**Division / Business Unit:** Enterprise Services
**Function:** Track & Civil
**Document Type:** Code of Practice

# Sleepers and Fastenings

## Section 2

### Applicability

ARTC Network Wide SMS

### Publication Requirement

Internal / External

### Primary Source

### Document Status

| Version # | Date Reviewed | Prepared by | Reviewed by | Endorsed | Approved |
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| 2.6 | 18 Oct 2016 | Standards | Stakeholders | Manager Standards | General Manager Technical Standards 16/03/2017 |

### Amendment Record

| Amendment Version # | Date Reviewed | Clause | Description of Amendment |
|---|---|---|---|
| 2.0 | 31 Jul 09 | | Implementation draft of network wide document which is an amalgamation of the CoP for SA/WA & Vic and NSW requirements. |
| 2.1 | 12 Apr 10 | 2.1.1; 2.1.3; 2.3.4 | Implementation draft update. Table 2.1A Sleeper Spacings amended and note 5 added; Requirements for use of pre-stressed concrete sleepers updated; Documentation section added. |
| 2.2 | 18 Jun 10 | | Banner added regarding mandatory requirements in other documents and alternative interpretations. |
| 2.3 | 18 Jan 11 | | Track classification A.B,C and D amended to show “Heavy Haul Lines”, Interstate lines”, “Intrastate Lines”, and “Light Weight Lines”. Deleted reference to Class E Lines |
| 2.4 | 08 Nov 11 | | Banner added regarding elements of RISSB National CoP being incorporated |

| Amendment Version # | Date Reviewed | Clause | Description of Amendment |
|---|---|---|---|
| 2.5 | 24 Jun 13 | 2.3.2 | Added tables 2.3A and 2.3B re: missing sleepers and fastenings. Definitions of ineffective concrete sleepers and fastenings added. Other minor editorial changes throughout including re-numbering of tables and updating of references to superseded documents. |
| 2.6 | 18 Oct 16 | All | Rebranded |
| | | 2.1.6 | Added screw spike and threaded inserts to table 2.1D – Fastening Assembly Standards. |

**This ARTC CoP has drawn on the Rail Industry Safety and Standards Board (RISSB) National Code of Practice Volume 4, Track and Civil Infrastructure, but is not identical. The ARTC CoP has been subject to Risk Assessment as required by the various State Rail Safety Regulators. The results of these risk assessments have made it necessary to deviate from the RISSB CoP in some areas. ARTC maintains traceability of the differences.**

# Table of Contents

**Mandatory requirements also exist in other documents.**

**Where alternative interpretations occur, the Manager Standards shall be informed so the ambiguity can be removed. Pending removal of the ambiguity the interpretation with the safest outcome shall be adopted.**

# 2 Section 2: Sleepers and Fastenings

## 2.1 Design and Rating

### 2.1.1 Sleepers – General

a. The spacing of existing concrete, steel and timber sleepers in NSW is shown in Table 2.1A.

*Table 2.1A - Sleeper Spacing*

| Main Line Track | ML Sleeper spacing mm (see note 2 and 3) | Connected sidings mm (see note 2 and 3) | Tolerance (spacing, skew) mm +/- | Tolerance Limit / m (see note 2and 3) | Number per Km (see note 2 and 3) |
|---|---|---|---|---|---|
| Heavy Haul | 600 | 600 | 10 | 10/6 | 1666 |
| Interstate Lines | 600 | 623 | 10 | 10/6 | 1666 |
| Intrastate Lines | 600 | 623 | 20 | 22/13.7 | 1605 |
| Light Weight lines | 623 | 623 | 20 | 22/13.7 | 1605 |

*Notes:*

*1 Spacing of sleepers at non-welded rail joints should be adjusted locally as shown in the Table 2.1B.*

*2 New concrete sleepers in tracks carrying axle loads not exceeding 25 tonne when inserted in a face may be spaced at 667mm with a minimum of 10 sleepers per 6.67m and 1500/Km. This does not apply to low profile or interspersed concrete sleepers.*

*3 The spacing of sleepers in Western Jurisdiction and Victoria is 685 mm unless as specified in Note 2 above and Table 2.1B.*

*4 Where concrete sleepers have been inserted in tracks with =/< 25 tonne axle loads at =/< 720mm spacing they may be permitted to remain at that spacing.*

*5 Timber sleepers to be flat adzed when used with sleeper plates.*

*Table 2.1B - Sleeper Spacing at Joints*

| Rail Kg/m | Spacing mm |
|---|---|
| 53 Insulated | 430 |
| 53 Mechanical | 510 |
| Glued Insulated Joints on Concrete Sleepers | 600 |
| All Others | 510 |

b. Design procedure

The beam on elastic foundation analysis may be used to determine sleeper size and spacing.

Timber bearers for points and crossing structures may also be designed using the beam on elastic foundation analysis similar to that used for sleepers; however some additional considerations may be necessary as follows:

i. Allowance for additional length of timber bearers over standard sleepers.

ii. Allowance for centrifugal forces through curved pairs of rail.

iii. Allowance for forces and moment induced from points motors and other such equipment.

iv. Although timber sleeper/bearer size and spacing is usually standardised within individual rail systems it is dependent on many local factors. Some of the local factors that have a significant affect on the determination of sleeper size and spacing are the species of timber, its strength and durability in local conditions and timber quality and defects.

### 2.1.2 Timber Sleepers

a. Size of timber sleepers

The timber sleeper size is as follows:

| | | |
|---|---|---|
| Sleeper size: | Length | 2440 +75/-0 mm |
| | Width | 230 +25/-0 mm |
| | Height | 130 +10/-0 mm |

Timber grade and performance requirements for timber sleepers and bearers should be in accordance with AS 3818 Parts 1 and 2.

### 2.1.3 Prestressed Concrete Sleepers

Mechanical joints are not permitted in tracks with concrete sleepers.

Prestressed concrete sleepers and bearers should be designed and manufactured in accordance with the methods described in AS 1085.14 and ARTC design specifications. The sleepers shall be of a monoblock pretensioned type with resilient fastenings and insulators. There are two sleeper designs, “Heavy Duty” that are suitable for 30 tonne axle loads and “Medium Duty” that are for general use with axle loads up to 25 tonne.

Concrete sleepers shall not be interspersed with timber sleepers unless endorsed by the Manager Standards who will specify the requirements within which they are to be installed.

When used in main lines, loops and sidings where 30 tonne axle loads operate concrete sleeper spacing is to be 600mm. For sidings with axle loads 25 tonne or less the spacing may be 720mm on all curve radii.

Concrete sleepers should preferably be designed to conform to the dimensions shown in Table 2.1C but alternative designs conforming to AS 1085.14 will be considered.

*Table 2.1C - Concrete Sleeper Designs*

| Parameter | Heavy Duty Sleeper | Medium Duty Sleeper |
|---|---|---|
| Length | 2440 - 2500mm | 2440 - 2500mm |
| Width (at base) | 245 - 255 mm | 220 - 255mm |
| depth ( centre of rail seat) | 250mm maximum | 250 mm maximum |
| Rail seat area (flat surface) | 160mm x 180mm | 160mm x 180mm |
| Rail pad size | 160mm x 180mm x (7mm +/- 0.5mm) | 160mm x 180mm x (7mm +/- 0.5mm) |

### 2.1.4 Steel Sleepers

Steel sleepers and bearers shall be designed and manufactured in accordance with the methods described in AS 1085.17 and ARTC design specifications.

### 2.1.5 Fastening Assemblies—Resilient Type

Resilient fastening assembly components should comply with AS 1085.19.

Testing should include meeting the criteria for pre-production fastening tests in AS1085.19 as follows:

a. Fastening uplift test. The minimum measured toe load per rail seat should be:
   - 15 kN per rail seat for tracks with axle loads not exceeding 25T; or
   - 20 kN per rail seat for tracks with axle loads not exceeding 30T.

b. Fastening longitudinal restraint test with a maximum applied longitudinal load of 10 kN.

c. Fastening assembly repeated load test.

d. Lateral load restraint test with a maximum applied load of 180kN for rail base translation and 90 kN for rail rotation.

e. Fastening insert pull out test (cast-in components).

f. Fastening insert torque test (cast-in components).

g. Electrical impedance test.

h. Impact testing for rail pad attenuation where necessary.

To ensure compatibility of the assembly with the inspection and assessment guidelines in this Section, consideration should also be given to repeated load testing of the fastening/sleeper assembly under lateral and vertical loadings equivalent to those determined for design of the track structure. This testing may replace the fastening assembly repeated load test prescribed in (c) if appropriate.

*Note: The guidelines apply to the design of new steel and concrete sleeper resilient fastening systems. Some of these guidelines may also apply to the design of resilient fastening systems for timber sleepers and should be considered.*

### 2.1.6 Fastening Assemblies—Non-resilient Type

Non-Resilient fastening assembly components should be manufactured to conform to the appropriate Australian Standard as detailed in Table 2.1D.

*Table 2.1D – Fastening Assembly Standards*

| COMPONENT | STANDARD |
|---|---|
| Fastenings | |
| • Dogspikes | AS1085.8 |
| • Spring fastening spikes for sleeper plates | AS1085.13 |
| • Screw spikes and threaded inserts | AS1085.18 |
| Rail anchors | AS1085.10 |
| Sleeper plates | AS1085.3 |

*Note: These standards generally define materials, material tests, manufacture, design/specification of the component, and component testing and compliance*

For tangent track and curved track of horizontal radius greater than 600m with CWR the following fastening assembly or equivalent should be used:

a. Sleeper plates These should be double shouldered and should be used to provide a nominal rail cant of 1 in 20 towards the centre of the track (except in special circumstances such as turnouts) (see AS 1085.3)

b. Dogspikes 2 (two) 19 mm square shank or 22 mm round shank dogspikes per sleeper plate or equivalent should be used

c. Rail anchors. These should be box anchored every 4th sleeper as a minimum.

For curves of radius 300 m or less, additional fastenings may be necessary to ensure compatibility with the guidelines in Clause 2.4, without the need for excessive maintenance intervention.

Additional rail anchors may be necessary in areas of significant rail movement. Even with 100% rail anchors rail movement cannot always be stopped. In these situations resilient fasteners or other monitoring and maintenance practices should be considered.

## 2.2 Maintenance – Cyclic Partial Timber Sleeper Replacement

Cyclic Partial Timber Resleepering (PRS) implies:

1. The sleepers in any section of track are a mixture of sleepers of various ages, so distributed that the safety of the track is maintained if a portion of the sleepers fail from age related problems.
2. The failed sleepers are replaced only when a Resleepering Gang works in a face through a section on a cyclic programme, nominally every five years.
3. That between cyclic passes of a Resleepering Gang only those sleepers that have failed and where this failure will allow the track to deteriorate below the standard for the Class of line are replaced by Housekeeping staff until the next pass of the Tie Gang.

The following policy should be noted:

1. Does not allow isolated groups of sleepers of the same age.
2. Acknowledges that new lines with sleepers initially of the same age must be progressively converted to the PRS patterns by replacing a defined proportion at the time the sleepers generally begin to deteriorate and then repeat the cycle each five years replacing only those

that have failed. Any sleeper that is removed to create the agreed pattern of new sleepers and is still effective would be recycled to replace a failed intermediate sleeper or reused elsewhere.

3. Requires that effective Resleepering Gangs be available for implementing the PRS policy.
4. Requires that where a group of sleepers in a face must be renewed, a portion of the sleepers inserted must be recycled to maintain an acceptable pattern.
5. Acknowledges that the housekeeping fettling gangs have a minor role in sleeper replacement.
6. This policy acknowledges that face resleepering is acceptable in special locations such as level crossings. Sleepers recovered from these locations with some life may be reused to replace spot failures.

## 2.3 Inspection and Assessment

### 2.3.1 General

This Clause covers timber, steel or concrete sleepers designed and manufactured in accordance with Clause 2.1. For the purposes of this Clause "sleepers" includes sleepers, timbers, bearers and transoms.

Fastening assembly systems should comprise individual components compatible with the system design determined in accordance with Clause 2.1.

*Notes:*

*1 The applicability of this Clause to transoms only relates to rail fastening type defects and not the transom structural integrity that should be considered under Clause 2.3.6.*

*2 Sleeper and fastening assembly condition for check rails in tight curves should be assessed in accordance with this section.*

*3 Refer to section 3 for bearers in critical areas of points and crossing structures.*

### 2.3.2 Scheduled Sleepers and Fastening Assembly Inspection

The inspection of sleepers and fastening assemblies shall incorporate the following guidelines:

a. Track Patrol inspection

The interval between track patrol inspections of sleepers and fastenings shall not exceed 7 days on main lines or 28 days on crossing loops or as specified otherwise by ARTC e.g. in an approved Technical Maintenance Plan. Track patrol inspections should observe sleeper and fastening condition (i.e. indicators of a defect) that may affect the integrity of the track structure including the following

Timber Sleepers:

i. Damaged, split, cracked, broken or missing components;
ii. Indications of lateral movement of fastenings and sleeper plates on timber sleepers;
iii. Indication of sleeper movement (e.g. bunching, skewing);
iv. Indications of incorrect rail cant;
v. Abnormal deterioration of sleepers and fastening condition;

vi. Rail back canting;

vii. Other obvious defects that may affect the track structural integrity or stability.

Concrete Sleepers:

i. Damaged or broken concrete sleepers

ii. Indication of damaged or loose shoulders

iii. Missing clips, in particular consecutive missing clips

iv. Indication of sleeper movement (i.e. bunching or skewing)

v. Abnormal deterioration of sleepers and fastening condition

vi. Rail back canting

vii. Other obvious defects that may affect the track Structural integrity of stability

Where possible, crossing loops may be inspected from the mainline as part of this patrol inspection.

The speed at which the inspection is carried out should be consistent with the local conditions and the full scope of the inspection being carried out (e.g. the type and number of other infrastructure elements being inspected).

b. General Inspection—Frequency

General Inspection of sleeper and fastening condition should be carried out visually in a manner and at an interval appropriate to the sleeper and fastening type, condition, rates of deterioration and other local and seasonal factors and in any case at intervals not greater than:

i. 1 year for timber sleepered track; and

ii. 2 years for concrete and steel sleepered track

iii. or as specified otherwise by ARTC in an approved Technical Maintenance Plan.

A General Inspection should also be carried out when suspected defects are identified during patrol inspections.

c. General Inspection—Tasks

General Inspections should identify locations of sleeper and fastening degradation that require action or further specialist inspection, or both.

General Inspections of timber sleepered track should be carried out by a walking inspection. A walking inspection should also be carried out at all known areas of sleeper and fastening damage (eg. derailment sites) or defects. These sites should be inspected for further deterioration in condition and effectiveness. Where appropriate the general inspection should be timed to suit seasonal factors, e.g. prior to hot weather (see Section 6, Track Lateral Stability).

General Inspections should look for those conditions inspected for in Patrol Inspections in addition to the following:

i. Clusters and distribution of ineffective sleepers or fastenings.

ii. Any skewing, misalignment or poor sleeper spacing.

iii. Misplaced pads, spacers and other fastening components.

iv. Any sleeper movement, and ballast displacement.

v. Other defects or missing components.

### 2.3.3 Concrete and Steel Sleepers and Fastening Assembly Assessment

*Table 2.3A - Concrete or Steel Sleepered Track – Sleepers Completely Missing [1] Response Codes (See Table 2.3C)*

| **Missing sleepers** | **Track speed before restriction (freight/pass.) km/h** | | | | | |
|---|---|---|---|---|---|---|
| | **20/20** | **40/40** | **60/65** | **80/90** | **100/115** | **A2.2 115/130** |
| 1 | A6 | A2 | A3 | A4 | A5 | A5 |
| 2 Consecutive – with temporary supports [6] | A1 | A1 | A1 | A1 | A1 | A1 |

*Notes:*

*1 Table 2.3A refers to a solitary missing sleeper only.*

*2 Where multiple missing sleeper defects occur within a group of sleepers, further assessment by a competent worker is required.*

*3 Where adjacent sleepers to the missing sleeper[s] are ineffective further assessment by a competent worker is required.*

*4 The responses are speeds relating to freight operations (shown first) and passenger operations (shown second) separated by a "/". Passenger operations refer to locomotive hauled passenger trains with carriages not exceeding 16TAL.*

*5 For trains with operational speeds greater than 115 km/h the response needs special consideration of the owner/operator organisations.*

*6 Adequacy of support to the rail to be approved by a competent track worker. If support is inadequate, then track should be closed to traffic.*

*Table 2.3B - Concrete or Steel Sleepered Track - Consecutive Sleepers Ineffective [2] Sleepers or Fastening [3] Response Codes (See Table 2.3C)*

This table does not apply to missing sleepers or sleepers failing to provide any support.

| **Cluster of Consecutive Ineffective Sleepers or fastenings** | **Track speed before restriction (freight/passenger) km/h** | | | | | |
|---|---|---|---|---|---|---|
| | **20/20** | **40/40** | **60/65** | **80/90** | **100/115** | **A2.3 115/130** |
| 2 | A7 | A7 | A7 | A7 | A7 | A7 |
| 3 | A6 | A6 | A6 | A6 | ***A6*** | ***A6*** |
| 4 | A6 | A6 | A6 | A4 | A4 | A4 |
| 5<br>Tangent or curve >600 m<br>Curve ≤600m | <br>A6<br>A1 | <br>A6<br>A2 | <br>A3<br>A2 | <br>A3<br>A3 | <br>A3<br>A3 | <br>A3<br>***NA*** |
| >5 | A1 | A1 | A1 | A1 | A1 | A1 |

*Notes:*

*1 Where adjacent or multiple clusters exist, or odd fastenings are missing, an assessment should be undertaken by a competent worker to determine if a more restrictive response is required. This assessment should consider such things as partial effectiveness of individual sleepers, the contribution of the whole group to vertical and lateral support and local site conditions.*

*2 The responses are speeds relating to freight operations (shown first) and passenger operations (shown second) separated by a "/". Passenger operations refer to locomotive hauled passenger trains with carriages not exceeding 16TAL.*

*3 For trains with operational speeds greater than 115 km/h the response needs special consideration of the owner/operator organisations.*

*4 An ineffective concrete sleeper is one which provides adequate vertical support, but reduced lateral and longitudinal restraint due to aged or damaged fastenings or damaged shoulders. Note: Sleepers with zero toe load fastenings in good condition are still effective.*

*5 An ineffective fastening is either a missing one or a severely damaged one which will not restrain the rail laterally or longitudinally.*

*Table 2.3C - Definition of Response Codes*

| Response code | Description [2] |
|---|---|
| A1 | Temporary speed restriction of 10/10 [1] with pilot or repair prior to the passage of the next train [3]. |
| A2 | Temporary speed restriction of 20/20 [1] or repair prior to the passage of the next train [3]. |
| A3 | Temporary speed restriction of 40/40 [1] or repair prior to the passage of the next train [3]. |
| A4 | Temporary speed restriction of 60/65 [1] or repair prior to the passage of the next train [3]. |
| A5 | Temporary speed restriction of 80/90 [1] or repair prior to the passage of the next train [3]. |
| A6 | An appropriate increase in the monitoring [2] and follow up action as required. |
| A7 | Routine Inspection [4] |

*Notes:*

*1 The speed restriction is shown in km/h for both freight operations (shown first) and passenger operations (shown second) separated by a "/".*

*2 Where the assessment responses include increased monitoring, knowledge of local factors that may affect the tracks deterioration rate and performance history is required. The increased monitoring frequency should be determined by these factors. This increased monitoring should be continued until rectification work is carried out.*

*3 If repairs cannot be made prior to the passage of the next train, the speed restriction should be implemented along with an appropriate increase in the monitoring [see Note 2] until actions are taken to restore the track.*

*4 Routine refers to normal scheduled inspections.*

| | |
|---|---|
| *5* | *Refer to monitoring and maintenance actions and response in the Track & Civil Code of Practice.* |

### 2.3.4 Timber Sleepers and Fastening Assembly Assessment

This section specifies the maintenance necessary for the satisfactory performance of timber sleepers. It does not apply to bridge transoms or turnout bearers.

a. **Definition of Condition**

| | |
|---|---|
| Failed/ missing sleepers | Are sleepers that are broken, missing or do not give vertical support to the rails. |
| Good sleeper | Is an effective sleeper that will remain effective for at least 5 years under normal operating conditions prevailing at the time of the inspection i.e. If the track normally carries 10MGT of 21t axle load traffic at 115km/h then a good sleeper will continue to carry the same amount of traffic and remain effective for at least 5 years.<br>Special traffic reduced or non operational periods are not counted as prevailing conditions. |
| Effective sleeper (Fair sleeper to Good sleeper) | When the sleeper and fastenings combine to effectively support the rails vertically and provides lateral restraint. Restraint must allow no lateral movement of the fastenings relative to the timber. The sleeper must provide gauge restraint and must be one piece that will not separate along its length or transversely. (For the purposes of assessment effective sleepers includes good sleepers).<br>Sleepers should not be excessively back canted more than 1 in 30. For double shouldered sleeper plates this is equivalent to back canting into the timber on the outer edge of the plate of 5mm. For Pandrol Plates this is equivalent to back canting into the timber on the outer edge of the plate of 6mm. For both plates this is approximately equal to ½ the plate thickness.<br>Timber sleepers with rot or holes through which ballast can be seen are not satisfactory. At least 300mm is required between rail foot and sleeper ends for effective tamping. |
| Ineffective sleeper (Poor sleeper) | Sleeper that is not effective. (For the purposes of assessment ineffective sleepers include those that are missing or failed). |

b. **Operating Limits and Maintenance Response**

Track is assessed to ensure that it will continue to provide vertical support, gauge restraint and lateral restraint (against track misalignment). Two types of assessments are considered;

i. the requirements for sleeper renewal to maintain sleeper condition in the longer term and

ii. the ongoing safety of the track (Base Operating Conditions).

Renewal requirements to maintain sleeper condition are considered on a five year basis. Base Operating Conditions apply to consideration of the performance of track over a 12 month period. The condition of sleepers must be such as to be secure for a minimum of 12 months unless location specific monitoring is applied.

The actual performance of any section of track will depend on the specific condition of the sleepers and fastenings and the train operations that prevail. Some element of judgement

based on experience is required. Guidelines are given for various sleeper conditions in the following sections.

Table 2.3D and Table 2.3E, apply to both longer term maintenance and Base Operating Condition requirements and for lateral and gauge strength. Table 2.3F applies to Base Operating Condition requirements for vertical support.

Sleeper condition must be such that the Base Operating Conditions for track geometry are maintained.

*Table 2.3D - Gauge Restraint and Lateral Strength for Timber Sleepers*

NOTE: In the table Curves are categorised as:
Sharp (<400m radius), Moderate (400m to 1000m), Wide (>1000m radius) curves or Tangent

| General Condition | Description | Response Required |
|---|---|---|
| Track is well tied for at least 5 years | Typically more than 65% of sleepers are Good.<br>No more than 2 consecutive ineffective (and only at isolated locations). | Nil |
| Track is well tied for at least 12 months | Typically<br>50 to 65% of sleepers are effective on sharp curves.<br>45 to 65% of sleepers are effective on moderate curves.<br>35 to 65% of sleepers are effective on tangents and wide curves.<br>No more than<br>2 consecutive ineffective sleepers on sharp and moderate curves.<br>3 consecutive ineffective sleepers on tangents and wide curves. | Include in cyclic resleepering program. Review condition each 12 months. |
| Track is tied for at least 28 days. | Interstate Lines and Intrastate Lines<br>No more than<br>3 consecutive ineffective sleepers on sharp and moderate curves.<br>4 consecutive ineffective sleepers on wide curves and tangents.<br>Light Weight Lines<br>No more than<br>3 consecutive ineffective sleepers on sharp curves.<br>4 consecutive ineffective sleepers on moderate curves.<br>5 consecutive ineffective sleepers on wide curves and tangent track. | Requirement for speed restriction to be considered dependent on traffic type, boarded speed, track geometry, local risk factors and detailed assessment of sleeper condition and deterioration potential.<br>Maximum of 60/65kph.<br>Monitor weekly until repaired.<br>Repair within 28 days.<br>Record in exceedent control system. |

NOTE: In the table Curves are categorised as:
Sharp (<400m radius), Moderate (400m to 1000m), Wide (>1000m radius) curves or Tangent

| General Condition | Description | Response Required |
|---|---|---|
| Track is not securely tied. | Conditions not meeting the above but no evidence that gauge widening is occurring and<br>Interstate Lines and Intrastate Lines<br>4 consecutive ineffective sleepers on sharp and moderate curves.<br>5 consecutive ineffective sleepers on wide curves and tangent track.<br>Light Weight Lines<br>4 consecutive ineffective sleepers on sharp curves.<br>5 consecutive ineffective sleepers on moderate curves.<br>6 consecutive ineffective sleepers on wide curves and tangent track | Immediate speed restriction to reduce impact, depending on, curvature, traffic type, boarded speed, track geometry, local risk factors and detailed assessment of sleeper condition and deterioration potential.<br>Maximum of 40kph.<br>Repair ASAP (Note 3).<br>Monitoring at appropriate interval until repaired.<br>Record in exceedent control system. |
| Track is not securely tied. | Conditions not meeting the above. | Assess if continued operation should be permitted dependent on traffic type, track geometry, local risk factors and detailed assessment of sleeper condition and deterioration potential.<br>Maximum of 20kph.<br>Repair ASAP (Note 3).<br>Monitor each train until repaired.<br>Record in exceedent control system. |

*Notes for Table 2.3C and Table 2.3D:*

*1 Where % of sleepers are referenced. This should be determined over a minimum of 20 sleepers.*

*2 Sleepers that are relied upon to be effective to meet the criteria for consecutive ineffective sleepers must have sufficient strength and remaining life to remain effective for the life specified in the general condition category.*

*3 ASAP (As soon as possible) means as soon as can be arranged without regard to resourcing, and when operationally an emergency possession window can be obtained (normally within 24 hrs).*

*Table 2.3E - Gauge restraint and lateral strength at Joints on Timber Sleepers*

NOTE: In the table Curves are categorised as:
Sharp (<400m radius), Moderate (400m to 1000m), Wide (>1000m radius) curves or Tangent

| General Condition | Description | Response Required |
|---|---|---|
| Track is well tied for at least 5 years | No sleeper at a joint is ineffective. | Nil |
| Track is well tied for at least 12 months | Interstrate Lines and Intrastate Lines<br>One sleeper at joint is ineffective on tangent and wide radius curved tracks.<br>For other curvatures see next category.<br>One sleeper at joint is ineffective on tangent and wide radius curved tracks.<br>For other curvatures see next category. | Include in cyclic resleepering program. Review condition each 12 months. |
| Track is tied for at least 28 days. | Interstrate Lines and Intrastate Lines<br>One sleeper at joint is ineffective on sharp and moderate curved tracks. | Consider requirement for speed restriction dependent on traffic type, boarded speed, track geometry, local risk factors and detailed assessment of sleeper condition and deterioration potential.<br>Monitor each patrol until repaired.<br>Repair within 28 days.<br>Record in exceedent control system. |
| | Light Weight Lines<br>One sleeper at joint is ineffective on sharp and moderate curved tracks.<br>Two sleepers at joint are ineffective on tangent and wide radius curved tracks but adjoining sleepers are effective and no evidence of gauge widening. | Consider requirement for speed restriction or operational limitations dependent on traffic type, boarded speed, track geometry, local risk factors and detailed assessment of sleeper condition and deterioration potential.<br>Maximum of 30kph for loaded trains, 50kph unloaded trains.<br>Repair within 28 days.<br>Monitor weekly until repaired.<br>Record in exceedent control system. |
| Track is not securely tied. | Light Weight Line<br>Two sleepers at joint are ineffective on sharp and moderate curved track but adjoining sleepers are effective and no evidence of gauge widening. | Assess if continued operation should be permitted dependent on traffic type, track geometry, local risk factors and detailed assessment of sleeper condition and deterioration potential.<br>Maximum of 20kph.<br>Repair within 14 days.<br>Monitor weekly until repaired.<br>Record in exceedent control system. |

| NOTE: In the table Curves are categorised as: Sharp (<400m radius), Moderate (400m to 1000m), Wide (>1000m radius) curves or Tangent | | |
|---|---|---|
| **General Condition** | **Description** | **Response Required** |
| Track is not securely tied. | Conditions not meeting the above. | Assess if continued operation should be permitted dependent on traffic type, track geometry, local risk factors and detailed assessment of sleeper condition and deterioration potential.<br>Maximum of 20kph.<br>Repair ASAP (Note 3).<br>Monitor each train until repaired.<br>Record in exceedent control system. |

*Table 2.3F - Vertical Support for Timber Sleepers*

| General Condition | Description | Response Required |
|---|---|---|
| Missing sleeper or excessive spacing | 1 sleeper missing or knocked down or sleeper spacing >900mm and less than 1200mm but not at a rail joint. | Repair within 14 days. (Note 1)<br>Record in exceedent control system |
| Missing sleepers or excessive spacing | 2 consecutive sleepers missing or knocked down or sleeper spacing > 1200mm and less than 1500mm.<br>OR 1 sleeper missing or knocked down or sleeper spacing > 900mm and less than 1200mm and at a rail joint. | Speed restriction dependent on traffic type and vertical support.<br>Maximum of 40kph.<br>Repair ASAP. (Note 2)<br>Record in exceedent control system |
| Missing sleepers or excessive spacing | Conditions not meeting the above. | Trains not permitted to pass except on authority of Authorised ARTC Maintenance Engineer.<br>Record in exceedent control system. |

*Notes for Table 2.3F:*

*1 Unless assessed by Authorised ARTC Maintenance Engineer and in consideration of current operations or after placement of appropriate operational restrictions (eg speed, axle load).*

*2 ASAP (As soon as possible) means as soon as can be arranged without regard to resourcing, and when operationally an emergency possession window can be obtained (normally within 24 hrs).*

### 2.3.5 Documentation

When sleeper marking, records are to be kept in accordance with EGP-10-01.

Records of exceedents are to be retained in the maintenance Works Management System.

Where speed restrictions have been applied the assessment method and factors considered are to be documented in accordance with PP-163.

Where application of Civil Engineering Representative Authority occurs, recording the basis for the application, the name and position of the person exercising the authority is required

### 2.3.6 Transoms, Turnout Bearers and Fastening Assembly Assessment

An effective transom or turnout bearer is one that has the required fastenings in place and conforms to the following:

1. It is of one piece which will not separate longitudinally or transversely.
2. It is able to support its share of the lateral, longitudinal and vertical track forces.
3. It retains its fastenings so that the rail cannot move laterally or more than 6 mm vertically relative to the transom or turnout bearer. A transom or turnout bearer that can be redrilled will become effective again.
4. A turnout bearer must have sufficient material between the rail fastenings (in the “four foot”) to withstand centre bound conditions. Turnout bearers with rot or holes through which ballast can be seen are not satisfactory. At least 300mm is required between the rail foot and the turnout bearer ends for effective tamping.
5. A transom must have sufficient material between the rail fastenings (in the “four foot”) to distribute the load adequately. Transoms with rot or holes through which “daylight” can be seen are not satisfactory.
6. It has a flat rail plate seat, within 2mm.
7. It has at least 75% of its original cross section at the fastenings and in the “four foot” with a depth of not less than 90mm.
8. It must possess at least 60% of the original cross section in the part between the end and the adjacent fastening with depth not less than 75 mm.
9. The fastenings on effective transoms or turnout bearers must be as specified for the class of Line.
10. Dogspikes do not have to be tight to be effective but must not be worn to the extent that allows gauge widening in excess of allowable limits.
11. Broken or fastening damaged sleeper plates are not permitted.

Each section of track must have a sufficient number of effective transoms or bearers which, together, provide such effective support to the track that it is possible to maintain the track within the specified tolerance for the Class of Track.

The minimum number of effective transoms or bearers under a standard 13.7m rail is shown n Table 2.3G.

*Table 2.3G - Effective Transoms or Bearers per 13.7m Rail Length*

| **Track** | **Number of effective transoms or bearers** | | | |
|---|---|---|---|---|
| | **Radius > 300m** | | **Radius < 300m** | |
| | Normal Operations | During renewal | Normal Operations | During renewal |
| Heavy Haul and Interstate Lines * | 15 | 13 | 17 | 15 |
| Intrastate Lines * | 13 | 11 | 15 | 13 |
| Light Weight Lines * | 9 | 9 | 11 | 11 |

** Includes sidings and crossing loops connected to these tracks.*

The number of effective transoms or bearers in a 13.7m section shall generally be evenly distributed. For Heavy Haul, Interstate and Intrastate tracks there should be no more than two ineffective transoms or bearers together. For Light Weight tracks and sidings and crossing loops there should be no more than 3 ineffective transoms or bearers together.

Where there are insufficient effective transoms or bearers as specified above and repairs cannot be made prior to the passage of the next train, a speed restriction should be implemented along with an appropriate increase in monitoring until actions are taken to restore the track.

### 2.3.7 Interspersed fastening types in existing tracks- backcanting

In existing tracks where resilient fastenings have been interspersed with dogspikes and the track has rail backcanting a minimum of every second sleeper is to be fitted with resilient fastenings. This is to be the minimum first stage in a process of conversion to all resilient fastenings in the section. Where the backcanting exceeds 8mm complete renewal in resilient fastenings should be considered.

## 2.4 Decommissioning and Disposal

### 2.4.1 Fastening Removal

In track circuited areas, the signalling should be decommissioned prior to the commencement of fastening removal.

### 2.4.2 Material Recovery

When sleepers, bearers, transoms and fastenings that have the potential for reuse are being recovered from track, care should be taken to minimise any damage.

### 2.4.3 Sorting

All sleepers, bearers, transoms and fastenings should be quarantined until sorted and classified. They should be segregated into those suitable for reuse, quarantine or disposal and should have all defect markings preserved.

a. reuse

   Those that have the potential for reuse should be marked in such a manner that the reuse potential is clear and unambiguous. In particular the sleepers and fastenings should be marked, and be segregated into stacks differentiated by their suitability for reuse in mainline, crossing loop or sidings.

b. Quarantine

   Where sleepers and bearers, and their associated fastenings require further checking prior to repair and/or reuse they should be quarantined from reusable sleepers, bearers and fastenings to prevent their use back in track.

c. Disposal

   Where sleepers, bearers or transoms are not suitable for reuse, they should be disposed of in an environmentally responsible manner. Treated timbers should be disposed of in accordance with the relevant Environmental Act and Regulation.