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Track & Civil Code of Practice Response Booklet

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Amendment Record

Amendment Version #	Date Reviewed	Clause	Description of Amendment
1.0	06 Mar 12		First Issue.
1.1	21 Apr 15	Table 5.5 & note 12, Table 5.6 & note 4	Document rebranded. Updates to Table 5.5 and note 12, and Table 5.6 and note 4 as per updates to T&C CoP Section 5 (versions 2.5, 2.6 & 2.8).
1.2	22 Dec 17	Tables 3.9, 3.10, 3.11, 3.12, 4.6, 5.5, 5.6 and notes.	Updated to match relevant ARTC Track & Civil CoP

1.3	14 Feb 18	Tables 5.11 & 5.12, Note 8	Table numbers restored to match current Section 5 tables 5.5 & 5.6. Note updated to reference current table 5.6.
1.4	26 Mar 18	Tables 5.11 & 5.12, Note 8	Table numbers and notes updated to match recently updated Section 5.

ARTC Track & Civil Code of Practice

1 Track Assessment and Response Tables

The ARTC Track & Civil Code of Practice includes Assessment and Response tables in the following Sections:

Section 1: Rail – for non-welded joints, and guard rails

Section 3: Points and Crossings – for points and crossing assembly

Section 4: Ballast – for shoulder height and width deficiencies

Section 5: Geometry – for Top, Line, Gauge, Twist, and Cross Level

The following assessment and response tables have been extracted from the current version of the ARTC Track and Civil Code of Practice.

2 Section 1 - Rail

2.1 Response codes

The responses in Section 1 are codified A1 to A7 as in the table below:

Table 1.16A – 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) *Where a speed restriction is applied rectification work should be programmed on a priority basis. The speed restriction is shown for both freight operations (shown first) and passenger operations (shown second) separated by a "/".*

2) *Rectification work should be programmed on a priority basis. 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) *If the cause of a defect is known and it is known that it will not deteriorate into an unsafe condition an alternate response to that shown in the table 1.16A above is permitted with appropriate documentation and approval by the Civil Engineering Representative or nominated representative.*

2.2 Rail Assessment Responses

Table 1.16 - Non-Welded Joint Assessment / Responses

Component Parameter	Dimension Limit	Track Speed (freight/passenger) km/h					
		20/20	40/40	60/65	80/90	100/115	115/160
Fishplates [1]							
Visual cracks	1 or both plates	A6	A6	A6	A6	A6	A6
Complete failure	1 fishplate	A4	A4	A4	A4	A4	A4
	Both fishplates	A1	A1	A1	A1	A1	A1
Fishbolts [2]							
Effective	≥ 2 on both rail ends	A7	A7	A7	A7	A7	A7
	1 only on either rail end	A6	A6	A6	A6	A6	A6
	Nil on one rail end [3]	A2	A2	A2	A2	A2	A2
	Nil on both rail ends [3]	A1	A1	A1	A1	A1	A1
Insulated Joints [4]							
Insulation material	Defective	A6	A6	A6	A6	A6	A6
Gap between rail ends	≥ 4mm	A7	A7	A7	A7	A7	A7
	< 4mm	A6	A6	A6	A6	A6	A6
Rail Ends							
Batter	> 2mm over 100mm	A6	A6	A6	A6	A6	A6
Rail end gap	≤ 20mm	A7	A7	A7	A7	A7	A7
	21mm to 30mm	A6	A6	A6	A6	A6	A6
	> 30mm [5]	A3	A3	A3	A3	A3	A3
Rail end mismatch misalignment	> 3mm [5]	A2	A2	A2	A2	A2	A2
Rail defects	Surface or internal defects	In accordance with Clause 1.4.8					

Notes:

1) *Failure means broken through whole cross-section between inner fishbolts.*
2) *Effective means able to maintain satisfactory vertical and horizontal alignment of rail ends under traffic. Ineffective bolts may be missing, broken, or loose (depending on condition of other bolts and operating environment). Effective bolts may be tight, or loose (depending on condition of other bolts and operating environment).*
3) *Default speed restriction may be increased after risk assessment of rail end pull-apart potential, and potential for the unacceptable alignment of rail ends.*
4) *It is an assumption that electrical failure of an insulated joint causes the signalling to "fail safe". I.e. it is a track reliability issue and not a track safety issue.*
5) *Default speed restriction may be increased after risk assessment of rail end gap growth potential, and wheel climb potential.*

Table 1.17 - Responses for Guard Rail Condition

Defect Name (Type Code, Position Code)		
Defect size	**Response time**	**Action**
Sleeper fastenings missing or ineffective [1]		
Isolated (non-effective) fasteners missing or ineffective on either side of the guard rail	—	No action
2 or more consecutive fasteners missing or ineffective on either side of the guard rail	13 Weeks	Replace or restore to specification
For splay rails or the ends of guard rails 1 or more fasteners missing or ineffective	13 Weeks	Replace or restore to specification
Component Damage		
Any damaged components which may render the guard rail ineffective in the event of a derailment	13 Weeks	Damaged guard rail components should be replaced or restored as necessary.
Rail joint condition		
Ineffective rail joint	13 Weeks	Ineffective joint components should be replaced or restored as necessary.

Notes:

1) These defect sizes and responses apply to all configurations of guard rail fasteners.

3 Section 3 – Points and Crossings

3.1 Response Codes

The responses in Section 3 are codified A1 to A7 as in the table below:

Table 3.12 – 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) *Where a speed restriction is applied rectification work should be programmed on a priority basis. The speed restriction is shown for both freight operations (shown first) and passenger operations (shown second) separated by a "/".*

2) *Rectification work should be programmed on a priority basis. 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) *Where the condition identified is a hazard for the facing condition only the speed restriction only needs to be applied to cover this facing movement*

6) *If the cause of a defect is known and it is known that it will not deteriorate into an unsafe condition an alternate response to that shown in tables 3.9, 3.10 and 3.11is permitted with appropriate documentation and approval from the Civil Engineering Representative or nominated representative.*

3.2 Points and Crossing Assessment Responses

Table 3.9 Switch Area Assessment Responses – 1435mm gauge

Component parameter	Dimension limit	Track speed (freight/passenger) km/h					
		20/20	40/40	60/65	80/90	100/115	115/160
Critical dimensions							
Note: Switch rail throat opening and open throw are checked by signalling technician. Locations with non-interlocked hand operated lever operation are included in the track and civil inspection.							
Switch rail throat opening dimension (junction of heads) *Note: Additional action maybe required for signalling purposes where the switch rail throat opening dimension is less than 50mm.*							
Back of switch rail to stock rail (actual dimension)	40 mm and greater	A7	A7	A7	A7	A7	A7
	35 mm to <40 mm	A6	A6	A3	A3	A3	A3
	<35 mm	A1	A1	A1	A1	A1	A1
Switch rail toe/stock rail dimension *Note: Additional action maybe required for signalling purposes.* *An alternative action to those specified is to prohibit facing train movements.*							
Open throw dimension (conventional only)	95 mm and greater	A7	A7	A7	A7	A7	A7
	85 mm to <95 mm	A6	A6	A6	A6	A6	A6
	80 mm to <85 mm	A6	A2	A2	A2	A2	A2
	<80 mm	A1	A1	A1	A1	A1	A1
Track gauge(at the switch tip) [1] (Refer Figure 3.5)	1430 mm to <1456 mm (≥1456 apply table 5.5 Geometry Defects – Response Category Maintenance Limits)	A7	A7	A7	A7	A7	A7
	1427 mm to< 1430mm	A6	A6	A6	A4	A4	A4
	1425 mm to <1427mm	A6	A2	A2	A2	A2	A2
	<1425 mm	A1	A1	A1	A1	A1	A1
Switch width at tip as presented to the wheel [2] (non-tangential switch only) (Refer Figure 3.9)	<4mm	A7	A7	A7	A7	A7	A7
	4mm to 6mm	A6	A6	A6	A6	A6	A6
	>6mm to 8mm	A6	A2	A2	A2	A2	A2
	>8mm	A1	A1	A1	A1	A1	A1

Component parameter	Dimension limit	Track speed (freight/passenger) km/h					
		20/20	40/40	60/65	80/90	100/115	115/160
Switch tip height (non-tangential,non-undercut, switch only) (Refer Figure 3.9) (Measured at the top of the arc at the switch nose)	Distance from stock rail running surface to top of switch rail: 13 mm and greater >12 mm to <13 mm 12mm or less	 A7 A6 A1	 A7 A6 A1	 A7 A6 A1	 A7 A6 A1	 A7 A6 A1	 A7 A6 A1
Stock or switch rail gauge face wear angle (Refer Figure 3.9) (At the point of wheel flange / rail contact at the switch tip area)	Angle (from vertical): <18 degrees 18 deg. to <26 deg. 26 degrees or greater	 A7 A6 A1	 A7 A6 A1	 A7 A6 A1	 A7 A6 A1	 A7 A6 A1	 A7 A6 A1
Key component condition							
Fixed and Pivot Heel block [3]	Cracked	A6	A6	A6 A3 Heavy Haul	A6 A4 Interstate	A5	A5
	Broken but still effective	A6	A6	A3	A3	A3	A3
	Missing/Broken and ineffective	A1	A1	A1	A1	A1	A1
Rail brace/chair	Cracked/loose	A6	A6	A6	A6	A6	A6
	Broken/Ineffective: 1 only	A6	A6	A6 A3 Heavy Haul	A6 A4 Interstate	A6	A6
	2 consecutive	A6	A6	A6 A3 Heavy Haul	A4 A3 Interstate	A4	A4
	>2 consecutive	A1	A1	A1	A1	A1	A1
Switch bearing stops (To avoid rail roll-over)	Cracked/loose	A6	A6	A6	A6	A6	A6
	Missing/Ineffective: 1 only	A6	A6	A6 A3 Heavy Haul	A6 A4 Interstate	A6	A6

Component parameter	Dimension limit	Track speed (freight/passenger) km/h					
		20/20	40/40	60/65	80/90	100/115	115/160
	2 consecutive	A6	A6	A6 A3 Heavy Haul	A4 A3 Interstate	A4	A4
	>2 consecutive	A1	A1	A1	A1	A1	A1
Ineffective bearers/fasteners in critical switch and crossing areas (Refer Figure 3.5) [4]	1 only	A6	A6	A6	A6	A6	A6
	2 consecutive	A6	A6	A3	A3	A3	A3
	>2 consecutive	A1	A1	A1	A1	A1	A1
Bolts	Bolt effectiveness	[5]	[5]	[5]	[5]	[5]	5]
Spreader Bar [6]	Missing/broken	A1	A1	A1	A1	A1	A1

Switch blade damage [8](Anywhere in the switch blade, damage deeper than 19mm from the stock rail running surface)	Length of damage:						
	<100 mm	A7	A7	A7	A7	A7	A7
	100 mm to <200 mm	A6	A6	A6	A6	A6	A6
	200 mm or greater	A1	A1	A1	A1	A1	A1
Crippled Switch		[9]	[9]	[9]	[9]	[9]	[9]

Notes:

1) *For wide gauge in the points critical area plain track limits also apply.*
2) *Switch width at the tip is the width exposed to the wheel and includes effects of side wear on stock rails and closed gap between switch and stock rails. It is not recommended that the gap between the switch rail tip and stock rail exceeds 2mm at any time.*
3) *Applies to fixed heel blocks (flexible switches), pivot heel blocks (jointed heel), stress transfer blocks, and creep control blocks.*
4) *An ineffective bearer or fastening is one that does not provide either vertical, lateral, or longitudinal support to the rail.*
5) *The competent worker should assess Individual defects identified for the effectiveness of the bolts. Ineffective bolts include missing or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced. Pivot heel blocks generally may be made up of connections which require some bolts to be not fully tightened providing for design switch movement.*
6) *Notify Signalling maintainer. An alternative action that may be taken is to install a points clip in accordance with Safeworking rules.*
7) *When a worn switch at the end of its service life is being replaced a new switch and stock rail set should be used*

8) *"Length of damage" also applies to the sum of consecutive areas of damage forming a length greater than the length specified in the Table.*

9) *A crippled switch blade refers to a switch blade that has suffered damage from a run through or derailment. Such switch blades may be suitable for temporary repair and re-installation to a geometry suitable for train movements at a reduced speed. The switch blade may have been, bent, twisted or have suffered wheel damage however it should be repaired to a condition suitable for the reduced speed of operation both in terms of geometry and structural integrity. The reduced speed of operation should not exceed 40km/h*

Table 3.10 – Crossing Area Assessment Responses – 1435 gauge

Component parameter	Dimension limit	Track speed (freight/passenger) km/h					
		20/20	40/40	60/65	80/90	100/115	115/160
Critical dimensions							
Check Rail effectiveness [1] (Refer Figure 3.6)	≥1400 mm	A1	A1	A1	A1	A1	A1
	1398 mm to < 1400	A6	A6	A3	A3	A3	A3
	1396 mm to <1398 mm	A6	A6	A6	A4	A4	A4
	1389 mm to <1396 mm	A7	A7	A7	A7	A7	A7
	1386 mm to <1389 mm	A6	A6	A6	A6	A6	A6
	1384 mm to <1386 mm	A6	A6	A6	A4	A4	A4
	1382 mm to <1384 mm	A6	A6	A3	A3	A3	A3
	<1382 mm	A1	A1	A1	A1	A1	A1
Wing Rail Vertical wear (Refer Figure 3.8)	<5 mm	A7	A7	A7	A7	A7	A7
	5 mm to 10 mm	A6	A6	A6	A6	A6	A6
	>10 mm	A6	A6	A3	A3	A3	A3
Track gauge(at the crossing nose) [2] (Refer Figure 3.6)	≥1443	A2	A2	A2	A2	A2	A2
	>1440mm to <1443 mm	A6	A6	A6	A4	A4	A4
	>1438 mm to 1440 mm	A6	A6	A6	A6	A6	A6
	>1430 mm to 1438 mm	A7	A7	A7	A7	A7	A7
	>1427 mm to 1430 mm	A6	A6	A6	A6	A6	A6
	>1425 mm to 1427 mm	A6	A6	A6	A4	A4	A4
	1425 mm and less	A2	A2	A2	A2	A2	A2
Check Rail Flangeway Width (Refer Figure 3.6)	>49 mm	A6	A6	A6	A4	A4	A4
	48 mm – 49 mm	A6	A6	A6	A6	A6	A6
	40 mm - <48 mm	A7	A7	A7	A7	A7	A7
	38 mm – <40 mm	A6	A6	A6	A6	A6	A6
	<38 mm	A6	A6	A6	A4	A4	A4
Swing Nose Crossings							
Swing nose width at tip as presented to the wheel [3]	<4mm	A7	A7	A7	A7	A7	A7
	4mm to 6mm	A6	A6	A6	A6	A6	A6
	>6mm to 8mm	A6	A2	A2	A2	A2	A2
	>8mm	A1	A1	A1	A1	A1	A1

Component parameter	Dimension limit	Track speed (freight/passenger) km/h					
		20/20	40/40	60/65	80/90	100/115	115/160
Swing nose crossing height (Measured at the top of the arc at the crossing nose)	Distance from wing rail running surface to top of crossing nose:						
	13 mm and greater	A7	A7	A7	A7	A7	A7
	>12 mm to <13 mm	A6	A6	A6	A6	A6	A6
	12mm or less	A1	A1	A1	A1	A1	A1
Swing nose crossing gauge face wear angle (At the point of wheel flange / crossing nose contact)	Angle (from vertical):						
	<18 degrees	A7	A7	A7	A7	A7	A7
	18 deg. to <26 deg.	A6	A6	A6	A6	A6	A6
	26 degrees or greater	A1	A1	A1	A1	A1	A1
Key Component Condition							
Crossing nose break (width of break, refer Figure 3.7)	Broken: (within transfer length):						
	15 mm to 20 mm width	A6	A6	A6	A6	A6	A6
	20 mm to 25 mm width	A6	A6	A3	A3	A3	A3
	>25 mm wide	A1	A1	A1	A1	A1	A1
Ineffective bearers/fasteners (in critical area) [4]	1 only	A6	A6	A6	A6	A6	A6
	2 consecutive	A6	A6	A3	A3	A3	A3
	>2 consecutive	A1	A1	A1	A1	A1	A1
Cracks in cast Crossings [5]	Non critical	A7	A7	A7	A7	A6	A6
	Critical	A6	A6	A6	A6	A6	A6
	Fully (not affecting the running surface)	A6	A6	A6	A4	A4	A4
	Fully (affecting the running surface)	A1	A1	A1	A1	A1	A1
Rail defects	Refer to Section 1 Rail						
Spacer blocks	Broken/cracked	A6	A6	A6	A6	A6	A6
Check rail bolts [6] [6]	Loose	A6	A6	A6	A6	A6	A6
	Missing/ineffective: ≤2	A6	A6	A6	A6	A6	A6
				A3 Heavy Haul	A4 Interstate		
	Missing/ineffective: 3	A6	A6	A6	A4	A4	A4
				A3	A3		

Component parameter	Dimension limit	Track speed (freight/passenger) km/h					
		20/20	40/40	60/65	80/90	100/115	115/160
				Heavy Haul	Interstate		
	Missing/ineffective: >3	A6	A2	A2	A2	A2	A2
Crossing bolts	Bolt effectiveness	[8]	[8]	[8]	[8]	[8]	[8]
Crossing flangeway		[7]	[7]	[7]	[7]	[7]	[7]

Notes:

1. *The main effectiveness of the check rail is its ability to protect the crossing nose. Wheel contact with the crossing nose is therefore a vital observation to be made during inspections. Any sign of excessive damage to the crossing nose is reason for replacement/adjustment of the check rail regardless of the check rail wear.*
2. *For wide gauge in the crossing critical area plain track limits also apply*
3. *Swing nose width at the tip includes effects of side wear on wing rails and closed gap between nose and wing rails. It is not recommended that the gap between the nose tip and wing rail exceeds 2mm at any time.*
4. *An ineffective bearer or fastening is one that does not provide either vertical, lateral, or longitudinal support to the rail.*
5. *"Cracked: non critical" means cracks longitudinally or vertically that may eventually cause a crossing to need repair.*

   "Cracked: critical" means cracks longitudinally or vertically that may lead to a piece of crossing eventually lifting or breaking out and affecting the running surface integrity.

   "Cracked: fully" (not affecting the running surface)" means a crack that runs the full section of the crossing such that the crossing is in two pieces, all fastenings are secure and does not impact on the running surface.

   "Cracked: fully (affecting the running surface)" means a crack that runs the full section of the crossing such that the crossing is in two pieces and fastening are not secure or the break affects running surface integrity.
6. *The end bolts of all check rails should be effective.*
7. *Flangeways should be checked for blockages and cleared where blocked.*
8. *The competent worker should assess Individual defects identified for the effectiveness of the bolts. Ineffective bolts include missing or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced.*

Table 3.11 – Housed Points Assessment Responses

Component parameter	Dimension limit	Track speed (freight/passenger) km/h					
		20/20	40/40	60/65	80/90	100/115	115/160
Housed Points							
Refer to ETE-03-01 Figure 1 for Dimensions A → G							
A & G – Checkrail flangeway and Housing flangeway clearance	>50 mm	A6	A6	A6	A4	A4	A4
	48 – 50 mm	A6	A6	A6	A6	A6	A6
	42 – 47 mm	A7	A7	A7	A7	A7	A7
	40 – 41 mm	A6	A6	A6	A6	A6	A6
	<40 mm	A6	A6	A6	A4	A4	A4
B – Top of Housing above checkrail	25 – 31 mm	A7	A7	A7	A7	A7	A7
	32 – 35 mm	A6	A6	A6	A6	A6	A6
	36 – 37 mm	A6	A6	A3	A3	A3	A3
	>37 mm	A1	A1	A1	A1	A1	A1
C – Vertical clearance between Switch tip and Housing [1]	3 mm	A7	A7	A7	A7	A7	A7
	<3 mm	A6	A6	A6	A6	A6	A6
D – Switch toe to Stockrail open throw dimension	95 mm and greater	A7	A7	A7	A7	A7	A7
	85 mm to <95 mm	A6	A6	A6	A6	A6	A6
	80 mm to <85 mm	A6	A2	A2	A2	A2	A2
	<80 mm	A1	A1	A1	A1	A1	A1
E – Width of Housing [2]	<140 mm	Replace housing. Priority dependant on flangeway clearance.					
F – Flare at end of Housing and Checkrail [3]	100 – 102 mm	A7	A7	A7	A7	A7	A7
	91 – 99 mm	A6	A6	A6	A6	A6	A6
	80 – 90 mm	A6	A6	A3	A3	A3	A3
	<80 mm	A1	A1	A1	A1	A1	A1

Notes:

1. *The 3mm clearance allows free movement of the switch. Speed restrictions will not have any impact on this clearance. The minimum priority set should be P2. More urgent attention may be required if point operation is affected.*
2. *The width of housing is limited by the shimming adjustment available (about 10mm). Once the housing has worn to about 140mm it will need to be replaced. Urgency will be determined by the flangeway clearance.*

3. *The impact of the wheels on the flare should be assessed and a priority given based on this. Normally the flare will "wear in" to give minimal impact. Care should be taken when shimming the housing not to create an impact point on the flared ends.*

4 Section 4 Ballast

4.1 Response codes

The responses in Section 4 are codified A1 to A7 as in the table below:

Table 4.6 – 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 for both freight operations (shown first) and passenger operations (shown second) separated by a "/".*
2) *Where the assessment responses include increased monitoring, a 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) *If the cause of a defect is known and it is known that it will not deteriorate into an unsafe condition an alternate response to that shown in tables 4.3, 4.4 and 4.5 is permitted with appropriate documentation and approval from the Civil Engineering Representative or nominated representative.*

4.2 Ballast Profile Assessment Responses

Table 4.3 – Ballast Profile Condition – Concrete Sleepers

Response Codes (See Table 4.6)

Ballast profile (simplified for field application)		**Track curvature >400 m radius**					
		Nominal track speed for freight/ passenger (km/h)					
Shoulder Height H	Shoulder Width W	20/20	40/40	60/65	80/90	100/115	115/-
Full	Half	A7	A7	A7	A7	A6	A6
Full	Nil	A7	A7	A7	A6	A5	A5
Half	Full	A7	A7	A6	A6	A5	A5
Half	half	A7	A7	A6	A6	A5	A5
Half	Nil	A7	A6	A6	A4	A4	A4
Nil	Nil	A6	A6	A3	A3	A3	A3
Ballast profile (simplified for field application)		**Track curvature ≤400 m radius**					
		Nominal track speed for freight/ passenger (km/h)					
Shoulder Height H	Shoulder Width W	20/20	40/40	60/65	80/90	100/115	115/-
Full	Half	A6	A6	A6	N/A	N/A	N/A
Full	Nil	A6	A6	A6	N/A	N/A	N/A
Half	Full	A7	A7	A6	N/A	N/A	N/A
Half	Half	A7	A6	A6	N/A	N/A	N/A
Half	Nil	A6	A6	A3	N/A	N/A	N/A
Nil	Nil	A6	A2	A2	N/A	N/A	N/A

Table 4.4 – Ballast Profile Condition – Timber Sleepers
Response Codes (See Table 4.6)

Ballast profile (simplified for field application)		**Track curvature >400 m radius**					
		Nominal track speed for freight/passenger (km/h)					
Shoulder Height H	Shoulder Width W	20/20	40/40	60/65	80/90	100/115	115/-
Full	Half	A7	A7	A7	A7	A6	A6
Full	Nil	A7	A7	A6	A6	A5	A5
Half	Full	A6	A6	A3	A3	A3	A3
Half	Half	A6	A6	A3	A3	A3	A3
Half	Nil	A6	A2	A2	A2	A2	A2
Nil	Nil	A1	A1	A1	A1	A1	A1
Ballast profile (simplified for field application)		**Track curvature ≤400 m radius**					
		Nominal track speed for freight/passenger (km/h)					
Shoulder Height H	Shoulder Width W	20/20	40/40	60/65	80/90	100/115	115/-
Full	Half	A6	A6	A6	N/A	N/A	N/A
Full	Nil	A6	A6	A3	N/A	N/A	N/A
Half	Full	A6	A2	A2	N/A	N/A	N/A
Half	Half	A1	A1	A1	N/A	N/A	N/A
Half	Nil	A1	A1	A1	N/A	N/A	N/A
Nil	Nil	A1	A1	A1	N/A	N/A	N/A

Table 4.5 – Ballast Profile Condition – Steel Sleepers
Response Codes (See Table 4.6)

Ballast profile (simplified for field application)		**Track curvature >400 m radius**					
		Nominal track speed for freight/ passenger (km/h)					
Shoulder Height H	Shoulder Width W	20/20	40/40	60/65	80/90	100/115	115/-
Full	Half	A7	A7	A7	A7	A6	A6
Full	Nil	A7	A7	A7	A7	A6	A6
Half	Full	A7	A7	A6	A6	A5	A5
Half	Half	A7	A6	A6	A4	A4	A4
Half	Nil	A6	A6	A3	A3	A3	A3
Nil	Nil	A6	A2	A2	A2	A2	A2
Ballast profile (simplified for field application)		**Track curvature ≤400 m radius**					
		Nominal track speed for freight/ passenger (km/h)					
Shoulder Height H	Shoulder Width W	20/20	40/40	60/65	80/90	100/115	115/-
Full	Half	A6	A6	A6	N/A	N/A	N/A
Full	Nil	A6	A6	A3	N/A	N/A	N/A
Half	Full	A6	A2	A2	N/A	N/A	N/A
Half	Half	A1	A1	A1	N/A	N/A	N/A
Half	Nil	A1	A1	A1	A1	N/A	N/A
Nil	Nil	A1	A1	A1	A1	N/A	N/A

Notes to tables 4.3, 4.4, and 4.5:

1) *The tables apply where crib ballast has not been substantially degraded from the full design profile. Where crib ballast deficiencies are found a more stringent response may be required depending on season, curvature, traffic, and other track stability parameters.*

2) *In concrete sleepers the responses apply where height and width deficiencies occur over lengths of 10 m or greater. In timber and steel sleepers the responses apply to any length. This deals with general ballast profile deterioration likely to impact on track lateral stability over time. Significant ballast disturbances including more severe degradation over distances of less than 10 m should be assessed by a competent worker.*

3) *H is the distance from the sleeper base (soffit) to the underside of the rail foot.*

4) W is the design shoulder ballast width from the sleeper end.
The nominal dimensions for W are as defined in Table 4.1:
W is measured from the extreme end of the sleeper, not the visible end when the track is fully ballasted. This applies particularly in the case of steel sleepers.

5) *The response action may be reduced in severity by one (1) level for tangent track in the non buckle prone season (e.g. A4 becomes A5)*

6) *Fractions of "H" and "W" (refer to Figure 4.2) are relative to the full design ballast profile (refer to Clause 4.1.2). For conventional sleeper designs the full design shoulder width is that defined in Note 4.*

7) *Interpolation of profile measurement criteria and responses is permitted.*

8) *Temperature is assumed to be within the design range (See Section 6 for extreme temperature responses).*

9) *Steel sleepers are assumed to have a full pod of ballast. If the pods are less than 3/4 full, then there should be an increased speed restriction by 2 categories (eg. an A5 response goes to an A3)*

10) *Track geometry limits specified in Section 5 are assumed.*

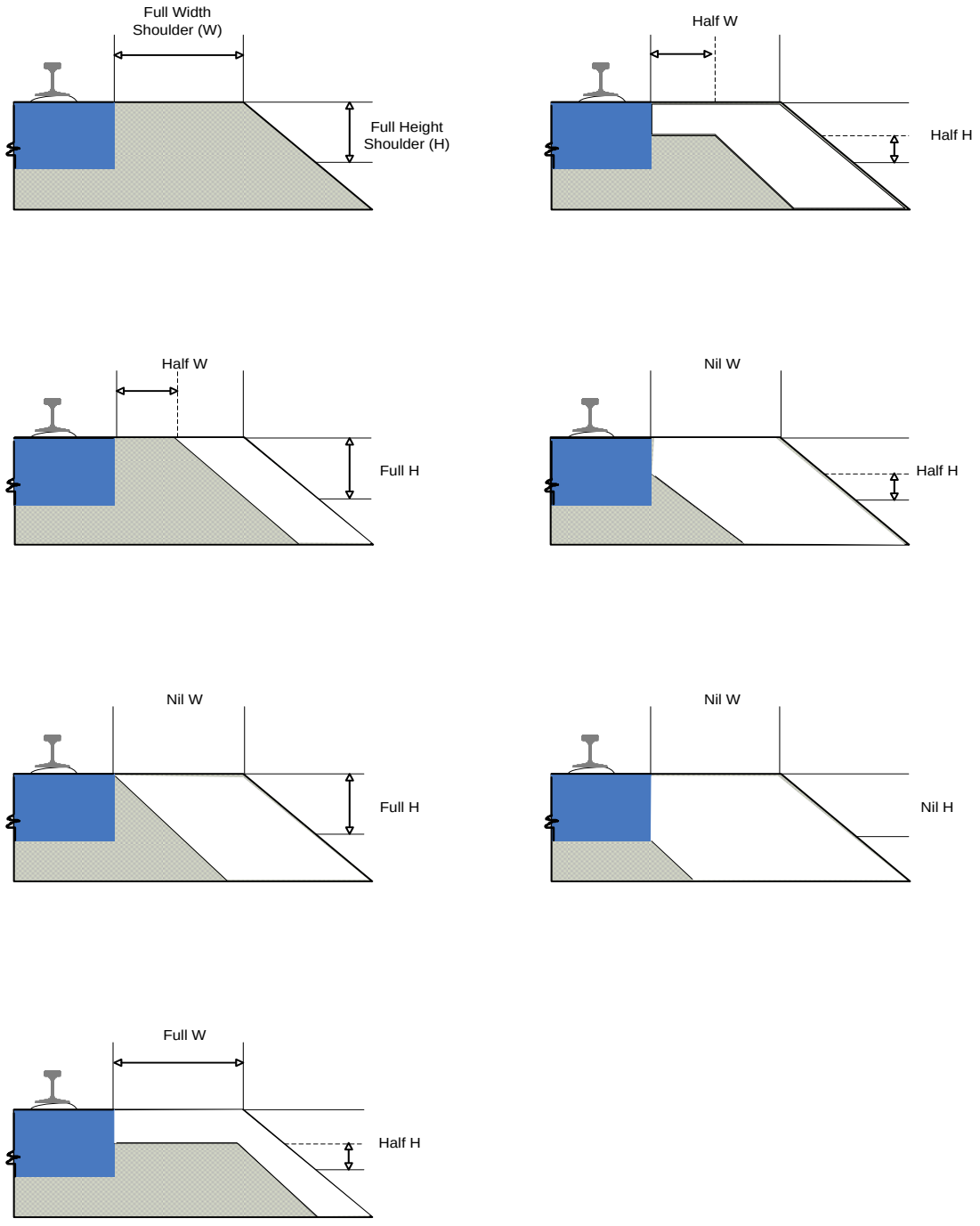
11) *Rail sizes 47 kg/m to 60 kg/m and CWR/LWR (>110 metre) rail lengths are assumed.*

12) *Crushed rock ballast with consolidation equivalent to >100,000 gross tonnes of traffic since the last track disturbance, is assumed.*

13) *The nominal track speeds relate 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.*

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

Figure 4.2 - Fractions of Design Ballast Profile



5 Section 5 Track Geometry

5.1 Track Geometry Assessment Responses

Table 5.11 – Geometry Defects – Response Category Maintenance Limits *see note 9, 10 and 11*

Measured parameters in mm under loaded track											Max. speed (f/p) *see note 1* *f/p refers to Freight/Passenger speed bands*						Defect Band
Gauge		Horiz. Align.		Top *see note 2*			Twist										
Wide *see note 8*	Tight	10m chord *see notes 2 & 12*		20m Inertial *see note 7*	Long 20m Chord *see note 3*	Short 4m Chord *see note 4*	Long 14m		Short *see note 12*		20/20	40/40	60/65	80/90	100/115	115/160	
		A	B				Transition	Non Transition	2 m A	2 m B							
>38	>20	>124 *see note 5*	>108 *see note 5*	>42	>90	>23	>74	>70	>24	>20	E1	E1	E1	E1	E1	E1	A
35-38	19-20	90-124 *see note 5*	83-108 *see note 5*	40-42	72-90	20-23	65-74	61-70	23-24	19-20	E2	E2	E2	E1	E1	E1	B
29-34	17-18	>45	>34	36-39	67-71	17-19	56-64	53-60	21-22	17-18	P2	P1	P1	E2	E1	E1	C
27-28	15-16	35-45	25-34	33-35	57-66	15-16	50-55	47-52	19-20	15-16	N	N	P2	P1	E2	E1	D
25-26	13-14	25-34	19-24	29-32	52-56	13-14	43-49	41-46	17-18	13-14	N	N	N	P2	P1	E2	E
23-24	11-12	19-24	15-18	27-28	47-51	11-12	38-42	36-40	15-16	11-12	N	N	N	N	P2	P1	F
21-22		15-18	11-14	24-26	38-46	9-10	33-37	31-35	12-14	9-10	N	N	N	N	N	P2	G

Cross level- Variation from design *see note 6*	Tangent track (Tangent & Radii >2000m)	Curved track including transitions (Radii <2000 m)		Additional action required for insufficient superelevation
		Insufficient cant based on Maximum design speed	Excess cant based on maximum design speed	
Absolute superelevation >170mm requires E1 response 160mm to 170mm *see note 13*				
>75	E1	E1	E1	
51-75	P2	E2	P1	Restrict 40km/h below posted speed
41-50	P2	E2	P2	Restrict 30km/h below posted speed
15-40		P1	P2	Restrict 20km/h below posted speed
<15				No action required

Notes:

1) *Speed band "F/P" refers to Freight / Passenger speed bands (in km/h) respectively. Passenger operations refer to locomotive hauled passenger trains with carriages not exceeding 16TAL.*
2) *Horizontal alignment and top parameters relate to the specific chord lengths nominated. The values specified cannot be directly related to values for use with other measurement systems*
3) *Long top defect limits have been adapted from the Track Safety Standards of the U.S. Federal Railroad Administration to assist track inspectors making manual measurements, and are measured using the offset at the mid ordinate of a 20 m chord.*
4) *Short top defects are provided to assist track inspectors making manual measurements, and are measured using the offset at the mid ordinate of a 4 m chord.*
5) *Defect Bands A and B are actual versine measurements (not variation from design) for simple and compound curves. Where curves are reversing the actual versine should not exceed 125 mm. The remaining exceedences – i.e. Defect Bands C to G - are variations from design.*
6) *To determine the cross level variation knowledge of the design cross level is required. Some track recording cars may not be able to determine this parameter and alternative methods such as manual onsite assessment may be required.*
7) *These figures are calculated from a 20m wave length inertial output from the system.*
8) *Normal operations may be permitted as per Table 5.12 (note 3) for defect bands C to G if the gauge widening is confirmed to be due to causes not expected to be prone to rapid deterioration, for instance curve wear or loss of insulating spacers. Provided the track is secure against further widening due to lateral movement of the rail and the rail side wear limits are not exceeded.*
9) *All geometry parameters used (except the long 20m chord) are based on the loaded conditions. Where static or unloaded measurements are taken, due allowance should be made for the additional impact of loading and dynamics.*
10) *The measured parameter limits set in the above table are derived from commonly occurring defects in actual conditions. Normally occurring multiple defects are provided for in the limits set, for example top and twist defects would commonly be expected to occur together. In such cases the most stringent response criterion of the two should be selected. Unusual combinations of defects that are considered to act together, for example horizontal alignment with twist should be subject to special consideration. A more stringent response than that specified for rectifying the defects individually should be considered.*
11) *Actual defects shall be rounded down to the nearest mm when using this table.*
12) *Limits for alignment and short twist headed "A" and "B" are to be applied as follows:*

    Limits in Column B – apply for curves that are operated at enhanced performance speeds (EP) with greater than 80mm cant deficiency. These limits apply to the transition as well as the curve. Limits in Column A – apply to all other ARTC tracks.
13) *The Track Geometry Car will record this as a P3 defect. However no response action is required but this should be an indication the limits are approaching emergency response levels.*

Table 5.12 – Defect response and action

Response Category	Inspect see Note 1 & Note 3	Repair see Note 2 & Note 3	Other Responses see Note 3
E1 (Emergency Class 1)	Prior to next train	Prior to next train	Where the response category cannot be reduced below E1 by a reduction in speed, trains may only pass the site under the control of a pilot. Assessment of the defect by a competent worker should be made to determine if the train can be piloted.
E2 (Emergency Class 2)	Within 2 hours or prior to the next train, whichever is greatest	Within 24 hours	If the defect cannot be inspected or repaired within the nominated time and the response category cannot be reduced below E2 by a reduction in speed, trains may only pass the site at speeds up to 20 km/h following assessment by a Competent Worker.
P1 (Priority Class 1)	24 hrs	7 days	
P2 (Priority Class 2)	7 days	28 days	
N			*A deviation from design geometry up to the lowest level of P2 defect does not require any action above the normal inspection regime.*

Notes:

1) *In the event of failure to inspect reported faults by the specified time the allowable speed should be reduced by at least one speed band. A revised inspection period in line with the lower speed band may then be used. If the defect is subsequently inspected the speed may be raised to the higher band subject to repair being achievable within the nominated period for the higher band.*

2) *In the event of an inability to repair the track, the fault should be reassessed on site prior to expiry of the repair response time. The Repair period can only be extended by the Civil Engineering Representative or a person with a delegated authority from the Civil Engineering Representative.*

3) *If the cause of a defect is known and it is known that it will not deteriorate into an unsafe condition an alternate response to that shown is permitted with appropriate documentation and approval by the Civil Engineering Representative or nominated representative.*