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Points & Crossings

Section 3

Applicability

ARTC Network Wide SMS

Publication Requirement

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Document Status

Version #	Date Reviewed	Prepared by	Reviewed by	Endorsed	Approved
2.7	13 Nov 15	Track Engineer	Standards and Procedures Administrator	Manager Standards	General Manager Technical Standards 20/11/2015

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	18 Jun 10		Banner added regarding mandatory requirements in other documents and alternative interpretations.
2.2	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
2.3		Table 3.7	Notes 6, 11 and 12 text simplified
2.4	27 May 11	3.3.4	Gauge and cross level readings for the straight and diverge roads
2.5	08 Nov 11		Banner added regarding elements of RISSB National CoP being incorporated

2.6	30 Jul 15	Cover page	Removed CRN applicability box.
		All	Numbering changed
		Various Table	Editorial including change ‘structures’ to ‘assemblies’; Added new clause 3.1.1 on performance requirement; 3.1.3(f) Deleted end of sentence ‘and should take into consideration structure clearances, see note’; Table 3.2, 3.3 and 3.4 Addition of gauge where they apply for clarity; Table 3.3 and 3.4 Changes to reflect new drawing numbers in DMS;3.1.8 (b) Added paragraph on approved configuration for catch points; New tables 3.5 and 3.6 For approved catch point configurations;3.3.1 Clarification where patrol inspections apply;3.3.2 Deleted inspection frequency from para 2 as it contradicts referenced table 3.7; Table 3.7 Clarified location where track gauge is measured, deleted crossing nose vertical wear and editorial;3.3.4 Removed mandating of 2m manual geometry measurements and added guidelines of areas that may require the geometry measurements; Fig 3.4 Amended; Existing tables 3.5, 3.6, 3.7, 3.8 and 3.9 changed to 3.7, 3.8, 3.9, 3.10 and 3.12 respectively. New table 3.11 Housed Points Assessment and Response added.

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.

3 Section 3: Points and Crossings

3.1 Design and Rating

3.1.1 Performance Requirements

Points and crossings components shall meet the following performance requirements:

i. Axle loads and Train speeds

   a. 20 tonnes at 160km/h

   b. 30 tonnes at 80km/h

ii. Design life

   a. 25 years or

   b. 400 MGT

All points and crossings components new designs shall be approved by ARTC Manager Standards.

3.1.2 Standard Track Components

Where standard plain track components are used in points and crossing assemblies then the rail, rail joining methods, fastenings, sleepers/bearers, ballast, and track geometry used should where applicable be designed in accordance with the relevant sections of this Code of Practice. Applicable maintenance guidelines described for standard track components should also comply with the relevant Sections of this Code unless otherwise specified.

3.1.3 Points and Crossings Assemblies

Due to the variety and complexity of points and crossing assemblies, ARTC has adopted a number of standard designs. Although points and crossing designs for all cases have not been defined in this section, the following criteria should be used in the design of assemblies with nominal 1435 mm gauge:

a. They should be designed for a wheelset back to back between 1357 and 1360 mm.

b. The nominal dimension from the gauge face of the running rail of a crossing to the working face of the check rail (i.e check rail effectiveness) should be 1390 mm with a flangeway width and check rail gap of 45 mm

c. The maximum superelevation (cant) deficiency and rate of change of cant deficiency allowable through the diverging track of conventional and tangential turnouts is defined in Section 5.

d. The design switch rail toe / stock rail open throw dimension should be at least 105 mm

e. The check rail end opening should be flared, and have at least 80 mm clearance to the gauge face of the running rail at the flared end

f. Check rail height should be between 0 mm and 38 mm above the running rail.

g. Switch rail throat opening should be at least 50 mm.

h. They should be designed for a maximum wheel flange height of 45 mm.

i. The crossing nose profile should be designed for the range of new and worn wheels operating over the crossing assembly.

Standard turnouts (turnouts with the main line straight) should be used wherever practical for turnout renewals.

Special turnouts (turnouts with the main line curved) are not permitted in new designs unless supported by an economic appraisal. Where the main line radius is less than 600 metres specific approval is required from the ARTC Manager Standards or his nominated representative. Where renewal of existing turnouts on curves is required they are to be relocated onto straight track where possible.

3.1.4 Tangential Geometry Turnouts

Tangential turnouts offer higher speed and reduced wear when compared to conventional turnouts. During renewals and new construction the installation of tangential geometry turnouts is recommended as follows:

- In Heavy Haul and Interstate lines;
- Where concrete bearers are to be used;
- Where the turnout is a 'Special', that is, where the main line track has an amount of curvature between the end of the stock rail front and the end of the crossing long leg;
- Where an increase in turnout speed is sought;
- Where there is more than 2 million gross tonnes (MGT) of traffic on the turnout road.

Where tangential turnouts are used the turnout and the track for 50 metres either side of the turnout should be fully welded.

Conventional turnouts should generally be restricted to sidings and slow speed, low traffic main line applications such as emergency crossovers.

ARTC has adopted a range of tangential geometry turnout standard footprints, as shown in table 3.1 below, that should be adopted where possible.

Table 3.1 - Standard Tangential Turnout Footprints – 60kg rail, 1435mm gauge

Crossing Rate	Turnout Radius (m)	Total Length (m)
1 in 9	190	26.298
1 in 10.5	250	30.310
1 in 12	300	33.630
1 in 15	500	43.532
1 in 18.5	800	54.660

3.1.5 Rating of Points and Crossing Assemblies

a. The following elements in points and crossings should be used in the capacity rating of assemblies:

   i. Weight of rail;

ii. Length of switch and type - heeled or flexible;

iii. Type of fastenings, whether resilient or dogspikes;

iv. Type of bearer, typically timber or concrete;

v. Crossing angle;

vi. Right or left hand;

vii. Tangential or conventional;

viii. Length.

b. Rating of Turnout Speed

Allowable speeds for turnouts are shown in Table 3.2.

Table 3.2 - Allowable Turnout Speeds - 1435mm gauge

Conventional		
Xing Rate	**Straight/ Curved Crossing**	**Turnout Speed (km/h)**
1 in 8.25	Straight	15
1 in 9	Straight	20
1 in 10.5	Straight	30
1 in 15	Straight	50
Tangential		
Radius : Xing Rate	**Straight/ Curved Crossing**	**Turnout Speed (km/h)**
190:7	Curved	35
190:9	Straight	35
250:8.25	Curved	40
250:10.5	Straight	40
300:9	Curved	45
300:12	Straight	45
500:12	Curved	60
500:15	Straight	60
800:15	Curved	75
800:18.5	Straight	75
1200:18.5	Curved	85
1200:24	Straight	85

Notes:

1. *Where there is a straight of 13m or longer between turnouts of a crossover, the speeds applicable to the individual turnouts above are to be applied.*
2. *The allowable speed through a crossover or reversing curves where the intervening straight section of track is less than 13m shall be calculated on an individual site specific basis.*

3. *Cant deficiency 75mm maximum - conventional.*
4. *Cant deficiency 85mm maximum - tangential;*
5. *Maximum Rate of Change of Cant Deficiency 135mm/sec.*

3.1.6 Standard Designs for Conventional Turnouts

Recommended design parameters and design references for standard conventional turnouts are shown below in Table 3.3 however designs from approved manufacturers may be used.

Table 3.3 - Standard Conventional Turnouts - 1435mm gauge

Rail (kg)	Crossing		Switch Description	General Arrangement			
	Rate	Type		Length	Bearers	Plating	Design Reference
50	8.25	Curved	5030 x 159 H	21.770	Timber	Resilient	720-420
			6100 x 159 F	23.470	Timber	Standard	320-1197
	9	Straight	6100 x 159 F	23.510	Timber	Standard	320-1305
		Curved	6100 x 159 H	24.740	Timber	Standard	320-1520
	10.5	Straight	6100 x 159 F	25.730	Timber	Standard	320-1309
		Curved	6100 x 159 F	27.170	Timber	Standard	320-1310
53	8.25	Curved	5030 x 159 H	21.770	Timber	Resilient	246-466
			10600 F	23.470	Timber	Resilient	246-403
	9	Straight	10600 F	23.510	Timber	Resilient	248-1160
	10.5	Straight	10600 F	25.730	Timber	Resilient	720-497
	15	Straight	10600F / 13650F	32.270 / 35.320	Timber	Resilient	248-1180
60	8.25	Curved	6100 x 159 H	23.470	Timber	Resilient	320-1215
			6100 x 159 F	23.470	Concrete	Resilient	690-418(RH) 690-419(LH)
	9	Straight	6100 x 159 F	23.510	Timber	Resilient	250-1258
			9150 x 159 F	26.560	Timber	Resilient	250-1258
	10.5	Straight	6100 x 159 F	25.730	Timber	Resilient	720-615
					Concrete	Resilient	320-1282 (RH), 720-436 (LH)
			9150 x 159 F	28.780	Timber	Resilient	720-615
	15	Straight	6100 x 159 F	32.270	Timber	Resilient	320-1219
			9150 x 159 F	35.320	Timber	Resilient	425-725,
			9150 x 159 F	35.320	Concrete	Resilient	720-538 (RH), 720-539 (LH)

Notes:

1. *H - Heeled Switches.*
2. *F - Flexible switches*

3. *For 53kg rail the flexible switch is defined as the total length of switch rail from which the switch is made. For 50kg and 60kg rail the flexible switch is defined as the length from the point to the theoretical head point (for design purposes only), and can be identified by the machining on the stockrail. (ie 53kg 10600 and 13650 switches have the same design geometry as the 6100x159 and 9150x159 (respectively) indicated for 50 and 60kg rail.*
4. *Standard Plating is a non-resilient type i.e. dogspikes, lockspikes, and/or screwspikes.*
5. *Resilient plating refers to an elastic type of fastener securing the rail foot to the baseplate*
6. *The layout for turnout bearers or ties forms part of the configuration. References to drawings detailing interface requirements for fixing components on standard turnouts, that is, crossings, checkrails, switch/stockrails and closure rails are indicated under design references.*

Details of other standard and semi-standard turnouts and catchpoints are shown on drawing 300-946 for 47kg/m and 53kg/m rails and drawing 180-1313 for 50kg/m and 60kg/m rail.

3.1.7 Standard Designs for Tangential Turnouts

Design parameters and design references for standard tangential turnouts are shown below in Table 3.4 however designs from approved manufacturers may be used.

Table 3.4 - Standard Tangential Turnouts - 1435mm gauge

Type	Crossing	Turnout Angle (0)	Length (T) (m)	Turnout Length (Pts to Theo Pt) (m)	Total Length (TOTP to TOEP) (m)	Distance (Pts to TP) (m)	General Layout Design Drawing Ref No.
190:7	Curved	5.94	13.503	22.862	27.006	0.600	CV0479040
190:9	Straight	6.34	10.523	22.988	26.298	0.600	CV0479041
250:8.25	Curved	6.91	15.096	26.296	30.193	0.490	CV0479042
250:10.5	Straight	5.44	11.878	26.489	30.309	0.490	CV0479043
300:9	Curved	6.34	16.616	28.853	33.231	0.490	CV0479044
300:12	Straight	4.76	12.478	29.238	33.630	0.490	CV0479045
500:12	Curved	4.76	20/797	37.391	41.595	0.490	CV0479046
500:15	Straight	3.81	16.648	37.707	43.532	0.490	CV0479047
800:15	Curved	3.81	26.637	46.827	53.274	1.090	CV0479048
800:18.5	Straight	3.09	21.606	47.083	54.660	1.090	CV0479049
1200:18.5	Curved	3.09	32.409	56.996	64.818	1.690	CV0479050
1200:24	Straight	2.39	24.989	57.754	67.026	1.690	CV0479051

3.1.8 Catch Point Design

a. Application

Catch points, derailers and other similar devices are to be provided, when required, to conform to Safeworking Standards. This is normally at the entrance to interlocked track areas.

b. Standard designs

Catch points are to be manufactured and installed in accordance with General Arrangement drawings although designs from approved manufacturers may also be used.

Approved configuration for catch points used in mainlines/crossing loops are detailed in Table 3.5 and in siding tracks in Table 3.6.

The standard distance from heel block to throw off rail is 1.625m.

When a coloured light signal is required at the catch point, the signal is to be located 2 metres on the approach side of the catch point switch.

When a ground signal is required at the catch point, the signal is to be located 1 metre on the approach side of the catch point switch.

Table 3.5 - Catchpoints in Mainlines, Crossing Loops

Drawing Number	Rail Weight	Switch Description
480 – 419	60	6100 x 159 F
153 – 891	53	10600 F
300 – 696	47	10600 F

Table 3.6 - Catchpoints in Sidings

		Drawing Number	Rail Weight	SwitchDescription
1	When associated with a Mainline Turnout.	153 - 891	53	10600 F
2	When associated with a Siding Turnout.	205A - 181	53	6100 x 159 H
3	Intrastate Lines	300 - 691	47	5030 x 159 H

Catch Points in 40kg and other lighter material should be constructed from suitable recovered components to match the track standard into which it is inserted.

c. Clearance Requirements

The catch points, including the throw off rail, are to be located to provide a minimum of 450mm between the side of a vehicle on the running line and a vehicle being derailed on the catch point. The ANZR Ultimate Vehicle dimensions should be used. The throw off rail is to be located so as to ensure the wheels of the derailing vehicle travel the correct path so ensuring that the vehicle does not foul the running line structure gauge.

Designers of infrastructure in the vicinity of catch points, derailers or other similar devices, must ensure that a vehicle derailed at such a device has a clear, even throw-off area to minimise subsequent damage. Derailed vehicles must not be directed into a building or onto any structure, particularly overbridges, masts or transmission line poles, earthworks or over any embankment or directly into any cutting or retaining wall. Each site will need to be reviewed in detail and the final arrangement confirmed by risk analysis.

The clear, even area required is dependent on the potential size and speed of any vehicle or train to be derailed and the nature of any retarding equipment or infrastructure (such as a sand drag) and will have to be determined for each site. The minimum requirement is 2 vehicle lengths beyond the catch point.

Bridge columns may need deflection walls in accordance with other standards.

Special consideration must be given if there is any possibility of an occupied building being in the path of a derailed vehicle. This will include land outside the rail boundary where there is, or is the potential for, building development.

3.1.9 Diamonds

Diamond crossings allow rail tracks to cross each other. They are an assembly of rail components comprising:

- V Crossings
- K Crossings
- Checkrail units (not required for swing nose crossings)
- Closure rails
- Bearers
- Plates, fasteners and rail joints

The following criteria should be used in the design of diamond crossing configurations:

- Nominal gauge shall be 1435 mm.
- All crossing components shall be designed so that the rail is vertical (ie zero cant).
- The 1:20 cant in open track shall be transitioned to zero cant over a minimum of 3 sleepers clear of the crossing bearers.
- Maximum unchecked area of the crossing shall be based on the maximum unchecked area of a 1:8.25 straight "K" crossing with a 25mm raised checkrail being traversed by a fully worn 840mm dia wheel.
- The design wheelset back to back dimension shall be 1357mm – 1360mm.
- Flangeways shall be designed to accommodate a maximum wheel flange height of 45mm.
- The nominal design dimensions used for turnout crossings and checkrails also apply to diamond assemblies ie check rail effectiveness (both V and K crossings), checkrail and crossing flangeways, checkrail flared end opening, check rail height.

3.1.10 Slips and Double Turnouts

Single and Double Slips are special track layouts that combine turnouts and diamond crossings. They allow train movements across, onto and out of a track. Double turnouts are overlapping turnouts. These are complex layouts to design, construct, and maintain.

Slips and double turnouts are not approved for standard application in ARTC. Existing slip and double turnouts configurations should be replaced with standard turnout and diamond crossing designs where practicable (Note that diamond crossings are also undesirable due to the derailment potential from the unchecked area in the throat of the K crossings). The ARTC will provide design requirements where any installation of slip or double turnout configurations is proposed.

3.2 Construction and Maintenance

The following sub-sections are for guidance only. Alternate rail sizes and materials may be used where supported by life cycle economic appraisal.

3.2.1 Turnout Renewals in Heavy Haul and Interstate Lines

Turnout Renewals in Heavy Haul and Interstate lines should be in 60kg head hardened rail.

Where the adjacent track has concrete sleepers, concrete bearers should be used in all turnouts. In other locations timber bearers may be used.

Railbound Manganese Crossings or monoblocs should be used where standard and special turnouts on Heavy Haul lines require renewal. Standard and special crossings in Interstate lines should be Railbound Manganese or monoblocs or fabricated from Head Hardened 60kg material.

On Interstate lines 53 kg/m components may be replaced by suitable 53kg material where stock is available.

Where 53 kg/m points require renewal they may be replaced in 60 kg/m material if 53 kg/m material is not available. In these circumstances junction rails or welds must be fitted between the switches and the crossing and associated closure rails.

3.2.2 Turnout renewals in Intrastate lines

Suitable secondhand 53kg turnouts or 47kg turnouts may be used in preference to new material where cost effective. If new material is to be used it should be at least as heavy as the adjoining plain track or heavier to suit any future line upgrade strategy. Fabricated crossings should be utilised in Intrastate lines.

3.2.3 Turnout renewals in Light Weight lines

Secondhand turnouts of the same weight and standard as the Mainline are to be used when available and cost effective on these lines. If new material is to be used it should be at least as heavy as the adjoining plain track or heavier to suit any future line upgrade strategy. Fabricated crossings should be utilised in Light Weight lines.

3.2.4 Sidings

Turnouts in sidings connected to Heavy Haul and Interstate lines should be renewed in recovered 53kg/m rails or better. Turnouts connected to lines with lower axle loads should be at least as heavy as the adjacent main line.

3.3 Inspection and Assessment

This Clause is applicable to conventional and tangential points and crossing assemblies manufactured using fixed crossings, including turnouts, catchpoints, diamonds, slips, and double turnouts, as well as swing nose crossings currently in use.

3.3.1 Scheduled Patrol Inspections

Patrol inspections apply to all mainline track, crossing loops and refuges where maximum track speed is in excess of 25 km/h.

The interval between patrol inspections of points and crossing assemblies shall not exceed 7 days or as specified otherwise by ARTC e.g. in an approved Technical Maintenance Plan. These patrols should keep a lookout for points and crossing defects and conditions (ie. indicators of a defect) that may affect the integrity of the track structure or which may indicate a risk of failure to guide rolling stock correctly, including the following:

a. Missing components

b. Broken crossings, switch blades, or rails.

c. Damage to any component that does not allow it to perform its intended function including switch operating equipment.

d. Flangeway and other obstructions.

e. Track geometry defects.

f. Wheel marks which indicate incorrect wheel/rail interaction.

g. Rail creep which may for example lead to displacement of components and rail alignment problems.

h. Rail pulling including at the point and splice rails of fabricated crossings.

i. Other obvious defects that may affect continuity of support and direction to rolling stock.

Patrol inspection of points and crossings should be carried out at walking pace (ie. 5 km/h) or less and should include walking inspection where appropriate.

3.3.2 Scheduled General Inspections

These inspections shall identify points and crossing conditions requiring action and determine the need for further specialist inspection.

General inspections of points and crossing condition shall be carried out in a manner and at an interval appropriate to the points and crossing type, condition, rate of deterioration, and other local and seasonal factors. Inspections shall include a visual inspection as defined in Table 3.7 or as specified otherwise in an ARTC approved Technical Maintenance Plan. Measurements should be taken where any defect is suspected and non-conformances recorded for assessment and action.

At locations where deterioration may occur at higher rates due to such factors as curvature, usage, axle load or speed, more frequent inspections may be scheduled.

For catchpoints, the switch area should be examined as for turnouts. In addition, the condition and security of the throw-off rail and derail block are to be checked and reported.

Table 3.7 – Inspection of Points and Crossings

Defect/Irregularity Type	Limits	Method of inspection [1]	Frequency	Action
Switch rail throat opening dimension – back of switch rail to stock rail (junction of heads) (Refer Figure 3.2)	Table 3.9	V M	3, 6, or 12 mths 12 or 24 mths	Table 3.9
Switch rail toe/stock rail dimension – open throw (Refer Figure 3.2)	Table 3.9	V M	3, 6, or 12 mths 12 or 24 mths	Table 3.9
Track gauge at switch toe and crossing nose (Refer Figure 3.1)	Table 3.9, & 3.10	T M,G	CoP Sect 5 12 or 24 mths	Table 3.9 3.10 Table 3.9 3.10
Check Rail effectiveness - nominal (Refer Figure 3.3)	Table 3.10	V M,G	3, 6, or 12 mths 12 or 24 mths	Table 3.10
Wing rail - vertical wear (Refer Figure 3.5)	Table 3.10	V M,G	3, 6, or 12 mths 12 or 24 mths	Table 3.10
Other track geometry limits	Section 5 Table 5.5	V T	3, 6, or 12 mths CoP Sect 5	Section 5 Table 5.5 Section 5 Table 5.5
Points area (Refer Figure 3.1)	Table 3.8	V M,G	3, 6, or 12 mths 12 or 24 mths	Table 3.8
Crossing area (Refer Figure 3.1)	Table 3.10	V M,G	3, 6, or 12 mths 12 or 24 mths	Table 3.10
Operation of manually operated points		Manual Test	3, 6, or 12 mths	Repair or adjust
Switch rail gauge face angle	Section 1	M,G	12 or 24 mths	Section 1 Rail

Notes:

1. The following abbreviations have been used:

V = Visual inspection as per 3.3.2 above

M = Inspection by measurement using ruler as per 3.3.3 below

G = Inspection by Measurement using gauge as per 3.3.3 below

T = Track Recording Vehicle as per plain track requirement.

A general inspection of specific components should also be carried out when suspected defects are identified from conditions determined during patrol inspections.

In addition to the routine patrol inspection, the scheduled general inspection should identify suspected defects in points and crossings and their components, including the following:

a. Turnout and diamond assemblies in respect of:
    i. missing or broken components;
    ii. track geometry; and
    iii. track centre to track centre at fouling points.
b. Rail condition in respect of :
    i. rail and weld defects from visual inspection;
    ii. rail wear
c. Points in respect of:
    i. gauge at the toe of the switch rail and other locations in the critical area;
    ii. switch rail throat opening at the junction of heads;
    iii. switch rail toe/stock rail open throw dimension;
    iv. switch rail toe/stock rail closed gap;
    v. alignment of switch rails;
    vi. heel spread;
    vii. fit of switch stops to stock rail;
    viii. condition of switch rail stops;
    ix. switch rail toe break;
    x. switch rail and stock rail wear;
    xi. switch rail cripple;
    xii. metal flow on all running rails;
    xiii. switch support on chairs and baseplates;
    xiv. heel block condition;
    xv. rail chair and baseplate condition; and
    xvi. rail joint condition including bolts.
d. Points operation in respect of—
    i. hand operated lever operation, which should be checked and any identified problems rectified for example obstructions, incorrect clearances of movable components, and poor lubrication, condition and visibility; and
    ii. spreader bars, rods, brackets and pins/bolts including—
        a. spreader bar condition, straightness, insulation, correct adjustment and clearance under rails;
        b. spreader bracket condition, attachment to switches, and pin or bolt connection to bars;
        c. connecting rod and bar condition and correct adjustment; and

d. lubrication of all movable pins and bolts.

e. Points lubrication.

f. Crossings in respect of—

i. gauge at critical areas;

ii. check rail effectiveness;

iii. vertical wear on the crossing nose;

iv. flangeway clearances;

v. flangeway depth;

vi. wing rail wear;

vii. rail alignment;

viii. running rail wear;

ix. metal flow;

x. crossing nose condition;

xi. crossing cracks;

xii. broken or cracked crossing spacer blocks;

xiii. check rail spacers;

xiv. check rail and crossing bolts;

xv. swing nose crossing bearing on plates; and

xvi. swing nose rails and rail stops ;

g. Check rails.

h. Fastenings in respect of—

i. damaged fastenings (eg. from incorrect installation, derailment, vandalism); and

ii. missing, ineffective (eg. corrosion, wear, loose), incorrect type of fastenings (clips, insulating spacers, metal spacers, pads and special components including gaskets and abrasion plates).

i. Baseplates and chairs.

j. Bearer condition.

k. Ballast in respect of—

i. ballast profile

ii. ballast condition

l. Components that may cause track circuit failure.

Note: the General Inspection would not normally require the switches to be thrown unless problems are suspected from observation.

3.3.3 Scheduled detailed inspection

A detailed inspection shall be carried out for points and crossing assemblies as defined in Table 3.7 or as specified otherwise in an ARTC approved Technical Maintenance Plan.

The items that should be inspected during scheduled detailed inspections are as described for the general inspection. Some items are required to be measured or gauged and the measurements/observations recorded on standard report forms for: turnouts and catchpoints; diamonds and slips; and swing nose crossings.

Measurement or gauging are carried out and recorded for items identified on the report forms including those identified in Table 3.7. Track geometry measurements identified for measurement in Table 3.7 are in addition to those described in the guidelines of Section 5 Track Geometry.

3.3.4 Track Geometry

Gauge must be measured at the switch toes and crossing noses as required by the detailed inspection. Otherwise, the track geometry should be assessed visually and measurements should be made if the visual assessment suggests that geometry defects requiring a maintenance response are present.

Points and Crossings configurations that are deemed high risk or points and crossings at high risk locations shall have manual measurements recorded during detailed inspection. Such locations could include:

- Crossovers between tracks which are not co-planar and which have different rail levels or different grades.
- A turnout road (diverging track) out of a superelevated mainline turnout.
- P&C with timber bearers and dogspike fastenings.

3.3.5 Assessment and Response

For points and crossing structures and their components the condition assessment and response criteria based on defects measured or observed during Patrol, General, and Detailed inspections shall be in accordance with Tables 3.9 and 3.10. Definition of worn and defective points and crossing conditions and critical areas for geometry are shown in Figures 3.1 to 3.8. The assessment response codes are defined in Table 3.12.

Note that if the cause of the 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 and 3.10 is permitted with appropriate documentation.

At all times, vertical, lateral, longitudinal and rotational restraint and support of the rails shall be maintained to ensure acceptable geometry is presented to the rolling stock wheels as specified in CoP Section 5 Track geometry.

Some aspects of points and crossing inspections are currently omitted from the defect response tables 3.9 and 3.10 as either practical response actions have not yet been documented or practical methods of measurement have not yet been identified. In these cases a competent worker is to assess defects found and determine an appropriate response. These aspects include:

- Stock or switch rail gauge face wear angle (refer figure 3.7)
- Switch tip wear angle (refer figure 3.8)
- Stock rail gauge face wear
- Switch tip height (refer figure 3.8)
- Switch gauge corner radius (refer figure 3.8).
- Switch blade vertical clearance to track plates on A & B Bearers
- Switch and crossing bolt effectiveness.
- Special aspects of trailable points.
- Switch housing dimensions for heavy duty housed switches and joggled stock rails.

Table 3.8 references other Parts of this Code that define condition assessment and response criteria for components relevant to points and crossing structures.

Unless specified in Tables 3.9 and 3.10 below the Track Geometry criteria defined in Section 5 should be used.

Table 3.8 – Other Relevant Sections in this Code of Practice

Component	Code of Practice
Rail and Rail Joints (welded and Non-Welded)	Section 1 Rail
Sleepers/Fastenings (non critical areas)	Section 2 Sleepers and Fastenings
Ballast	Section 4 Ballast
Track Geometry	Section 5 Track Geometry

Table 3.9 – Switch Area Assessment Responses - 1435mm gauge

Component parameter	Dimension limit	Track speed (freight/passenger) km/h [3]					
		20/20	40/40	60/65	80/90	100/115	115/160
Critical dimensions							
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) (Refer Figure 3.2)	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) (Refer Figure 3.2)	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 3.1)	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 <1430 mm	A6	A6	A6	A4	A4	A4
	1425 mm to <1427 mm	A6	A2	A2	A2	A2	A2
	<1425 mm	A1	A1	A1	A1	A1	A1
Key component condition							
Fixed Heel block [5] (Refer Figure 3.2)	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

Component parameter	Dimension limit	Track speed (freight/passenger) km/h [3]					
		20/20	40/40	60/65	80/90	100/115	115/160
Switch bearing stops (To avoid rail roll-over) (Refer Figure 3.2)	2 consecutive	A6	A6	A6	A4	A4	A4
	>2 consecutive	A1	A1	A3 Heavy Haul A1	A3 Interstate A1	A1	A1
	Cracked/loose	A6	A6	A6	A6	A6	A6
	Missing/Ineffective: 1 only	A6	A6	A6 A3 Heavy Haul	A6 A4 Interstate	A6	A6
	2 consecutive	A6	A6	A6	A4	A4	A4
	>2 consecutive	A1	A1	A3 Heavy Haul A1	A3 Interstate A1	A1	A1
Ineffective bearers/fasteners in critical switch and crossing areas (Refer Figure 3.1) [6]	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	[4]	[4]	[4]	[4]	[4]	[4]
Spreader Bar [7]	Missing/broken	A1	A1	A1	A1	A1	A1
Switch Rail/Stock Rail Set [9,10]							
Note: An alternative action to those specified is to prohibit facing train movements on the relevant leg of the turnout.							
Switch blade damage [11] (Refer Figure 3.7) (Anywhere in the switch blade, damage deeper than 19mm from the 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
Switch width at tip (Refer Figure 3.7) (As presented to the wheel [8])	<4 mm	A7	A7	A7	A7	A7	A7
	4 mm to 6 mm	A6	A6	A6	A6	A6	A6
	>6 mm to 8 mm	A6	A2	A2	A2	A2	A2
	>8mm	A1	A1	A1	A1	A1	A1
Crippled		[2]	[2]	[2]	[2]	[2]	[2]

Notes:

1. *For wide gauge in the points critical area plain track limits also apply.*
2. *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.*
3. *The responses are speeds relating to freight operations (shown first) and passenger operations (shown second) separated by a "/".*
4. *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.*
5. *Applies to fixed heel blocks only. Pivot heel cracks and breaks should be assessed by a competent worker.*
6. *Refer to Section 2.3.3 of the ARTC T&C CoP for the definition of "ineffective" sleepers and bearers.*
7. *An alternative action that may be taken is to install a points clip in accordance with Safeworking rules.*
8. *Switch width 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 and stock rail exceeds 3mm at any time.*
9. *Applies to conventional switches only (i.e. not undercut switches).*
10. *When a worn switch at the end of its service life is being replaced a new switch and stock rail set should be used*
11. *"Length of damage" also applies to the sum of consecutive areas of damage forming a length greater than the length specified in the Table.*
12. *It is recommended the switch corner radius when measured with the switch tip gauge be maintained to 6mm or greater particularly where manganese or heat treated materials are used. All new switch and switch sets should be manufactured to meet this recommendation. See Figure 3.8.*

Table 3.10 – Crossing Area Assessment Responses - 1435mm gauge

Component parameter	Dimension limit	Track speed (freight/passenger) km/h [3]					
		20/20	40/40	60/65	80/90	100/115	115/160
Critical dimensions							
Check Rail effectiveness [7] Note: An alternative action to those specified is to prohibit facing train movements.							
Nominal (Refer Figure 3.3)	≥1400 mm	A1	A1	A1	A1	A1	A1
	1398 mm to < 1400	A6	A6	A3	A3	A3	A3
	1396 mm to <1398	A6	A6	A6	A4	A4	A4
	1389 mm to <1396	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 3.5)	<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) [1]							
(Refer Figure 3.1)	≥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 3.3)	>49 mm	A6	A6	A6	A4	A4	A4
	48 mm – 49 mm	A6	A6	A6	A6	A6	A6
	40 mm -47 mm	A7	A7	A7	A7	A7	A7
	38 mm – 39 mm	A6	A6	A6	A6	A6	A6
	<38 mm	A6	A6	A6	A4	A4	A4
Key Component Condition							
Crossing nose break (width of break,	Broken: (within transfer length): 15 mm to 20 mm width	A6	A6	A6	A6	A6	A6

Component parameter	Dimension limit	Track speed (freight/passenger) km/h [3]					
		20/20	40/40	60/65	80/90	100/115	115/160
refer Figure 3.4)	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) [9]	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 [2]	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
Heel rail defects	Refer to Section 1 Rail						
Rail defects	Refer to Section 1 Rail						
Spacer blocks	Broken/cracked	A6	A6	A6	A6	A6	A6
Check rail bolts [5] [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 Heavy Haul	A3 Interstate		
	Missing/ineffective: >3	A6	A2	A2	A2	A2	A2
Crossing bolts	Bolt effectiveness	[8]	[8]	[8]	[8]	[8]	[8]
Crossing flangeway		[6]	[6]	[6]	[6]	[6]	[6]

Notes:

1. *For wide gauge in the crossing critical area plain track limits also apply*
2. *“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 (eg Tang area of crossing).

"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.

3. *The responses are speeds relating to freight operations (shown first) and passenger operations (shown second) separated by a "/".*
4. *Table does not apply to wheel flange bearing crossing designs*
5. *The end bolts of all check rails should be effective.*
6. *Flangeways should be checked for blockages and cleared where blocked.*
7. *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*
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.*
9. *Refer to Section 2.4 for the definition of "ineffective" sleepers and bearers.*

Table 3.11 Housed Points Assessment Responses

Component parameter	**Dimension limit**	**Track speed (freight/passenger) km/h [3]**					
		20/20	**40/40**	**60/65**	**80/90**	**100/115**	**115/160**
Housed Points							
Refer to ETE-03-01 Plate 5 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 (3)	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	A6	A2	A2	A2	A2	A2

Component parameter	Dimension limit	Track speed (freight/passenger) km/h [3]					
		20/20	40/40	60/65	80/90	100/115	115/160
	mm <80 mm	A1	A1	A1	A1	A1	A1
E – Width of Housing (1)	<140 mm	Replace housing. Priority dependant on flangeway clearance.					
F – Flare at end of Housing and Checkrail (2)	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 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.*
2. *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.*
3. *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.*

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 and 3.10 is permitted with appropriate documentation and approval from the Civil Engineering Representative or nominated representative.*

3.4 Decommissioning and Disposal

3.4.1 Components Sorted for Reuse, Refurbishment, Quarantine or Disposal

"Released" materials should be reused where it is cost effective to do so. To facilitate this, released points and crossings components should be sorted into one of the following categories;

a. Reuse

Components that have been "released" from track and assessed as suitable for reuse should be marked in such a manner that their reuse potential is clear and unambiguous. In particular the components should be marked, and segregated into stacks differentiated by:

- o Rail Size
- o Switch type
- o Crossing No. (angle)
- o Check rail (length)

b. Refurbishment

Refurbished components should comply with relevant drawings and specifications prior to reuse in track.

c. Quarantine

Where components require further classification they should be quarantined from reusable components.

d. Disposal

All non reusable components should be clearly marked and disposed of as soon as practicable after release from track.

Figure 3.1 – Definition of Points and Crossing Critical Areas

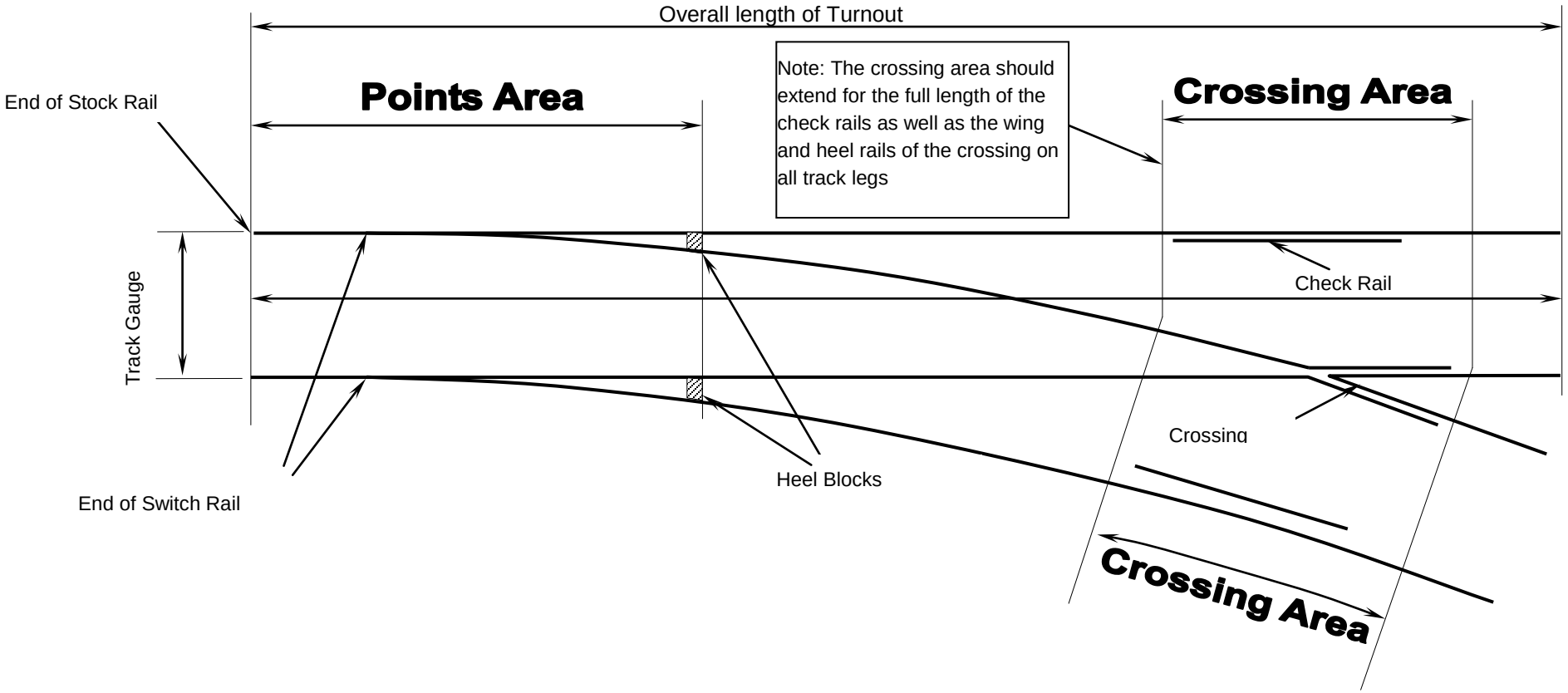


Figure 3.2 - Switch Area Definitions

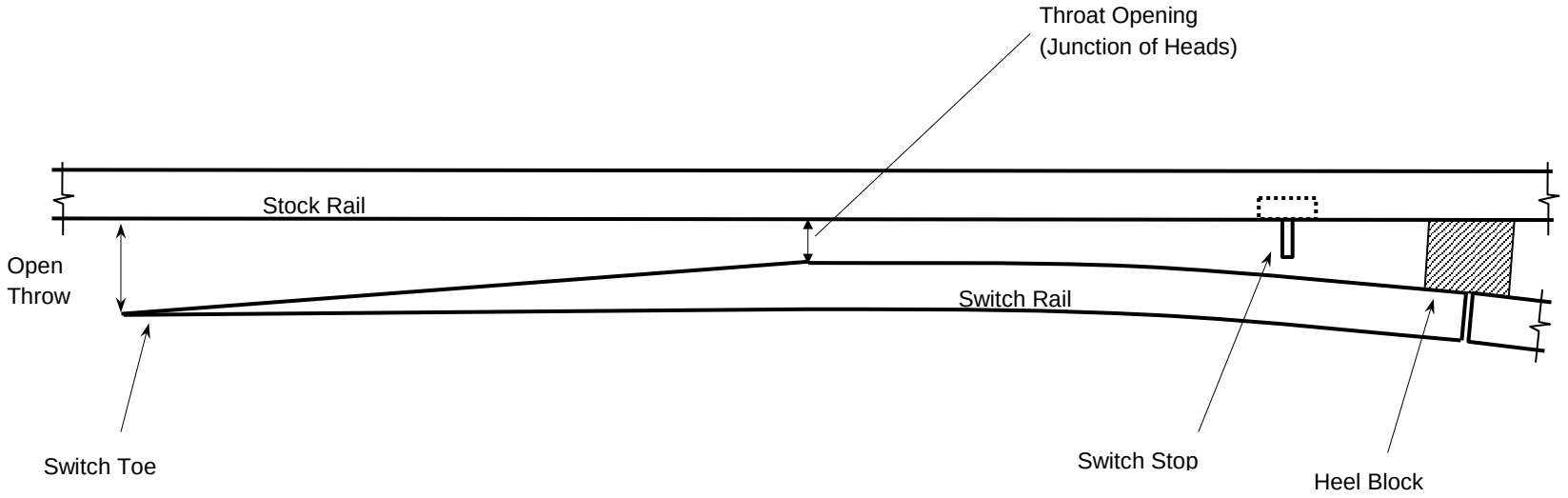
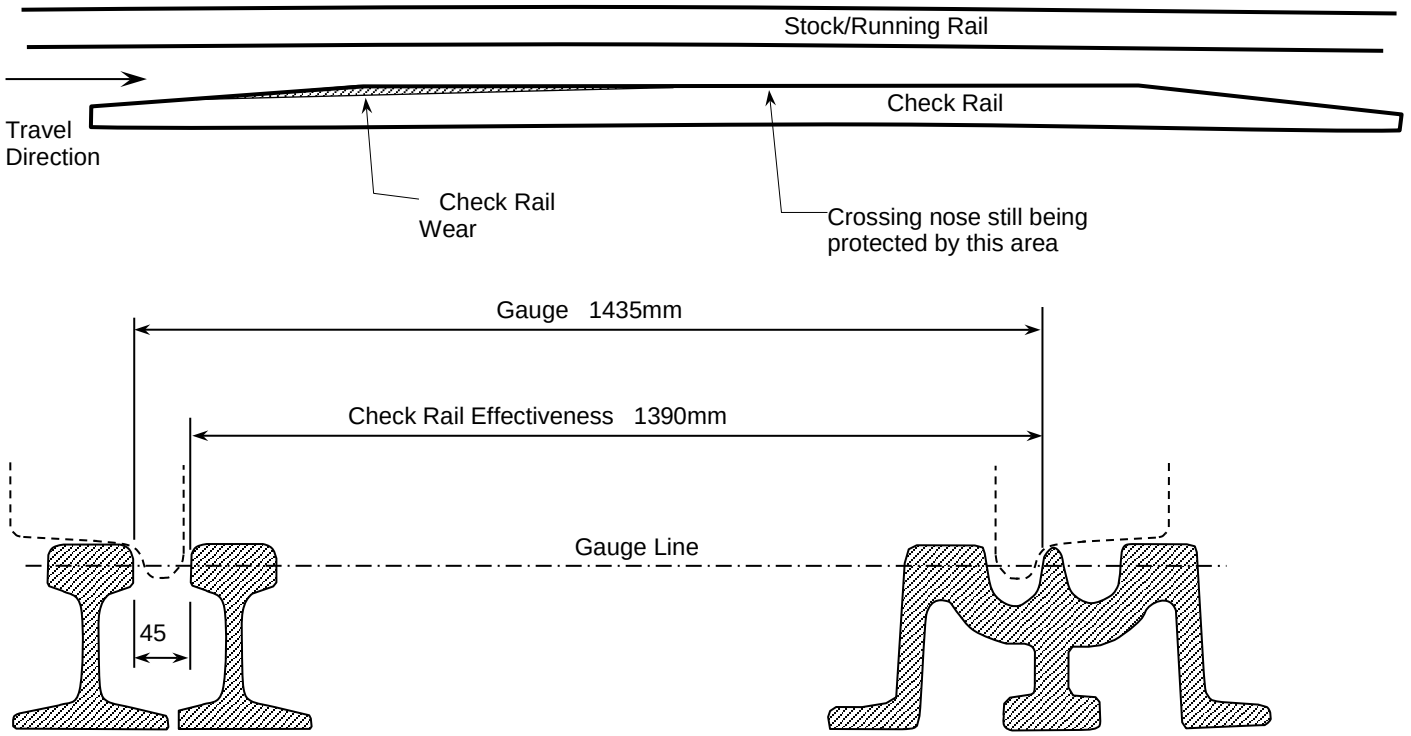


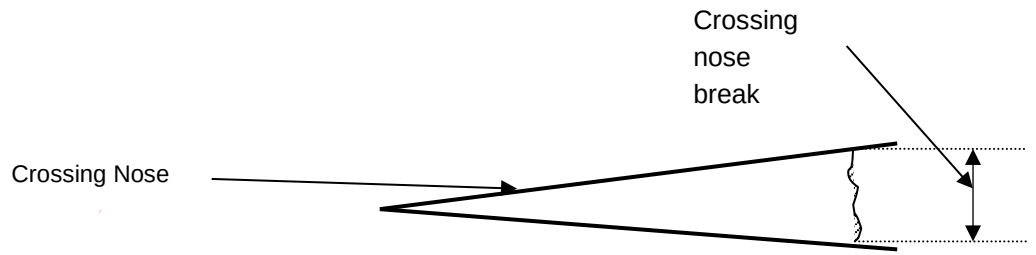
Figure 3.3 - Check Rail Effectiveness Definitions



Note: Check rail effectiveness should be measured in the vicinity of the crossing nose. A distance equal to 2 times the distance from the Virtual Point to the start of the crossing nose (with the start of the crossing nose as the central point) is the critical area for the crossing.

Figure 3.4 - Measurement of Crossing Nose Breaks

PLAN



ELEVATION

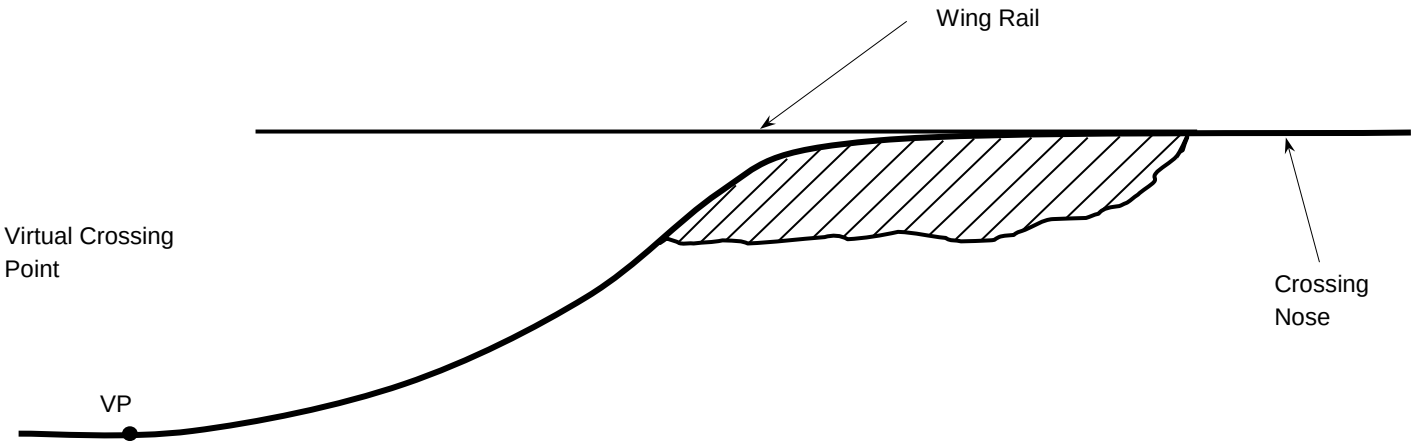
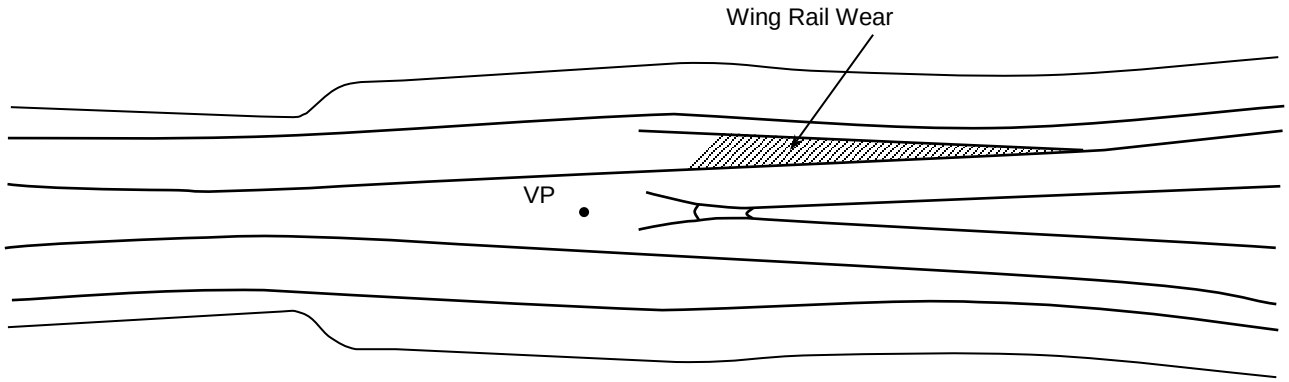
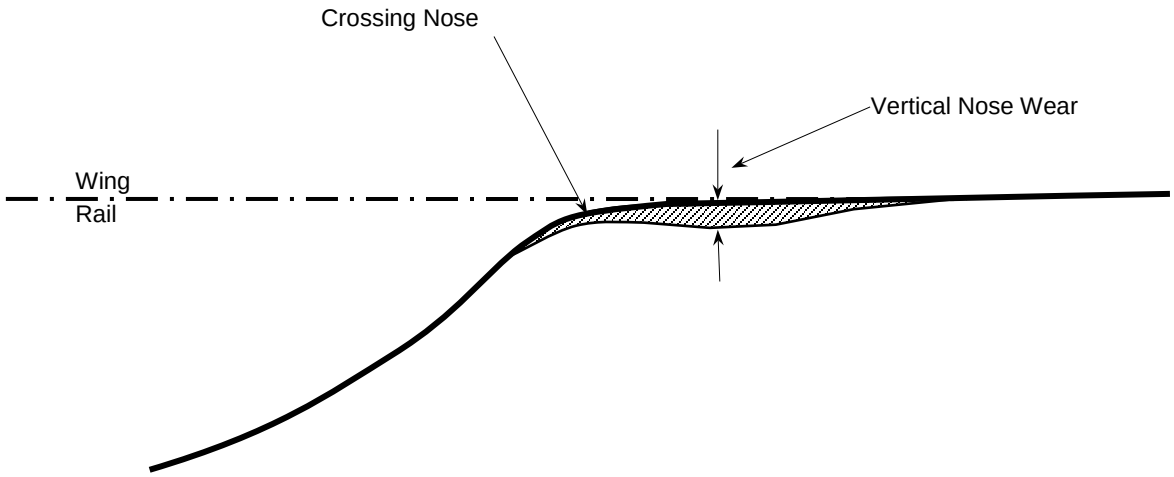


Figure 3.5 - Crossing Nose Definitions





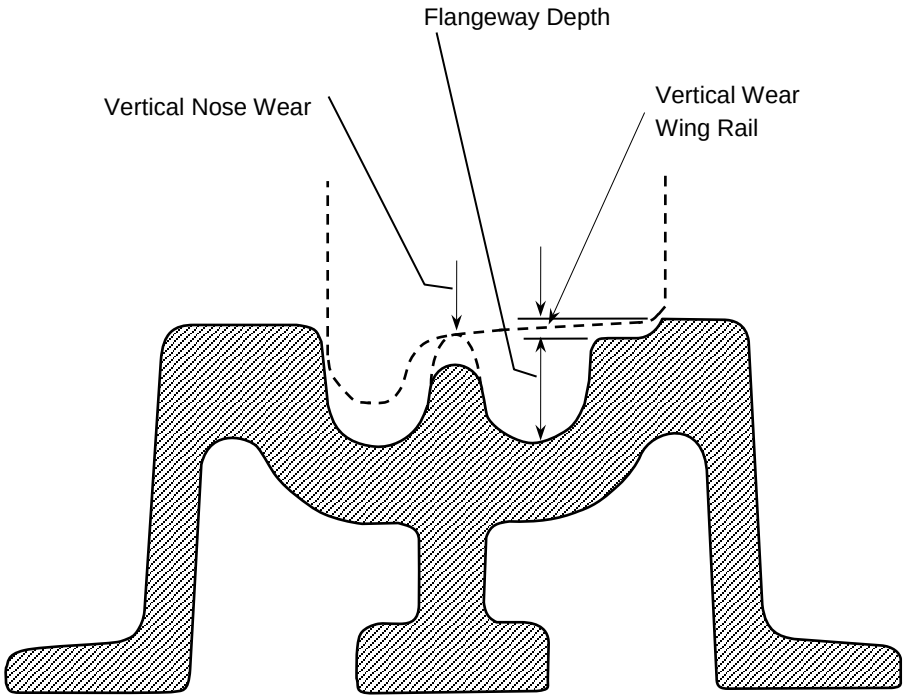


Figure 3.6 - Flangeway Depth And Clearance Definitions

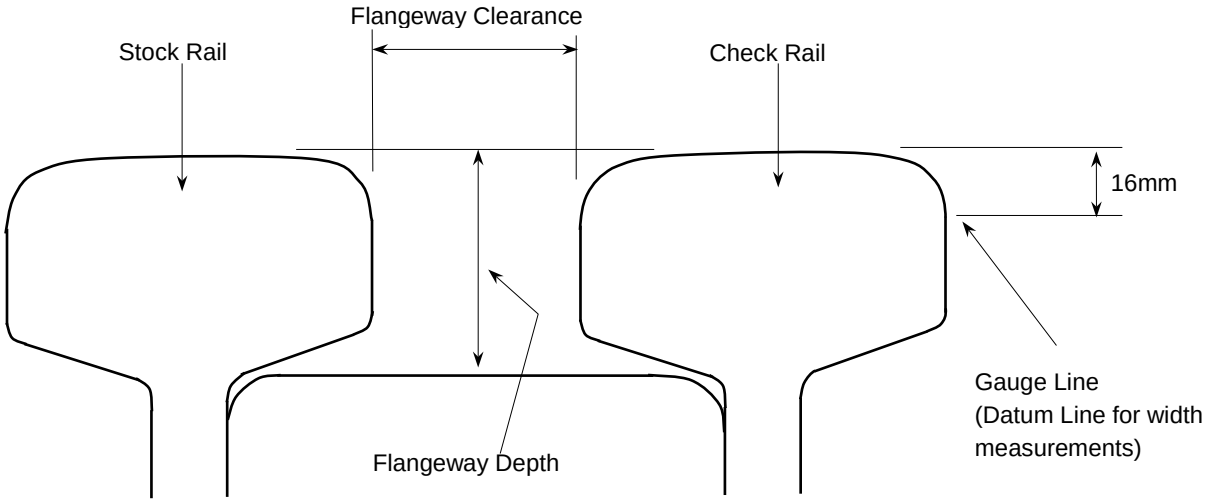
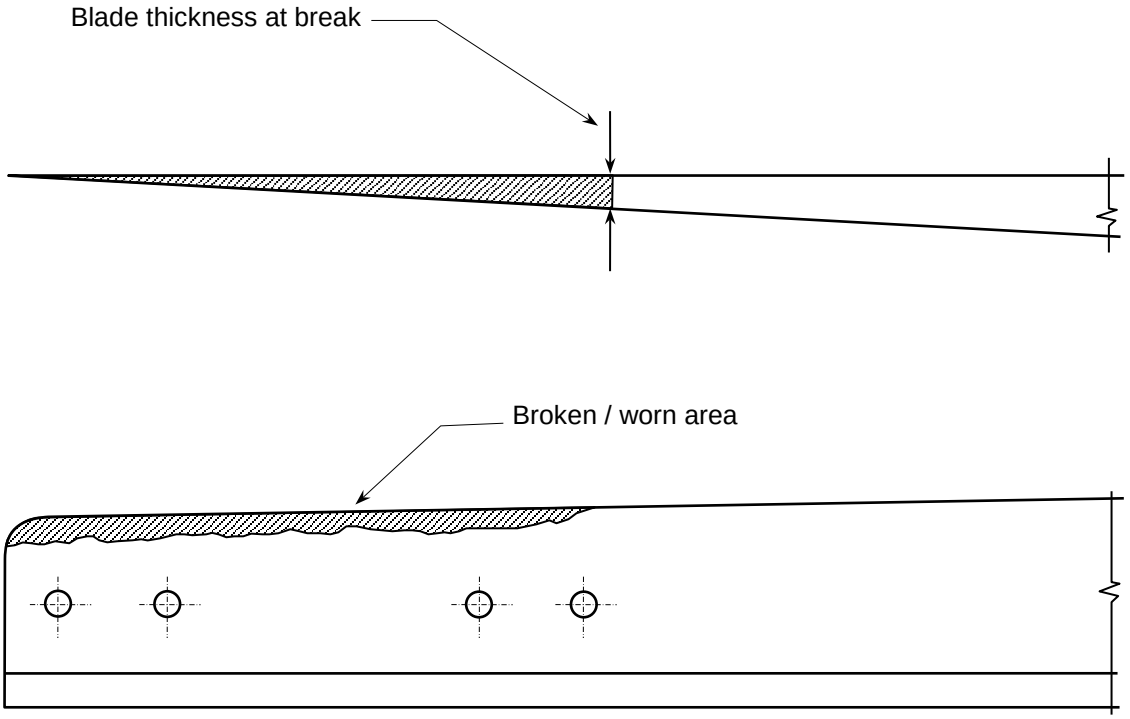
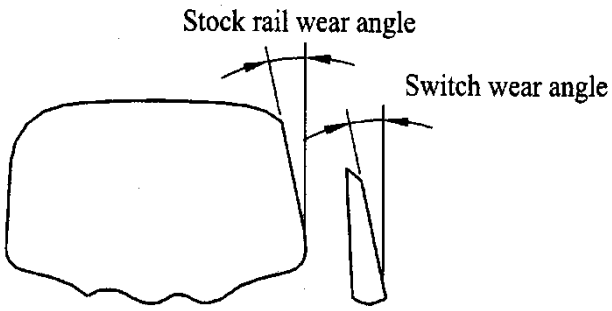


Figure 3.7 - Measurement of Switch Blade Breaks





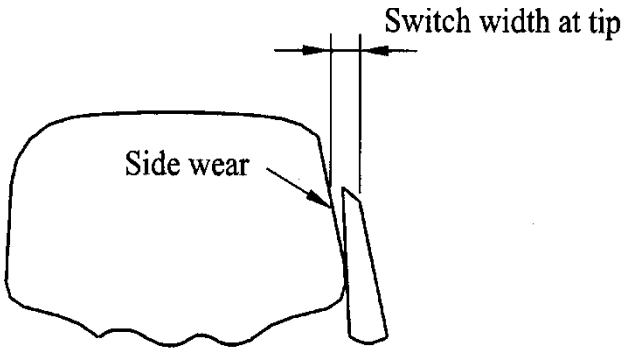


Figure 3.8 - Measurement of Switch Component Parameters