)	Steel - 10mm thick 1435mm gauge Insulated Track Lok II fastening system – Part No. 10SG12195TSS (NSW)	AS 1085.17 Dwg 12195-1A or CRN CC000064	Liberty Onesteel
Concrete Sleepers				
	Concrete Sleeper Medium Duty Fastclip (MDFC), 25T	Concrete; Medium duty low profile 25t axle load; Pandrol Fastclip fastening system; mass 232kg	AS 1085.14 Dwg 91750	Rocla
	Concrete Sleeper Medium Duty E-clip (MDEC), 25T	Concrete; Medium duty low profile 25t axle load; Pandrol e2003 fastening system; mass 232kg	AS 1085.14 Dwg 90744	Rocla
	Concrete Sleeper Heavy Duty E-clip (HDEC), 30T	Concrete; Heavy Duty Type 5 30t axle load ;Pandrol e-clip fastening system; mass 285kg;	AS 1085.14 Dwg 90699	Rocla

Product Approval No.	Common Item Name	Description	Standard/ Drawing	Manufacturer/ Supplier
	Concrete Sleeper Heavy Duty Fastclip (HDFC), 30T	Concrete; Heavy Duty 30t axle load; Pandrol Fastclip fastening system; mass 285kg	AS 1085.14 Dwg 91749	Rocla
	Concrete Sleeper Type 6M 30t E-clip	Concrete; Type 6M 30t axle load; 20 wire Pattern; Pandrol e2003 fastening system; (mass 275kg);	AS 1085.14	Rocla
	Concrete Sleeper track circuit Fastclip	Concrete; track circuit sleeper; Medium duty 25t axle load; Pandrol Fastclip fastening	AS 1085.14	Rocla
	Concrete Sleeper Heavy Duty E-clip (HDEC), 30T	Concrete; Heavy Duty 30t axle load ;Pandrol e-clip fastening system; mass 285kg;	AS 1085.14 Dwg 217-20S-E-C	Austrak
	Concrete Sleeper Heavy Duty Fastclip (HDFC), 30T	Concrete; Heavy Duty 30t axle load; Pandrol Fastclip fastening system; mass 285kg	AS 1085.14 Dwg 217-20S-F-C	Austrak
Concrete Guardrail Sleepers				
	Concrete Guardrail Sleeper Heavy Duty E-clip (HDEC) 30T No.1 to No. 6	Concrete, Heavy Duty E-clip Guardrail sleeper, GR1 to GR6, 30T axle load, Pandrol E-clip fastening system	AS 1085.14 Dwg 91935	Rocla
	Concrete Guardrail Sleeper Medium Duty E-clip (MDEC) 25T No. 1 to No. 6	Concrete, Medium Duty E-clip Guardrail sleeper, GR1 to GR6, 25T axle load, Pandrol E-clip fastening system	AS 1085.14 Dwg 91933	Rocla
	Concrete Guardrail Sleeper Heavy Duty Fastclip (HDFC) 30T No. 1 to No. 6	Concrete, Heavy Duty Fastclip Guardrail sleeper, GR1 to GR6, 30T axle load, Pandrol E-clip fastening on guardrail and fastclip on running rail	AS 1085.14 Dwg 91936	Rocla
	Concrete Guardrail Sleeper Medium Duty Fastclip (MDFC) 25T No. 1 to No. 6	Concrete, Medium Duty Fastclip Guardrail sleeper, GR1 to GR6, 25T axle load, Pandrol E-clip fastening on guardrail and fastclip on running rail	AS 1085.14 Dwg 91934	Rocla
	Concrete bearer	Concrete bearer, FLAT 1, 30T, 8 ferrules cast in for cant reducing sleeper plates	AS 1085.14 Dwg 785-576	Rocla
	Concrete Guardrail Bearer	Concrete Guardrail Bearer, Type AGR1 to AGR7 for "Alternative 1" sleeper plates under running rail, 'A' clips hold the guardrail	AS 1085.14 Dwg 785-030 / 785-031	Rocla
	Concrete Guardrail Sleeper Heavy Duty Fastclip (HDFC) 30T No. 1 to No. 6	Concrete, Heavy Duty Fastclip Guardrail sleeper, GR1 to GR6, 30T axle load, Pandrol E-clip fastening on guardrail and fastclip on running rail	AS 1085.14 Dwg 217-20S-F-GA Dwg 217-20S-F-GR1 - 6	Austrak

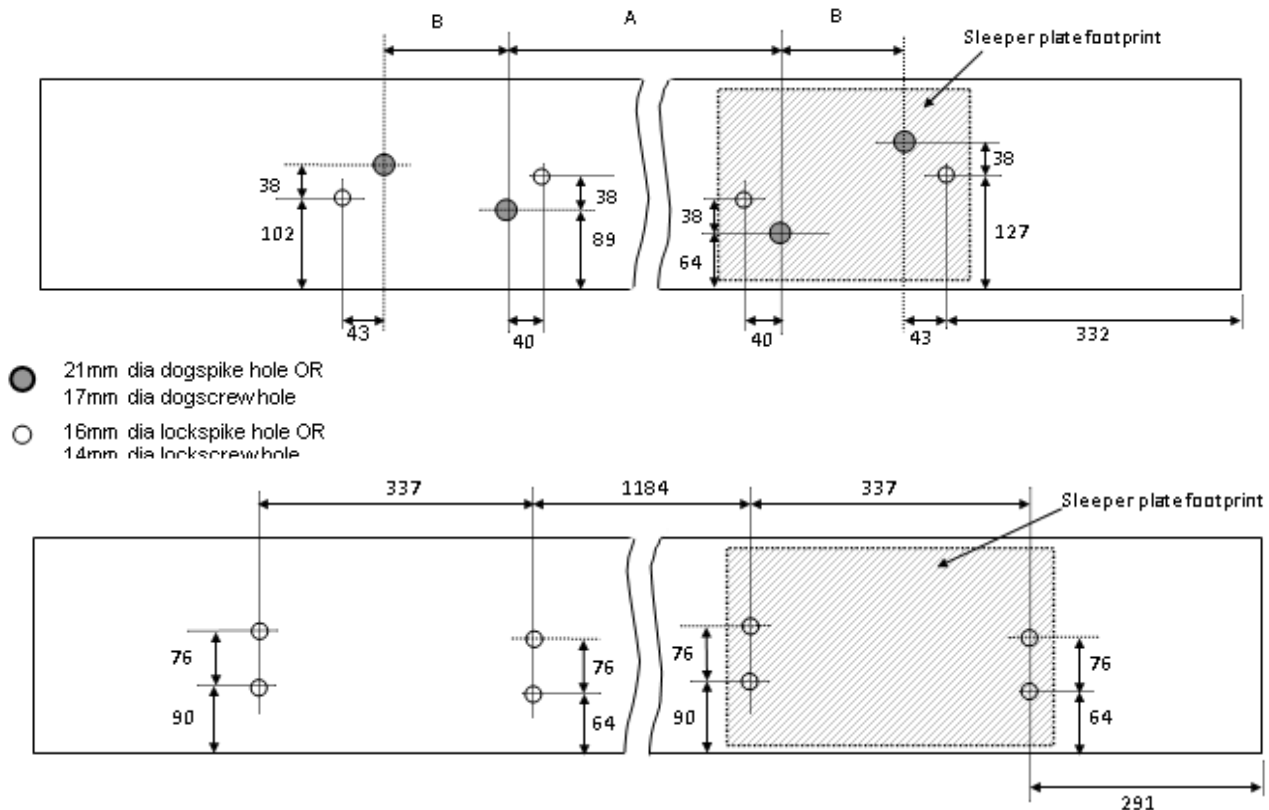
Appendix 2 Approved repair processes

Product Approval No.	Repair Item	Description	Standard/ Drawing	Manufacturer/ Supplier
	Pandrol Cast in shoulders	Epoxy concrete repair of damaged concrete shoulders		Pandrol
	Pandrol Fastclip shoulders	Welded repair of Fastclip cast-in shoulder components		Pandrol

Appendix 3 Sleeper boring patterns

Rail Section	Plate Cat No.	A (mm)	B (mm)	Comment
53 kg	DF 30 New Pattern	1348	171	Lockspike and dogspike arrangement is a mirrored and inverted image of Old Pattern
53 kg	DF 30 Old Pattern	1348	171	
100lb AS	DF 30 Old Pattern	1348	171	
100lb AS 1916	DF 10 Old Pattern	1354	171	
AS 50, AS 47, 90lb 1925/28, 80lb AS 'A' 1928	DF 10	1366	152	
90lb AS 1916		1346	162	Unplated. i.e. not on tapered base or cant adzed and no lockspike holes
90 'J' 1913		1343	162	
80lb AS 'B' 1928, A, A ^{1,2&3}		1346	152	
71½lb 'D' 1875		1346	146	
60lb AS 1916, AS 'A', AS 'B'		1365		
60lb B 1896 & 'B ^A ' 1907		1366	127	

For cant adzed increase 'A' by 6mm
'A' dimension based on tapered base sleeper plates except for unplated
All dimension tolerance are + - 1mm.



Appendix 4 Approved special configurations

The following configurations are approved variations from standard configurations. They are applicable to the nominated locations only. When due for replacement they shall be replaced by standard configurations.

Configuration Type	Approved variation	Location	Controls	Original Waiver
Concrete sleepers	Reduction in MDFC sleeper shoulder tilt tolerance	Where installed in CRN	- Only for MDFC sleepers produced by Rocla Braemar in 2002 and installed before 15/1/2012	CCW 12/001 15/01/2012
Steel sleepers	Use of 53kg/m insulated steel sleepers on 80A rails	Yanco to Griffith 659km to Griffith	- Monthly visual inspection. - Monitor geometry conditions by track geometry recording car. - Check the sleeper fastenings for signs of movement or wear.	CCW 12/007 15/01/2012
Steel Sleepers	Authorise M7.5 sleepers between Orange and Dubbo, Class 1 track	Orange to Dubbo 320.800km to 460.890km	- Populate maximo with locations - Identify locations where sleeper spacing exceeds standards and manage defects - Report cracking sleepers to engineering	CCW 15/016 22/06/2015
Steel sleepers	Retain steel sleepers at mechanical joints	The Rock to Boree Creek 554.100km to 607.840km	- For previously installed sleepers only - Steel sleeper type marked as 53.60BJ13S drawing 12287-0-A, - Sleeper spacing at joints to be managed in accordance with limits and responses CRN CM 203 C5-5.1 (At a joint) for track speed of 50km/hr (i.e. 60km/hr band). - Indications of poor performance e.g. fastenings breaking/loosening; to be advised to Engineering.	CCW 15/022 17/09/2015