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CRN CP 232

Specification

Engineering Specification Concrete Sleepers

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Version 1.2	January 2022	TfNSW template applied
Version 2.0	30 January 2022	First full UGLRL release

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1. Scope and application

This specification details requirements for the design and type approval of prestressed concrete sleepers complete with resilient fastenings and insulators for use on Country Regional Network (CRN) track.

Concrete sleepers for special applications, including multi-gauge tracks and turnout bearers, are not covered by this specification.

2. References

2.1. Australian and International Standards

AS 1085.1	Rails
AS 1085.14	Prestressed Concrete Sleepers

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 230	Sleepers and Track Support
CRN CP 236	Resilient fastenings for concrete sleepers

2.3. Other References

Nil

3. Definitions

Refer to AS 1085.14 for definitions.

Monoblock sleeper:	Prestressed concrete sleeper cast in a single piece.
Face work:	Where concrete sleepers are replaced systematically one after another.
TAL:	Tonnes Axle Load

4. Design requirements

The design shall be in accordance with AS 1085.14 unless otherwise specified in this document.

Fastenings and cast-in inserts shall comply with CRN CP 236 “Resilient Fastenings for Concrete Sleepers”.

Rail seat pads and insulators shall be designed and manufactured to provide a minimum service life as required in CRN CP 236 for the operating environment in Table 1, and assuming that concrete sleepers are installed in a face.

4.1. Operating environment

Sleepers shall be designed to operate in the environment detailed in Table 1, which provides design information relating to track and rail operations where the prestressed concrete sleepers will be used.

Table 1 – Design Information

Criterion	Detail / Description
Sleeper types	Monoblock, prestressed concrete sleeper of two types, for use with resilient fastenings and insulators: “Heavy Duty” suitable for heavy freight tonnages and axle loads ≤ 30 tonnes; “Medium Duty” suitable for general use with axle loads ≤ 25 tonnes.
Track gauge	1435mm gauge with installation tolerance ±4 mm (See CRN CS 210 “Track Geometry and Stability”).
Rail	AS 1085.1 - 60 kg/m rail, with the capacity to use 53 kg/m.
Rail cant	All running rails shall slope towards the track centre-line at 1 in 20.
Maximum Grade	1 in 33.
Locomotive sanding	Sanding is applied for improved traction on extensive lengths of sharp curves and steep gradients. Concrete sleepers shall be designed to minimise potential for soffit abrasion and rail seat erosion in the operating environment.
Curve Radius	Minimum Radius 200m.
Signalling	Track circuited signalling – in accordance with CRN Signalling standards.
Climate	Temperate
Nominal distance between axles	1.8m for 30 tonne axle load 1.7m for 25 tonne axle load 1.6m for 23 tonne axle load
Minimum Service life	50 years.
Electrical Insulation	Rail/Sleeper fastening assemblies and sleepers shall ensure a minimum electrical resistance between the running rails of 10 Ohms per track kilometre.
Impact factor	The combined quasi-static and dynamic load factor for Medium Duty Concrete sleepers is 2.04. For Heavy duty concrete sleepers use the impact factor in AS 1085.14

Criterion	Detail / Description
Load distribution factor	Use 60kg/m rail to calculate the wheel load distribution factor for Heavy Duty sleepers. Use 53 kg/m rail to calculate the wheel load distribution factor for Medium Duty sleepers.
Thermal expansion and contraction	Thermal expansion and contraction forces act on the continuously welded rails with a rail temperature range from -10°C to 75°C about a neutral rail temperature of 35°C.

Maximum train speeds to be used are specified in CRN CS 200 “Track System“ and detailed in Table 2.

Table 2 – Maximum Train Speed

Axle Load	19TAL	22TAL	23T AL	25TAL	30TAL (1)
Max Super Deficiency	75 mm	75 mm	110 mm	75 mm	75 mm
Maximum Speed on Tangent Track	160 km/h	115 km/h	100 km/h	80 km/h	80 km/h

Note 1 - Applicable for Heavy Duty Sleeper design only

Track geometry assumptions (curvature, gradient, superelevation, cant deficiency etc.) shall be in accordance with the requirements detailed in CRN CS 210.

4.2. Track Information

Track configuration and operating requirements to be used are specified in CRN CS 200 and detailed in Table 3.

Table 3 – Track Structure Data (for use in conjunction with AS 1085.14)

Parameter	Heavy Duty Sleeper	Medium Duty Sleeper
Operating Class	Class 1	Class 1
Nominal ballast depth	350 mm	300 mm
Nominal track modulus	30 MPa	30 MPa
Nominal track condition index (TCI)	40 to 45	45 to 50
Axle Load	30 tonnes	25 tonnes
Sleeper Centres	600 mm	600 mm
Annual Tonnage	70 mgt	20 mgt

4.3. Sleeper dimensions

The sleepers shall be designed to conform to the dimensions detailed in CRN Engineering Standard CRN CS 230 “Sleepers and Track Support “as shown in Table 4.

Table 4 – Sleeper Dimensions

Parameter	Heavy Duty Sleeper	Medium Duty Sleeper
Length	2390 - 2500mm	2390 - 2500mm
Width (at base)	220 - 255 mm	220 - 255 mm
Depth (centre of rail seat)	230mm maximum	180mm maximum
Rail seat area (flat surface)	28800mm^2	25620mm^2
Rail pad size (E-clip)	Nominal 148mm x 180mm x 7.5mm (+/- 0.5mm)	Nominal 148mm x 180mm x 7.5mm (+/- 0.5mm)
Rail pad size (Fastclip)	Nominal 148mm x 180mm x 10mm (+/- 0.5mm)	Nominal 148mm x 180mm x 10mm (+/- 0.5mm)
Surfaces	flat (non-curved) excepting the longitudinal top edges must be rounded to a nominal 10mm radius	flat (non-curved) excepting the longitudinal top edges must be rounded to a nominal 10mm radius

5. Handling and maintenance performance

Sleepers must be suitable for efficient transportation on special rolling stock and be stable for stacking on rolling stock or on-site. Medium duty sleepers must also be suitable for installation by conventional track laying equipment of a type used for partial resleepering.

Trackwork fitted with these concrete sleepers must be suitable for maintenance with conventional track maintenance equipment. Such equipment may include tamping machines, track adjustment jacks, track lining machines and fastening insertion/removal equipment.

For the purpose of track adjustment, rails must move freely on the rail seats. To achieve this, fastening systems must be able to be released for the adjustment and re-fastened on completion of the work.

6. System performance

System performance requires the concrete sleeper assembly to function as part of the track structure. The sleeper must be able to transfer all the relevant track forces generated by train operations and the forces of rail thermal expansion and contraction to the ballast.

Pads must possess sufficient edge stiffness to prevent the sleeper tilting (about its longitudinal axis) in order to resist longitudinal track forces arising from thermal expansion, contraction and rail creep.

7. Allowance for retro-fit

The longitudinal centre line of the sleeper, over the full length of the sleeper excluding the area of fastening, must have a vertical section of at least 50mm wide which is clear of any reinforcing steel. This is to allow for the attachment of ancillary equipment.

8. Sleeper marking

The following marks shall be displayed on each sleeper:

- Mark of Manufacturer.
- Year of manufacture with 50mm high numbers.
- Batch number and date stamp.
- Letters H (for heavy duty) and M (for medium duty) plus a 2-digit identifier issued by UGLRL CRN to uniquely identify the sleeper design.
- Lettering and marks shall be on the upper surface of the sleeper between the rail seats.

9. Type approval requirements

The following type approval requirements apply to new designs of concrete sleepers:

1. One set of design calculations which should include the following: -
    a. Tendon design stress including strain relaxation.
    b. Tendon bond stress including losses from interface bond/anchorage.
    c. Concrete strength including shrinkage creep and curing effects.
    d. The effects on sleeper strength of manufacturing tolerances (e.g. concrete shape and tendon placement) and the design attrition allowance.
2. Two sets of fully detailed drawings are to be supplied for each combination of sleeper type, fastening assembly and rail size (60kg/m and 53 kg/m).

    The drawing should detail the following:

    a. Tendon type, size and material.
    b. Cast in Shoulder type, detail and material.
    c. Insulator type, detail and material.
    d. Clip type, detail and material.
    e. Concrete mixture specification and properties.
3. The supplier will also be required to provide documentation of testing outcomes as specified in AS 1085.14.