MID WEST PORTS

MWPA TECHNICAL GUIDELINE

MWPA800 –Guidelines for Rail Infrastructure

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Rev 0	14/11/2013	Document Approved for Use	Longrun	I. McLeod (MWPA)
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Rev 4	08/10/2014	Document revised	Longrun	L. Morrison (MWPA)

CONTENTS

1 PREFACE

This document has been compiled for the Mid West Ports Authority (MWPA) to provide developers, designers, contractors and inspectors guidance on MWPA's Rail Infrastructure. It does not replace bespoke project basis of design, design criteria or specifications, but it is intended to provide a benchmark for the minimum technical requirements for new construction, refurbishment and repair of Rail Infrastructure within Geraldton Port.

The chapters of this Guideline include guidance and statutory requirements for rail infrastructure in general and Appendix A contains an Addendum that has been prepared for the Narrow Gauge rail infrastructure at the Mid West Ports Authority. It is for the operational maintenance of track standards and is an addendum to the Brookfield Rail Mainline Narrow Gauge Code of Practice Track & Civil Doc No.W190-400-002.

This Guideline will be used as a basis for identifying any shortcomings in the technical content and ultimately accepting or rejecting proposed, underway or complete projects.

2 SCOPE

2.1 GENERAL

This Guideline defines the minimum requirements for the maintenance of Narrow Gauge rail infrastructure.

Where documents are referred to in this Guideline, the reference should be taken to mean the most recent revision, unless noted otherwise.

2.2 PRECEDENCE

As a general guide, where particular aspects are not covered in the MWPA Technical Guidelines or where conflict between documents exists, the following precedence for standards applies:

1. Statutory Regulations
2. Design Codes and Standards
3. Project Specific Specification
4. MWPA Technical Guidelines; and
5. Other References (E.g. Recognised Industry Best Practice)

Regardless of the general order of precedence, if there is a conflict between documents, the clause presenting the more conservative and pragmatic guidance will govern. If in doubt, or in all cases where noncompliance is anticipated, clarification should be sought from the MWPA.

3 GLOSSARY

The following definitions have been provided to ensure a good understanding of terms across a wide range of readers.

Table 3-1: Glossary of Terms

Term	Definition
Bearer	Timber, steel or concrete support beams (sleepers) under turnout steel work.
Blade Gap	Gap between the turnout blade and the stock-rail at the switch.
Crossing	Steel piece at the centre of the turnout where the curved rail crosses the straight rail, also known as a vee-crossing.
Crossing nose	Point in the vee-crossing where the flangeways cross.
Damage	Visible surface defects caused by the passing of rail vehicles.
Datum	Any permanent line, plane or surface used as a reference datum to which elevations are referred.
Design Life	The length of service the structure is designed to provide in a functional state.
Flangeway	Gap or groove provided for the passage of the flange of a rail wheel as it rolls over the rail or crossing.
Heel Block	Steel attachment where the blade is fixed to the turnout.
Heel Rail	Rail connected to the blade at the heel block.
Locos	Locomotives - vehicles providing tractive effort to the train.
Narrow Gauge	1067 mm being the distance between the inside faces of the two rails making up the NG track.
Nose Point	Point ahead of the crossing nose where the rail gauge faces cross.
Rail Brace/Chair	Bracket or plate for fastening rails within a turnout.
Siding	Rail track other than mainline, secondary track.
Stock rail	Fixed running rail within a turnout.
Switch blade	Moveable rails within a turnout. Machined to closely fit against the stock rail when closed.
Switch blade toe	Moveable point of the switch blade closest to the front end of the turnout.
Switch Stops	Blocks against which the blades close.
Switch Toe / Stock Rail Gap	Gap between the turnout blade and the stock-rail at the switch.
Throat Gap	Gap at the heel block.
Track gauge	1067 mm being the distance between the inside faces of the two rails making up the NG track.
Turnout	Track device used to guide trains from one track to the adjacent parallel track.
Wagons	Rail vehicles for carrying freight.
Wing Rail	Rail within a turnout to guide wheel flanges along the correct path, also known as a check rail. Contacts the rail wheel at the back side of the flange.

For the purposes of this Guideline the following particular abbreviations apply:

Table 3-2: Abbreviations

Abbreviation	Meaning
AS	Australian Standard
AS/NZS	Australian / New Zealand Standards
CoP	Brookfield Rail Mainline Narrow Gauge Code of Practice Track & Civil Doc No. W190-400-002
MWPA	Mid West Ports Authority
NG	Narrow Gauge
PTA	Public Transport Authority
C(DG)	Concrete Dual Gauge sleeper with rail fastened in NG position.

4 RELEVANT DOCUMENTATION

4.1 GUIDELINE SERIES

This guideline should be read in conjunction with other parts of the MWPA Technical Guideline series, where relevant, as listed below:

- MWPA 000 Series – Port Development Guidelines;
- MWPA 100 Series – General Guidelines;
- MWPA 200 Series – Drafting and Survey Guidelines;
- MWPA 300 Series – Mechanical Guidelines;
- MWPA 400 Series – Guidelines for Maritime Structures;
- MWPA 500 Series – Civil Engineering Guidelines;
- MWPA 600 Series – Buildings and Structures Guidelines;
- MWPA 700 Series – Electrical and Instrumentation Guidelines;
- MWPA 800 Series – Guidelines for Rail; and
- MWPA 900 Series – Additional Guidelines.

Where the referenced MWPA guidelines do not yet exist, the relevant Australian standards and industry best practice shall apply.

4.2 MID WEST PORTS AUTHORITY POLICIES AND PROCEDURES

All parties involved in a rail infrastructure project should be aware of and comply with MWPA policies and procedures. A full list of MWPA's policies and procedures can be found in MWPA 100 and obtained either from the MWPA website (https://www.MWPA.wa.gov.au) or requested from the MWPA Project Manager.

4.3 LOCAL, STATE AND FEDERAL STATUTORY REQUIREMENTS

In addition to the requirements of this part of the MWPA Technical Guidelines, all projects should meet the requirements of Local, State and Federal statutory, health, safety and environmental requirements and regulations and include, but not be limited to, the following:

- Western Australian Environmental Protection Act 1986
- Western Australian Occupational Safety and Health Act (1984) and Regulations (1996)
- Western Australian Occupational Safety and Health Legislation Amendment Act (1984)
- Western Australian (Certificates of Competency and Safety Manning) Regulations (1983)
- Western Australian Mines Safety and Inspection Act 2005 and Regulations (2005)
- Dangerous Goods Safety Act (2004)
- Port Authorities Act (1999)
- Maritime Transport and Offshore Facilities Security Act (MTOFSA) (2003)
- Environmental Protection Act and Regulations (1986)
- Rail Safety Act (2010)
- Brookfield Rail Mainline Narrow Gauge Code of Practice Track & Civil Doc No. W190-400-002

4.4 AUSTRALIAN STANDARDS AND DESIGN CODES

The latest version of the following standards and documents should be adopted for all works covered by this Guideline:

Table 4-1: Australian / New Zealand Standards and Design Codes

No.	Title
AS 1012	Methods of Testing Concrete
AS 1141	Methods for Sampling and Testing Aggregates
AS/NZS 1170.0	Structural design actions – General Principals
AS/NZS 1170.1	Structural design actions – Permanent, imposed and other actions
AS/NZS 1170.2	Structural design actions – Wind actions
AS/NZS 1170.4	Structural design actions – Design for earthquake actions
AS 1302	Steel reinforcing bars for concrete
AS 1303	Steel reinforcing wires for concrete
AS 1304	Welded wire reinforcing for concrete
AS 1379	Specification and supply of concrete
AS 1478	Chemical Admixtures for Concrete
AS 1726	Geotechnical Site Investigations
AS 2350	Methods of Test for Portland and Blended Cement
AS 2758	Aggregates and rock for engineering purposes
AS 3582	Supplementary cementitious materials for use with Portland and blended cement
AS 3600	Concrete Structures

No.	Title
AS 3610	Formwork for Concrete
AS 3799	Liquid membrane-forming curing compounds for concrete
AS 3972	Portland and Blended Cements
AS/NZS 4671	Steel reinforcing materials
AS 7630	Railway Infrastructure - Track Classification
AS 7631	Railway Infrastructure - Sight Distance
AS 7632.2	Railway Infrastructure - Signage
AS 7633	Railway Infrastructure - Clearances
AS 7634	Railway Infrastructure - Survey
AS 7635	Railway Infrastructure - Track Geometry
AS 7636	Railway Infrastructure - Structures
AS 7638	Railway Infrastructure - Earthworks
AS 7639	Railway Infrastructure Track Structure
AS 7640	Railway Infrastructure - Rail Management

APPENDIX A

ADDENDUM TO BROOKFIELD RAIL NARROW GAUGE MAINLINE CODE OF PRACTISE TRACK & CIVIL INFRASTRUCTURE FOR GERALDTON PORT RAIL SIDINGS

APPENDIX A

Addendum to Brookfield Rail Narrow Gauge Mainline Code of Practise Track & Civil Infrastructure for Geraldton Port Rail Sidings

Addendum to

Brookfield Rail Narrow Gauge Mainline Code of Practice Track & Civil Infrastructure

For Geraldton Port Rail Sidings

PREPARED BY: Longrun Transport Developments Pty Ltd

LONGRUN FILE NO: GP0531

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Version	Revision Date	Author	Checked by	Distributed to
REV 0	15/05/2014	R.M.Marks	N.W.Tan	Mr. L. Morrison (MWPA)
REV 1	08/10/2014	Longrun	R.M. Marks	S. Good (MWPA)

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1 PREFACE

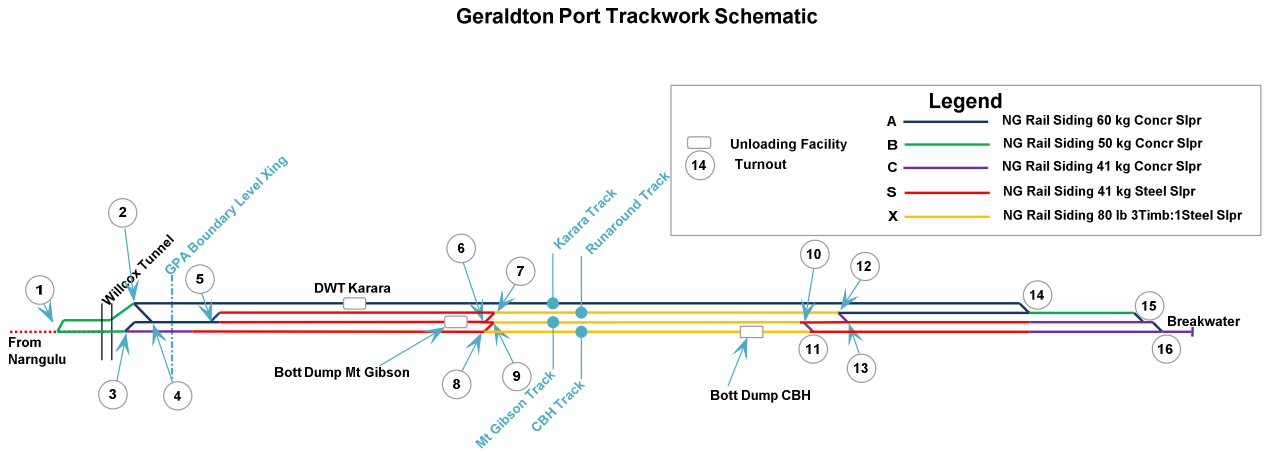
This Addendum has been prepared for the Narrow Gauge rail infrastructure at the Mid West Ports Authority.

It is for the operational maintenance of track standards and is an addendum to the Brookfield Rail Mainline Narrow Gauge Code of Practice Track & Civil Doc No.W190-400-002 (CoP). It is not meant to replace the CoP. The CoP is to be consulted to fill in the detail where the Addendum is brief.

The maximum speed within the Geraldton Port is 10kph.

The track layout for the Geraldton Port sidings is as shown in the schematic diagram below.

Figure 1-1 Schematic 1 - Geraldton Port Rail Layout Showing Track Standards



Note: track between ❺ and ❻ is shown as type S 20 tal but the rail is 100 year old 40 kg/m that is due for replacement.

2 INTRODUCTION

The railway sidings at the Geraldton Port require routine maintenance to ensure they can be used safely for the movement of locomotives and wagons. This is a requirement of the Rail Safety Act 2010.

This report proposes track maintenance standards for the Port's tracks.

The track is narrow gauge (NG). There are twelve NG turnouts within the Port boundaries.

The standards in this document are based on the Brookfield Rail Mainline Narrow Gauge Code of Practice (CoP) Doc No.W190-400-002.

A schematic map of the Port Yard is given as Figure 1 below exhibiting track types and Figure 2 turnout types.

This specification covers:

- Geraldton Port's NG track;
- all the turnouts numbered 5 to 16.

Responsibility for track maintenance and repair commences at the boundary of Brookfield Rail NG infrastructure which runs through the Connell Rd level crossing near Turnout No. 4. The layout is shown in separate drawing Dw0531-100.

Track is categorized as having a maximum speed of 20kph or as being Type 20/20 in the CoP tables. Rails, rail-welds, rail-joints and turnouts are considered to be Type B.

This addendum is not to be applied to special track structures such as those contained in slab track and unloading facilities.

Track details are shown in Table 2-1 Siding Tracks Types

Table 2-2 below.

There are four axle load levels and five track structures in the sidings at the Port.

Table 2-1 Siding Tracks Types

Track Type	Axle Load Max tonne	Rail kg/m	Sleeper Type & Spacing (mm)	Ballast
A	30	60	concr 650	CR good depth
B	25	50	concr 650-700	CR good depth
C	25	41	concr 700	CR medium depth
S	20	41	steel < 700	CR medium depth
X	16	40 (80 lb/yd)	3T:1S 750	CR shallow depth

CR – crushed rock. 3T:1S – 3 Timber & 1 Steel pattern

Table 2-2 Siding Tracks Details

From Turnout	To Turnout	Rail kg/m	Sleepers	Spacing	Fasten	Type
1	3	50 kg	C	716	Pandrol	B
1	2	50 kg	C	695	Pandrol	B
2	4	60 kg	C		Pandrol	A
2	14	60 kg	C (DG)	650	Pandrol	A
3	8	41 kg	C	703	Pandrol	C
3	8	41 kg	S	686	Trak Lok	S
3	4	60 kg	C		Pandrol	A
4	5	60 kg	C	648	Pandrol	A
5	6	80 lb CoA	S	709	Trak Lok	S
5	7	41 kg	S	693	Trak Lok	S
6	7	41 kg	S	695	Trak Lok	S
6	9	41 kg	S		Trak Lok	S
7	12	82 lb	3T:1S	738	Spike & TL	X
8	9	41 kg	S	695	Trak Lok	S
8	11	80 lb CoA	3T:1S	758	Spike & TL	X
9	10	82 lb	3T:1S	742	Spike & TL	X
10	11	41 KG	C		Pandrol	C
10	13	41 kg	S	684	Trak Lok	S
11	16	41 kg	C	703	Pandrol	C
11	16	41 kg	S	697	Trak Lok	S
12	13	41 & 60 kg	C&S		P & TL	C
12	14	60 kg	C (DG)	643	Pandrol	A
13	15	41 kg	C	706	Pandrol	C
13	15	41 kg	S	717	Trak Lok	S
14	15	50 kg	C	655	Pandrol	B
14	15	50 kg	C	657	Pandrol	B
15	16	60 kg	C	699	Pandrol	A
16	BS	41 kg	C	696	Pandrol	C

Figure 2-1 Schematic Map of Geraldton Port track loadings by colour

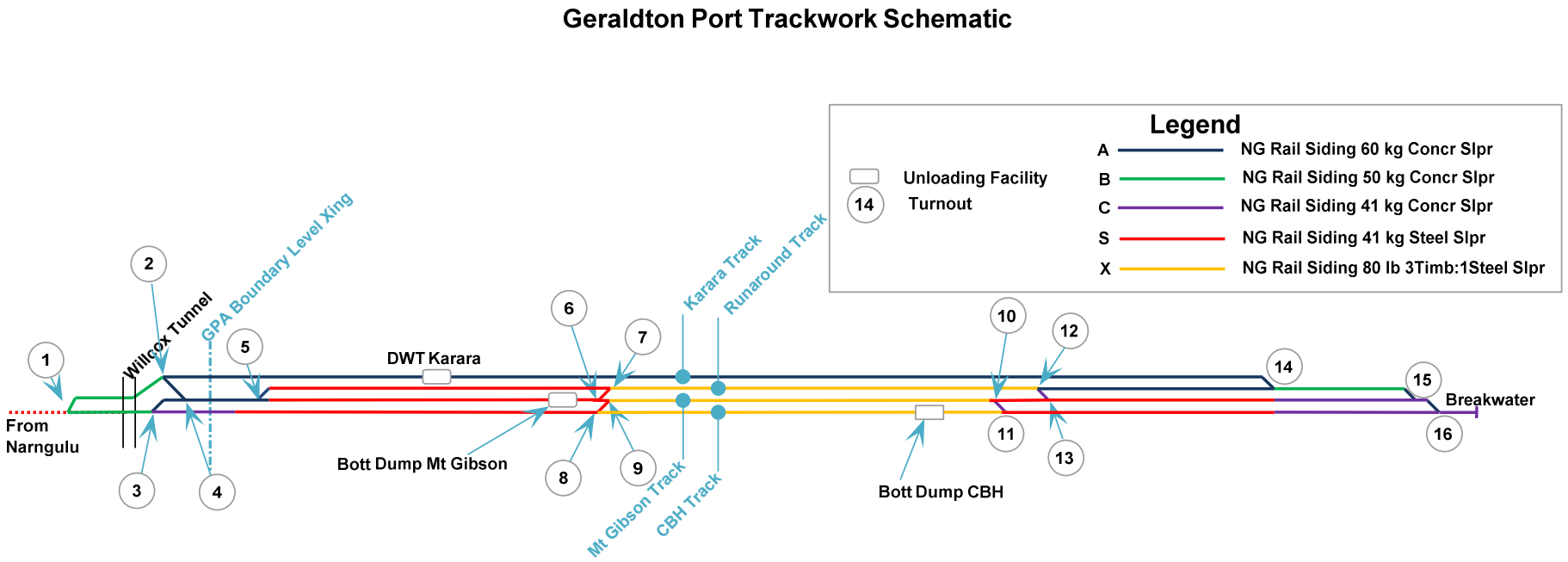


Figure 2-2 Schematic Map of Geraldton Port turnout types

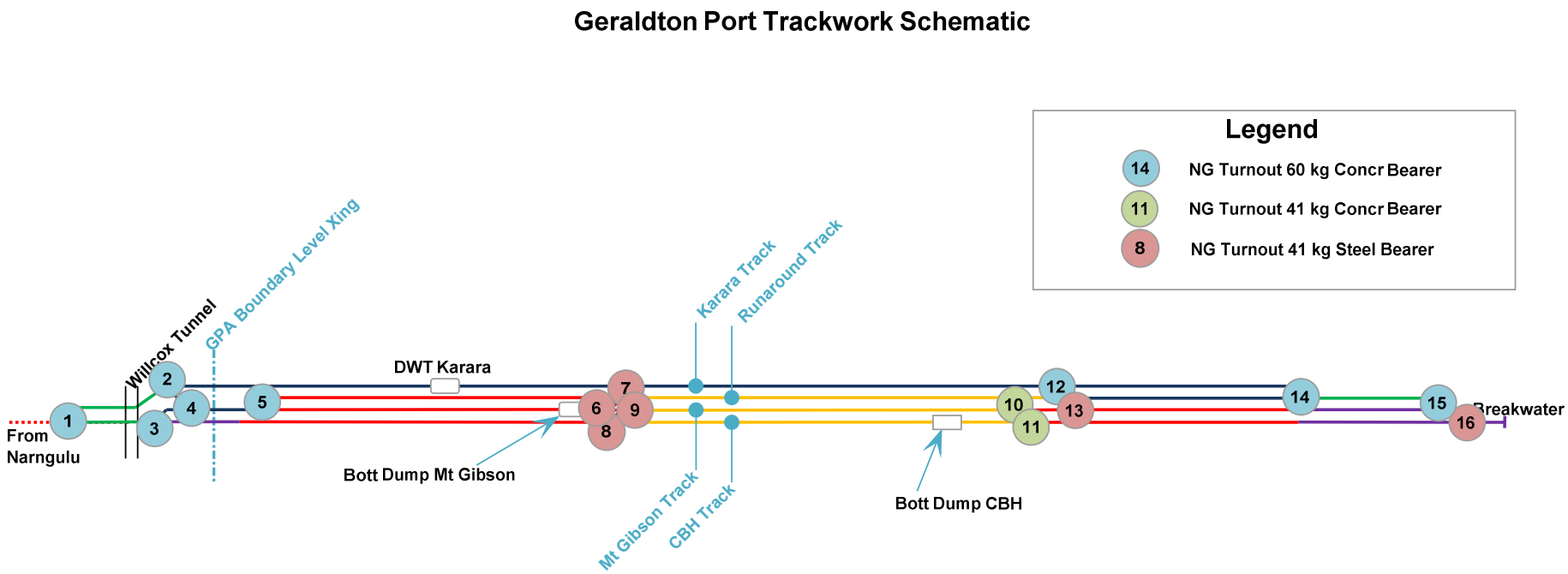


Table 2-3 Turnout Details

Turnout	Rail kg/m	Angle	Bearers	Fasten	Frog/Vee Xing	Lever	Indicator
5	60 kg	12	C	Pandrol	RBM	✓	✓
6	41 kg	10	S	Pandrol	RBM	✓	×
7	41 kg	10	S	Pandrol	RBM	✓	×
8	41 kg	10	S	Pandrol	RBM	✓	×
9	41 kg	10	S	Pandrol	RBM	✓	×
10	41 kg	10	C	Pandrol	CM	✓	✓
11	41 kg	10	C	Pandrol	CM	✓	✓
12	60 kg	10	C	Pandrol	Fabricated	✓	×
13	41 kg	10	S	Pandrol	RBM	✓	×
14	60 kg	10	C	Pandrol	CM	×	×
15	60 kg	10	C	Pandrol	Fabricated	✓	×
16	41 kg	10	S	Pandrol	RBM	✓	×

C-concrete bearers, S - steel bearers, RBCM – rail bound cast manganese frog, CM – cast manganese frog.

The Track types are characterized as:

A – very high standard track with 60 kg/m rail and concrete sleepers. Sleepers at close spacings (about 650 mm) and deep ballast profile. Max axle load 30 tonne at mainline speed.

B - high standard track with 50 kg/m rail and concrete sleepers. Sleepers at close spacings (650 to 700 mm) and deep ballast profile. Max axle load 25 tonne at mainline speed.

C – normal siding standard track with 41 kg/m rail and concrete sleepers. Sleepers at larger spacings (700 mm) and reasonable ballast profile. Max axle load 25 tonne at slow siding speed.

S - normal siding standard track with 41 kg/m rail and steel sleepers. Sleepers at larger spacings (less than 700 mm) and reasonable ballast profile. Max axle load 20 tonne at siding speed.

X - poor siding standard track with 40 kg/m (old 80 lb/yd CofA) rail and aged timber sleepers and steel sleepers in 3T:1S pattern. Sleepers at larger spacings (about 750 mm) with thin and fouled ballast profile. Max axle load 16 tonne at siding speed.

The Turnout types are characterized as:

- Heavy Duty – heavy rail weight 60 kg/m supported by concrete bearers. Max load up to 30 tal at mainline speeds.
- Normal Yard Duty – lighter rail weight 41 kg/m supported by concrete bearers. Max load up to 25 tal at yard speeds and lighter 20 tal at mainline speeds.
- Light Yard Duty - lighter rail weight 41 kg/m supported by steel bearers. Max load up to 19 tal at yard speeds.

3 STANDARDS FOR OPERATION & MAINTENANCE

The tracks within the Port Yard are of varying standards.

- Rail weights vary being from 40 kg/m (80 lb/yd Commonwealth) to 60 kg/m.
- There are medium to tight radius curves as in Table 5 below.
- Tracks experience predominantly loaded rail traffic or predominantly empty rail traffic. This is demonstrated in Table 4 which also gives the axle loading.

Table 3-1 Track Loading and Duty

From Turnout	To Turnout	Type	Loaded	Empty	Axle Load (tonne)
2	Unloader	A	✓		30
Unloader	14			✓	30
3	8	C	✓		25
3	8	S	✓		20
4	5	A	✓		30
5	6	S	✓		20
5	7	S		✓	20
6	7	S		✓	20
6	9	S		✓	20
7	12	X		✓	16
8	9	S		✓	20
8	11	X	✓		16
9	10	X		✓	16
10	11	C		✓	25
10	13	S		✓	20
11	16	C	✓		25
11	16	S	✓		20
12	13	C		✓	25
12	14	A		✓	30
13	15	C		✓	25
13	15	S		✓	20
14	15	B		✓	25
15	16	A		✓	30
16	BS	C		✓	25

Table 3-2 Radii of Typical Yard Curves

Approx. Radii (m)	Siding Track	Gauge Widening (mm)
300	Yard entrance to Mt Gibson unloader	+ 6
700	Mid-yard near Berth 3	0
200	East of Grain Terminal to breakwater	+ 6
140	Just east of Turnout 14 (1 curve only)	+ 6

There is no super-elevation (cant) on the Yard track.

For the purposes of the NG Code of Practice the track categories can be allocated as Track Cat 20/20 as defined in Table 6.2 Max Speed (F/P) this being the lowest duty requirement described within the CoP. It reflects that the vehicles within the Geraldton Port rail yard are moving slowly in the order of 10 kph. Wagons are loaded when arriving and empty when departing while locos can be regarded as being loaded to normal track running axle-load.

4 MAINTENANCE PRACTICE

Recognizing the track standards and operational standards described above, detailed here the maintenance requirements as deemed by the CoP.

4.1 SURVEILLANCE

- Visual inspections of the Yard track and turnouts to be two-weekly. This inspection includes detecting any changes in clearances between structures and the rail sidings. These can be permanent or temporary structures.
- Measurement & Gauge inspections of the track and turnouts to be conducted three monthly.
- Track recorder/on-train inspection to be conducted 12 monthly. (Hand pushed or hyrail recorder as appropriate, data recorded for file.)
- Unscheduled inspections are to be conducted as and when required.
- For siding buried under pavement, the track is to be assessed by observing pavement disturbance such as cracking and unevenness. Sleepers and fasteners are to be exposed for closer inspection when disturbance is detected and when geometric standards of Table 3.3 are exceeded.

4.2 RESPONSE TO DEFECTS

The level of response required for defects observed in the siding track during inspections are to be as described in Table 3.1 for track and Table 3.2 for rail.

Table 4-1 Response Codes to Track Defects

Response Category	Inspect	Repair	Other Requirements
E1 - Emergency Class 1	Immediately	Immediately	Where the response category cannot be reduced below E1 by a reduction in speed, trains may only pass the site under control of a pilot; assessment of the defect by a qualified worker must be made to determine if the train can be piloted.
E2 - Emergency Class 2	Within 2 hrs or before the next train	Within 24 hrs	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 20 kph if authorized by a qualified worker.
P1 - Priority Class 1	Within 24 hrs	Within 7 days	
P2 - Priority Class 2	Within 7 days	Within 28 days	
M - Monitor & Planned Maintenance			Monitor as part of routine track inspection and consider for planned maintenance and strategic upgrading requirements.

Ref CoP Table 6.3

Table 4-2 Response Codes for Rail and Turnouts

Response Code	Description
A1	Temporary speed restriction of 10/10 with pilot or immediate repair
A2	Temporary speed restriction of 20/20 or immediate repair
A3	Temporary speed restriction of 30/30 or immediate repair
A4	Temporary speed restriction of 40/40 or immediate repair
A5	Temporary speed restriction of 60/65 or immediate repair
A6	Follow up action to restore track and an appropriate increase in monitoring
A7	Routine inspection

Ref CoP Table 6.54 with Notes

4.3 TRACK GEOMETRY CRITERIA

The criteria for track geometry defect decision making are described in Table 3.3 below.

Table 4-3 Track Standard Criteria for Response Decisions

Response	Gauge		Horiz Align	Top		Twist			X Level
	Wide	Tight	10m Chord	Short 1.8/10m	Long 20m	Long14m Non-	Long14m Trans	Short 2m	
E1	>35	>20	>156	>37	>90	>70	>74	>25	>75
P1	31-35	19-20	>125	32-37	72-90	61-70	65-74	23-25	69-75
M	25-31	17-18	45-125	28-31	67-71	53-60	56-64	21-22	61-68
Nil	< 24	< 16	< 45	< 28	< 66	< 52	< 55	< 20	< 60

Ref CoP Table 6.2

For tracks with steel and concrete sleepers, where a higher than expected deterioration in gauge has been detected between inspections, the track should be subjected to an unscheduled detailed inspection and appropriate actions taken.

4.4 CONSECUTIVE DEFECTIVE SLEEPERS

The maximum number of consecutive defective sleeper acceptable is 3 sleepers in tangent track and 2 in curved track. Sleeper shall be replaced to achieve the minimum criteria detailed in Table 3.3 above and to ensure there is adequate vertical support for the rails. Similarly ineffective fastenings are to be replaced to achieve the Table 3.3 criteria.

4.5 SLEEPER SPACING

Sleeper spacing is to be maintained at the existing listed in Table 1.2 with a variation of no greater than 1.25 times the list value.

4.6 RAIL WEAR

- Rails and welds are to be inspected as Type B track as defined in CoP section 6.11 and managed in accordance with the tables contained in the CoP.

- Non-Destructive testing of rails (ultrasonic) to be done every two years.
- Grinding of rail to be by assessment and no less frequent than every 10 years for all tracks.
- Rails are to be replaced no later than when total head wear ***exceeds 30%***.

4.7 RAIL DEFECTS

Attachment 1 gives criteria and responses to observed defects in rail with these defects being treated as for track Type B. (Ref CoP section 6.11.1.)

4.8 TURNOUT WEAR

Turnout maintenance shall be conducted in accordance with CoP Tables 6.52 and 6.53 for Speed column 20/20 and as follows in Tables 3.4 & 3.5 with these defects being treated as Response Type A1, A2 and A7 as in Table 3.2 above.

Table 4-4 Switch Area Max Permissible Criteria

Component	Parameter	Response Code
Critical Dimensions		
Throat Gap – Back of switch to stock from design (refer CoP Fig 6.3)	40mm	A6
Switch toe/stock rail gap – open throw dimension design from 100mm (refer CoP Fig 6.3)	-20mm	A6
Closed (blade gap)	3mm	A6
Track gauge (Critical Areas) From 1435mm/1067mm (refer CoP Fig 6.2)	10mm	A6
Key Component Condition		A6
Heel Block	Broken/Cracked/Missing	A6/A6/A1
Rail Brace/Chair	Broken:2 or more	A6
Switch Stops (avoid rail rollover)	Missing:2 or more	A6
Ineffective fastenings (in critical areas)	2 consecutive or more	A6
Bolts (Critical areas, blocks & all joints)	Missing/broken: *2 or more*	A6
Bolts (Critical areas, spreader bar bracket)	Missing/broken: 1 or more	A1
Switch blade (refer CoP Fig 6.8) Switch blade toe broken/worn	Crippled More than 9mm	A6 A1

Ref CoP Table 6.52

Table 4-5 Crossing Area Max Permissible Criteria

Component	Parameter	Response Code
Critical Dimensions		
Track gauge (in critical areas) (tight gauge only) From 1067mm(refer CoP Fig 6.2)	10mm	A1
Check rail effectiveness NG Nominal 1024mm	<1015mm	A1
Crossing nose Vertical wear (refer CoP Fig 6.6)	10mm	A6
Flangeway clearance from 43mm (refer CoP Fig 6.7)	10mm	A1
Flangeway Depth (refer CoP Fig 6.7)	10mm	A6
Key Component Defects		
Nose Point (within transfer ref Fig 6.5 of CoP)	Broken >25mm width	A1
Ineffective bearers/fastenings (in critical areas)	2 consecutive or more	A6
Crossing	Cracked fully	A1
Heel rail defects	Assessment (CoP 6.11)	
Wing Rail wear	10mm	A6
Rail defects	Assessment (CoP 6.11)	
Spacer Blocks	Broken/Cracked	A6
Check Rail Bolts	Missing/Ineffective 3	A6

Ref CoP Table 6.53

Gauge shall be maintained through the whole length of turnouts. However critical areas for track gauge are from the toe of points to the end of the blades, and the vee crossing (frog) area from 1 m ahead and behind the crossing.

5 Rail & Welding Response Criteria

Below definitions of responses are defined for rails and joint defects.

Table 5-1 Response Time Definitions (CoP Table 6.16 refers)

Response Time	Definition
Immediate	To be carried out prior to the next train
Specified in days (e.g. 30 days)	To be carried out, or the defect reassessed, within the specified period.
No action	The defect need not be recorded on a data base unless required for quality assurance or research purposes.

Table 5-2 Actions Definitions (CoP Table 6.16 refers)

Action	Definition
Observe	The defect should be visually inspected not greater than 90 days for any appearance of visual defects (for example discolouration, red or purple oxidation around the crack (also bleeding), or surface cracking).
Reassess	Repeat original assessment process, and carry out actions as required.
Speed restriction	Reduce train speed to no more than 30 kph to limit consequences of failure.
Repair	The defect is to be repaired; see CoP Section 4.
Plate	The defect is to be fishplated to standards in accordance with CoP Clause 3.12.7 with respect to temporary joints. Any plated defect must be treated as a temporary joint and monitored in accordance with inspection on non-welded rail joints (CoP Clause 6.12). A defect that has been plated and subsequently breaks should be treated as a broken rail and replated or removed as required.
Remove	The defect is to be removed or the rail replaced as specified.
Pilot	Each train operation should be visually supervised by a pilot over the defective rail or track. The pilot should be on the ground and controlling the movement of the train. Train speeds should not exceed 10 kph.

Table 5-3 Shatter crack defect response requirements (CoP Table 6.19 refers)

Defect Size	Response Time	Action
<5% (less than 10 mm)	360 days	Reassess or remove.
>5% (greater than 10 mm)		Treat as TM (multiple transverse defects).

Table 5-4 Transverse defect response requirements (CoP Table 6.20 refers)

Defect Size	Response Time	Action
<5% (less than 10 mm)	None	No action
5-7% (10-15mm)	90 days	Reassess or plate or remove
7-10% (15-20mm)	30 days	Reassess or plate or remove
10-30% (20-30mm)	14 days	Reassess or plate or remove

Defect Size	Response Time	Action
>30% (greater than 30mm)	1 day	Speed restrict and reassess, or plate and remove
>30% & surface cracking in rail head	Immediate	Speed restrict and visually inspect every day, or plate and remove
Broken rail (refer to Broken Rail defect)	Immediate	Pilot or plate and remove

Table 5-5 Multiple transverse defect response requirements (CoP Table 6.21 refers)

Defect Size	Response Time	Action
<5% (less than 10 mm)	None	Observe
5-7% (10-15mm)	60 days	Reassess or remove
7-10% (15-20mm)	14 days	Reassess or remove
10-30% (20-30mm)	1 day	Speed restrict and reassess or plate or remove
>30% (greater than 30mm)	Immediate	Speed restrict or remove
>30% & surface cracking in rail head	Immediate	Pilot or remove

Table 5-6 Horizontal split in head response requirements (CoP Table 6.22 refers)

Defect Size	Response Time	Action
Intermittent		Observe
25-100mm	90 days	Reassess or remove
100-200mm	30 days	Reassess or remove
Greater than 200mm	14 days	Reassess or remove
Greater than 200mm with severe bleeding or head flow	Immediate	Speed restrict and visually inspect every day or remove
Broken rail (refer to Broken Rail defect)	Immediate	Pilot or remove

Table 5-7 Horizontal split in web response requirements (CoP Table 6.23 refers)

Defect Size	Response Time	Action
Less than 40mm	30 days	Reassess or remove
40-75mm	7 days	Reassess or remove
Greater than 75mm	Immediate	Pilot or remove
Broken rail (refer to Broken Rail defect)	Immediate	Pilot or remove

Table 5-8 Vertical split in head response requirements (CoP Table 6.24 refers)

Defect Size	Response Time	Action
Less than 25mm		Observe
25-100mm	90 days	Reassess or remove
100-200mm	45 days	Reassess or remove
200-400mm	7 days	Reassess or remove
Greater than 400mm	Immediate	Speed restrict and visually inspect every day or remove
Broken rail (refer to Broken Rail defect)	Immediate	Pilot or remove

Table 5-9 Vertical split in web response requirements (CoP Table 6.25 refers)

Defect Size	Response Time	Action
All sizes	180 days	Reassess or remove *

**Check for piped rail and transverse or horizontal split web.*

Table 5-10 Piped rail response requirements (CoP Table 6.26 refers)

Defect Size	Response Time	Action
Less than 25mm	None	No action
25-150mm	60 days	Reassess or remove
150-300mm	14 days	Reassess or remove
Greater than 300mm	1 days	Speed restrict or remove
Visible cracking	Immediate	Speed restrict and visually inspect every day or remove
Broken rail (refer to Broken Rail defect)	Immediate	Pilot or remove

Table 5-11 Transverse split in web response requirements (CoP Table 6.27 refers)

Defect Size	Response Time	Action
Less than 20mm	None	No action
20-40mm	7 days	Reassess, plate or remove
40-75mm	2 days	Reassess, plate or remove
Greater than 75mm	Immediate	Speed restrict, plate or remove
Broken rail (refer to Broken Rail defect)	Immediate	Pilot or remove

Table 5-12 Head separation response requirements (CoP Table 6.28 refers)

Defect Size	Response Time	Action
Less than 20mm	90 days	Reassess or remove
20-40mm	7 days	Reassess or remove
40-75mm	2 days	Speed restrict and reassess every day, or remove
Greater than 75mm	Immediate	Speed restrict and reassess every day, or remove
Broken rail (refer to Broken Rail defect)	Immediate	Pilot or remove

Table 5-13 Foot web separation response requirements (CoP Table 6.29 refers)

Defect Size	Response Time	Action
Less than 20mm	90 days	Reassess or remove
20-40mm	30 days	Reassess or remove
40-75mm	7 days	Reassess or remove
Greater than 75mm	Immediate	Speed restrict and reassess every day, or remove
Broken rail (refer to Broken Rail defect)	Immediate	Pilot or remove

Table 5-14 Bolt hole crack response requirements (CoP Table 6.30 refers)

Defect Size	Response Time	Action
Less than 20mm	90 days	Reassess or remove
20-40mm	30 days	Reassess or remove
40-75mm	7 days	Reassess or remove
Greater than 75mm	Immediate	Speed restrict and reassess every day, or remove
Broken rail (refer to Broken Rail defect)	Immediate	Pilot or remove

Table 5-15 Bolt hole elongation response requirements (CoP Table 6.31 refers)

Defect Size	Response Time	Action
Any	None	No action

Table 5-16 Bolt hole non-conforming response requirements (CoP Table 6.32 refers)

Defect Size	Response Time	Action
Any	None	No action

Table 5-17 Weld defect in head response requirements (CoP Table 6.33 refers)

Defect Size	Response Time	Action
<5% (less than 10 mm)	None	No action
5-10% (10-20mm)	180 days	Reassess, plate, repair or remove
10-30% (20-30mm)	90 days	Reassess, plate, repair or remove
30-70% (30-40mm)	30 days	Reassess or plate or remove
>70% (greater than 40mm)	Immediate	Speed restrict or remove
Surface cracking* on rail head (visual – not confirmed by ultrasonic examination)	7 days	Speed restrict and reassess every day, or remove
Broken weld	Immediate	Pilot or plate and remove

Table 5-18 Weld defect in web response requirements (CoP Table 6.34 refers)

Defect Size	Response Time	Action
Less than 25mm	None	No action
25-50mm	90 days	Reassess, plate, repair or remove
50-75mm	30 days	Reassess, plate, repair or remove
Greater than 75mm	1 day	Speed restrict and reassess every day, or plate, or remove
Broken weld	Immediate	Pilot or plate or remove

Table 5-19 Weld defect in foot response requirements (CoP Table 6.35 refers)

Defect Size	Response Time	Action
Less than 15mm	14 days	Reassess or remove
15-35mm width edge is 10-35mm	1 day	Speed restrict and reassess every day, or remove
Greater than 35mm	Immediate	Speed restrict and reassess every day, or remove
Broken weld	Immediate	Pilot or plate or remove

Table 5-20 Weld defect: repairs of surface defects response requirements (CoP Table 6.36 refers)

Defect Size	Response Time	Action
<3% (less than 10 mm)	None	No action
3-7% (10-15mm)	90 days	Reassess, plate, repair or remove
7-10% (15-20mm)	30 days	Reassess, plate, repair or remove
10-20% (20-30mm)	14 days	Reassess, plate, repair or remove
>20% (greater than 30mm)	1 day	Reassess, speed restrict, plate, repair or remove
>20% and surface cracking on rail head	Immediate	Reassess, speed restrict, plate, repair or remove
Broken weld	Immediate	Pilot or plate or remove

Table 5-21 Mill defect response requirements (CoP Table 6.37 refers)

Defect Size	Response Time	Action
Any	None	No action

Table 5-22 Rail corrosion response requirements (CoP Table 6.38 refers)

Defect Size	Response Time	Action
	To be determined	

Table 5-23 Mechanical joint response requirements (CoP Table 6.39 refers)

Defect Size	Response Time	Action
Any	14 days	Remove plates and assess

Table 5-24 Rail surface response requirements (CoP Table 6.40 refers)

Defect Size	Response Time	Action
Any	30 days	Assess

Table 5-25 Wheel burn response requirements (CoP Table 6.41 refers)

Defect Size	Response Time	Action
Any		Check for transverse defect

Table 5-26 Notches response requirements (CoP Table 6.42 refers)

Defect Size	Response Time	Action
	To be determined	

Table 5-27 Broken foot response requirements (CoP Table 6.43 refers)

Defect Size	Response Time	Action
All	Immediate	Speed restrict and reassess daily, or plate, or remove.

Table 5-28 Broken rail response requirements (CoP Table 6.44 refers)

Defect Size	Response Time	Action
All	Immediate	Pilot, or plate, or remove.

Table 5-29 Fishplate crack defects response requirements (CoP Table 6.45 refers)

Defect Size	Response Time	Action
Any visual cracks: 1 fishplate	30 days	Reassess or replace
Any visual cracks: both fishplates	14 days	Reassess or replace
Complete failure: 1 fishplate	1 day	Speed restrict and reassess, or replace
Complete failure: 1 fishplate and visual crack on other	Immediate	Speed restrict and reassess every day, or replace
Complete failure: both fishplates	Immediate	Pilot or replace

Table 5-30 Bolt joints: Missing or ineffective fishbolts response requirements (CoP Table 6.46 refers)

Defect Size 6 Bolt Joint	Defect Size 4 Bolt Joint	Response Time	Action
1 on 1 side	1 on 1 side	None	No action
1 on each side	1 on each side	90 days	Reassess or replace
2 on 1 side	N/A	1 day	Reassess or replace
2 on each side	N/A	1 day	Reassess or replace
3 on 1 side	2 on 1 side	Immediate	Pilot or replace
All		Immediate	Pilot or replace

Table 5-31 Bolt joints: Loose fishbolts response requirements (CoP Table 6.47 refers)

Defect Size 6 Bolt Joint	Defect Size 4 Bolt Joint	Response Time	Action
1 on 1 side	1 on 1 side	None	No action
1 on each side	1 on each side	90 days	Reassess, replace or tighten
2 on 1 side	N/A	28 days	Reassess, replace or tighten
2 on each side	N/A	1 day	Reassess, replace or tighten
3 on 1 side	2 on 1 side	1 day	Reassess, replace or tighten
All		Immediate	Speed restrict, replace or tighten