



AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline: Engineering (Track & Civil)

Category: Code of Practice –
General Appendix

Management of Rail Defects

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Applicability

New South Wales		Victoria	✓
Queensland		Western Australia	✓
South Australia	✓		

Primary Source

ARTC Track & Civil Code of Practice - Section 1: Rail

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1.1	27 May 13	Standards	Stakeholders	Manager Standards	GM Technical Standards & Environment 07/06/2013

Amendment Record

Version	Date Reviewed	Clause	Description of Amendment
1.0	29 Nov 11		First Issue
1.1	27 May 13	Table 2	Change 360 and 180 day responses to 1 year and 6 months respectively throughout Table 2.

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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.

1 General

This General Appendix sets out the requirements for the management of rail defects.

2 Rail and Welded Joint Assessment

The assessment of rail and welded rail joint condition should incorporate the following guidelines:

a) Standard track types for determining assessment responses:

Assessment responses are based on two representative track types, Type A and Type B, which are defined in Table 1. For track where all factors fall within the definition of Type A track, then the response times and action regimes for Type A track shall apply. For track where all factors fall within the definition of Type B track, then the response times and action regimes for Type B track shall apply. Where the factors vary between those of Type A and Type B track, an assessment shall be performed to determine the appropriate response times and action regimes.

Type A track represents a higher risk situation generally requiring more stringent responses. Type B track is the base case track type.

Responses (and inspection frequency) should be adjusted to suit local conditions and special situations of risk hazards (e.g. high embankments, very tight curvature, bridges), and should include consideration of the actual operating regime. Alternative responses should be consistent in nature with the responses nominated in this Clause.

Table 1 – Definition of Track Types

Factor	Type A track	Type B track
Line type	Multiple main lines	Single main line
Track alignment	Track alignments with curve radii less than or equal to 600 m	Track alignments with curve radii greater than 600 m or straight
Rail support system	A sleeper and fastening system that supplies longitudinal, lateral and vertical restraint to the rail equivalent to dog spiked and rail anchored track	A sleeper and fastening system that supplies longitudinal, lateral and vertical restraint to the rail equivalent to concrete, steel or timber sleepers track with resilient fastenings
Passenger Volumes	Over an average of 1000 passengers per day	Up to an average of 1000 passengers per day

Notes:

[1] Table applies to 47kg rail or greater.

[2] Table does not apply to local areas of higher risk, for example at bridges or track on high embankments.

[3] The criteria that divides each factor between Type A or B tracks are indicative and not absolute.

b) Assessment and actions:

Defects detected from inspections should be assessed and reported in accordance with the classification, position and sizing codes as specified in Table 2. The actions for each defect and the response time to carry out such actions are also specified in Table 2.

Reference should be made to Volume 2, the Glossary, for a general description of the most common rail and welded joint defects, including the defect origin, their manner of propagation, how to detect them visually, and failure mode information. The Glossary also provides definitions of:

- i. defect type codes
- ii. defect position codes
- iii. defect response times
- iv. defect actions

used for the assessment responses in Table 2.

Known defects should be positively identified in track with indelible marking to ensure traceability.

c) Sizing of defects:

Transverse defects are recorded as a height measurement.

Transverse head defects may also be recorded as a percentage of head area. It is assumed in Table 2 that defects measured in mm are approximately circular to give a conversion to percentage.

Longitudinal defects are recorded as a length.

Table 2 – Rail and Rail Welded Joint Assessment Responses

	Type A track		Type B track	
Defect size	Response time	Action	Response time	Action
Defect Name (Type Code, Position Code)				
Shatter Crack (SC, H)				
<5% (< 10 mm)	90 days	Reassess or remove	1 year	Reassess or remove
>5%		Treat as TM		Treat as TM
Transverse Defect (TD, H)				
5-7% (10-15 mm)	7 days	Reassess or plate or remove	90 days	Reassess or plate or remove
7-10% (16-20 mm)	7 days	Reassess or plate or remove	30 days	Reassess or plate or remove
10-30% (21-30 mm)	1 day	Speed restrict and reassess, or plate or remove	14 days	Reassess or plate or remove
>30% (> 30 mm)	2 hours	Pilot or plate or remove	1 day	Speed restrict and reassess, or plate or remove
>30% and surface cracking on rail head	Prior to the passage of the next train	Pilot or plate or remove	Prior to the passage of the next train	Speed restrict and visually inspect every day, or plate or remove
Broken rail (ref BR defect)	Prior to the passage of the next train	Pilot or plate or remove	Prior to the passage of the next train	Pilot or plate or remove

	Type A track		Type B track	
Defect size	Response time	Action	Response time	Action
Multiple Transverse Defects (TM, H)				
5-7% (10-15 mm)	7 days	Reassess or remove	60 days	Reassess or remove
7-10% (16-20 mm)	7 days	Reassess or remove	14 days	Reassess or remove
10-30% (21-30 mm)	1 day	Speed restrict and reassess every day or remove	1 day	Speed restrict and reassess or remove
>30% (>30 mm)	Prior to the passage of the next train	Pilot or remove	Prior to the passage of the next train	Speed restrict or remove
>30% and surface cracking on rail head	Prior to the passage of the next train	Pilot or remove	Prior to the passage of the next train	Pilot or remove
Transverse Defect From Wheel Burn (TW, H)				
Any	Treat as TD or TM as appropriate.			
Transverse Defect From Shelling (TS, H)				
Any	Treat as TD or TM as appropriate.			
Horizontal Split (HS, H)				
25 - 100 mm	35 days	Reassess or remove	90 days	Reassess or remove
101-200 mm	7 days	Reassess or remove	30 days	Reassess or remove
>200 mm	Prior to the passage of the next train	Speed restrict and visually inspect every day or remove	14 days	Reassess or remove
>200 mm and with severe bleeding or head flow	Prior to the passage of the next train	Speed restrict and visually inspect every day or remove	Prior to the passage of the next train	Speed restrict and visually inspect every day or remove
Broken Rail (refer BR defect)	Prior to the passage of the next train	Pilot or remove	Prior to the passage of the next train	Pilot or remove
Horizontal Split (HS, W)				
40 - 75 mm	2 days	Speed restrict or remove	7 days	Reassess or remove
>75 mm	Prior to the passage of the next train	Pilot or remove	Prior to the passage of the next train	Pilot or remove
Broken Rail	Prior to the passage of the next train	Pilot or remove	Prior to the passage of the next train	Pilot or remove

	Type A track		Type B track	
Defect size	Response time	Action	Response time	Action
Vertical Split (VS, H)				
<i>NOTE: If defect exhibits severe bleeding or is cracked out increase defect size by one level.</i>				
25-100 mm	35 days	Reassess or remove	90 days	Reassess or remove
101-200 mm	35 days	Reassess or remove	45 days	Reassess or remove
201-400 mm	7 days	Reassess or remove	7 days	Reassess or remove
>400 mm	Prior to the passage of the next train	Speed restrict and visually inspect every day, or remove	Prior to the passage of the next train	Speed restrict and visually inspect every day, or remove
Broken Rail	Prior to the passage of the next train	Pilot or remove	Prior to the passage of the next train	Pilot or remove
Vertical Split (VS, W)				
<i>NOTE: Check for piped rail and transverse or horizontal split web.</i>				
All sizes	6 months	Reassess or remove	6 months	Reassess [1] or remove
Piped Rail (PR, W)				
25–150 mm	35 days	Reassess or remove	60 days	Reassess or remove
151–300 mm	7 days	Reassess or remove	14 days	Reassess or remove
> 300 mm	Prior to the passage of the next train	Speed Restrict and reassess every day, or remove	1 day	Speed restrict or remove
Visible cracking	Prior to the passage of the next train	Speed restrict and reassess every day, or remove	Prior to the passage of the next train	Speed restrict and reassess every day, or remove
Broken rail	Prior to the passage of the next train	Pilot or remove	Prior to the passage of the next train	Pilot or remove
Transverse Split (TS: W)				
20–40 mm	7 days	Reassess, plate or remove	7 days	Reassess, plate or remove
41–75 mm	2 days	Reassess, plate or remove	2 days	Reassess, plate or remove
> 75 mm	Prior to the passage of the next train	Speed restrict, plate or remove	Prior to the passage of the next train	Speed restrict, plate or remove
Broken rail	Prior to the passage of the next train	Pilot or remove	Prior to the passage of the next train	Pilot or remove
Head Web Separation (HW, X)				
20–75 mm	7 days	Reassess or remove	7 days	Reassess or remove
76–200 mm	2 days	Speed restrict and reassess every day, or remove	2 days	Speed restrict and reassess every day, or remove
> 200 mm	Prior to the passage of the next train	Speed restrict and reassess every day, or remove	Prior to the passage of the next train	Speed restrict and reassess every day, or remove
Broken rail	Prior to the passage of the next train	Pilot or remove	Prior to the passage of the next train	Pilot or remove

	Type A track		Type B track	
Defect size	Response time	Action	Response time	Action
Foot Web Separation (FW, Y)				
20–40 mm	7 days	Reassess or remove	30 days	Reassess or remove
41–75 mm	2 days	Speed restrict and reassess every day, or remove	7 days	Reassess or remove
> 75 mm	Prior to the passage of the next train	Speed restrict and reassess every day, or remove	Prior to the passage of the next train	Speed restrict and reassess every day, or remove
Broken rail	Prior to the passage of the next train	Pilot or remove	Prior to the passage of the next train	Pilot or remove
Bolt Hole Crack (BC, W)				
Note: For bolt hole cracks less than 20mm refer engineering instruction ETI -01-05 dated Oct 2008				
20–40 mm	7 days	Reassess or remove	30 days	Reassess or remove
41–75 mm	2 days	Speed restrict and reassess every day, or remove	7 days	Reassess or remove
>75 mm	Prior to the passage of the next train	Speed restrict and reassess every day, or remove	Prior to the passage of the next train	Speed restrict and reassess every day, or remove
Broken rail	Prior to the passage of the next train	Pilot or remove	Prior to the passage of the next train	Pilot or remove
Bolt Hole Elongation (BE, W)				
*** To Be Determined ***				
Bolt Hole Non-conforming (BN, W)				
*** To Be Determined **				
Weld Defect: head (WA or WF or WT, H)				
5-10% (10-20 mm)	7 days	Reassess, plate, repair or remove	6 months	Reassess, plate, repair or remove
10-30% (21-30 mm)	1 day	Reassess, plate, repair or remove	90 days	Reassess, plate, repair or remove
30-70% (31-40 mm)	2 hours	Speed restrict and reassess every day, or plate, or remove	30 days	Reassess, plate, or remove
>70% (>40 mm)	Prior to the passage of the next train	Speed restrict and reassess every day, or plate, or remove	Prior to the passage of the next train	Speed restrict or remove
Surface cracking on rail head (visual– not confirmed by ultrasonic examination)	Prior to the passage of the next train	Speed restrict and reassess every day, or plate, or remove	7 days	Speed restrict and reassess every day, or remove
NOTE: Surface cracking may not be very deep but this can only be confirmed by manual ultrasonics.				
Broken weld	Prior to the passage of the next train	Pilot, or plate, or remove	Prior to the passage of the next train	Pilot or plate, or remove

	Type A track		Type B track	
Defect size	Response time	Action	Response time	Action
Weld Defect: web (WA or WF or WT, W)				
25–50 mm	30 days	Reassess, plate or remove	90 days	Reassess, plate or remove
51–75 mm	1 day	Speed restrict and reassess daily, or plate, or remove	30 days	Reassess, plate or remove
>75 mm	2 hours	Speed restrict and reassess daily, or plate, or remove	1 day	Speed restrict and reassess daily, or plate, or remove
Broken weld	Prior to the passage of the next train	Pilot or plate or remove	Prior to the passage of the next train	Pilot or plate or remove
Weld Defect: foot (WA or WF or WT, F)				
< 15 mm width and full height of rail foot	14 days	Reassess or plate or remove	30 days	Monitor. Removal is optional
15–35 mm width (if on edge use 10–35 mm)	1 day	Speed restrict and reassess every day, or remove	1 day	Speed restrict and reassess every day, or remove
>35 mm width	Prior to the passage of the next train	Speed restrict and reassess every day, or remove	Prior to the passage of the next train	Speed restrict and reassess every day, or remove
Broken Weld	Prior to the passage of the next train	Pilot or plate or remove	Prior to the passage of the next train	Pilot or plate or remove
Weld Defect: surface (e.g. gas hole, hot tear, shrinkage, porosity)				
Visual	1 day	Speed restrict, plate or remove	1 day	Speed restrict, plate or remove
Weld Defect: repairs of surface defects (WR, H)				
3–7% (10–15 mm)	7 days	Reassess, plate, repair or remove	90 days	Reassess, plate, repair or remove
7–10% (16–20 mm)	7 days	Reassess, plate, repair or remove	30 days	Reassess, plate, repair or remove
10–20% (21–30 mm)	1 day	Speed restrict, plate, repair or remove	14 days	Reassess, plate, repair or remove
>20% (>30 mm)	Prior to the passage of the next train	Speed restrict, plate, repair or remove	1 day	Reassess, speed restrict, plate, repair or remove
>20% and surface cracking on rail head	Prior to the passage of the next train	Speed restrict, plate, repair or remove	Prior to the passage of the next train	Speed restrict, plate, repair or remove
Broken weld	Prior to the passage of the next train	Pilot or plate, or remove	Prior to the passage of the next train	Pilot or plate, or remove

		Type A track		Type B track	
Defect size	Response time	Action		Response time	Action
Mill Defect (MD, Z) <i>NOTE:</i> The necessary action should be assessed by a competent worker.					
Corroded Rail (CR, Y) <i>NOTE:</i> The necessary action should be assessed by a competent worker and include consideration of the location, extent and geometry of the corrosion. Refer also to Rail Surface below where corrosion impacts on the running surface of the rail.					
>3 mm section loss in web or foot	7 days	Speed restrict until removed		7 days	Speed restrict until removed
Mechanical Joint (MJ, X)					
Any	14 days	Remove plates and assess		14 days	Remove plates and assess
Rail Surface: e.g. rolling contact fatigue (RS, H) <i>NOTE:</i> The necessary action should be assessed by a competent worker and include consideration of the location, extent and the impact on the ability to carry out ultrasonic testing of the rail affected. Rolling contact fatigue is a known phenomena and owners are referred to current literature on the topic.					
*** To Be Determined ***					
Wheel Burn (WB, H) <i>NOTE:</i> Wheel burns should generally be removed by grinding and/or surface repair welding and in severe cases by removal of the rail and insertion of a closure rail. Grinding should remove all heat affected rail steel. Wheel burns can vary significantly in severity. The severity will determine the response time and actions necessary. The geometry of the wheel burn can result in severe dynamic loading of the track and a resulting increased rate of deterioration of the track structure in general. Where defects are not removed from track, a defect management plan should be put in place to monitor the wheel burn for TWH defects and general track deterioration.					
Any	[1]	Check for TWH		[1]	Check for TWH
Notches (NO, Z) <i>NOTE:</i> The necessary action should be assessed by a competent worker and include consideration of the location, extent and geometry of the notch or cut. Isolated dented or bruised rail, for example due to a hammer blow, may not generally require removal.					
Broken Foot (BF, F)					
All	Prior to the passage of the next train	(Pilot) or (Speed restrict, plate and reassess daily) or (Remove)		Prior to the passage of the next train	(Pilot) or (Speed restrict, plate and reassess daily) or (Remove)
Broken Rail (BR, Z)					
All	Prior to the passage of the next train	(Pilot) or (Speed restrict, plate and reassess) or (Remove)		Prior to the passage of the next train	(Pilot) or (Speed restrict, plate and reassess) or (Remove)

Notes:

- [1] If not otherwise specified, "reassess" requires defects that have not been corrected to be re-examined ultrasonically (or by visual or other means if ultrasonic methods are not appropriate). If not otherwise specified, the frequency of reassessment is to be the same as the nominated response time.
 - [2] Time period used in Table 1.2 are based on the assessment of the rate of propagation of rail defects. Where a defect cannot be actioned in accordance with the table an assessment of the track condition is to be undertaken. This should be based on the severity of the defect, the time to planned repair completion, whether and under what circumstances trains can operate over the defect and what arrangements for regular retesting and increased surveillance are to be made.
 - [3] "1 day" is to be taken to mean in daylight hours on the next day.
 - [4] More stringent restrictions should be applied if vertical, lateral or longitudinal support conditions are poor.
 - [5] Any subsequent actions determined from an initial assessment should be carried out within a timescale consistent with the severity of the problem. For example, piloting should be applied on an emergency basis whereas marginal reduction in speed should follow normal process.
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