



CODE OF PRACTICE - VOLUME TWO - TRAIN SYSTEM [CP2] TRANSADELAIDE INFRASTRUCTURE SERVICES		
PART 13: POINTS AND CROSSINGS		DOC. NO. CP-TS-963
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TRACK AND CIVIL INFRASTRUCTURE

CODE OF PRACTICE

VOLUME TWO - TRAIN SYSTEM [CP2]

POINTS AND CROSSINGS



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1.0 PURPOSE AND SCOPE

1.1 PURPOSE

The purpose of this part is to set standards to ensure that points and crossings are safe and fit for purpose.

1.2 PRINCIPLES

This part complies with the principles set out in the "Code of Practice for the Defined Interstate Rail Network", volume 4, part 2, section 3.

1.3 SCOPE

This part specifies general procedures for the design/rating, monitoring and maintenance of railway points and crossings and relevant documentation.

1.4 REFERENCES

1.4.1 Industry codes of practice

Code of Practice for the Defined Interstate Rail Network, volume 4 (Track, Civil and Electrical Infrastructure), part 2 (Infrastructure Principles), section 3: Points and crossings

1.4.2 TransAdelaide documents

TransAdelaide Common and General Operating Rules

1.4.3 TransAdelaide documents

a) TransAdelaide Procedure

CPRD/PRC/046 Records Management

b) CP2

CP-TS-953: Part 3, Infrastructure management and principles

CP-TS-956: Part 6, Track geometry

CP-TS-960: Part 10, Track support systems

CP-TS-961: Part 11, Rails and rail joints

c) Infrastructure Services Procedure

QP-IS-501: Document and Data Control



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2.0 DESIGN OF POINTS AND CROSSINGS

2.1 STANDARD TRACK COMPONENTS

This part refers to components specifically designed for use in points and crossings (e.g. switches, crossings etc.). Other components used in points and crossings and the relevant parts are as follows:

- a) Closure and lead rails, plain running rails, fishplates, insulated joints or welded joints – see CP-TS-961 (Rails and rail joints);
- b) Sleepers, crossing timbers and bearers, track fastenings including all sleeper plates and their fastenings and ballast – see CP-TS-960 (Track support systems).
- c) Track geometry – see CP-TS-956 (Track geometry).

2.2 DESIGN CRITERIA FOR POINTS AND CROSSING ASSEMBLIES

The following criteria shall be common to the design of all points and crossings used on 1600mm gauge lines of TransAdelaide:

- a) Components shall be designed for the back to back dimension of wheelsets to be 1524 ± 1 mm (broad gauge) or 1359 ± 1 mm (standard gauge) and shall allow for new and worn wheels, i.e. a maximum wheel flange height of 45mm .
- b) The dimension from the running rail gauge face of the 'V' or 'K' crossing to the working face of the check rail shall be 1555 ± 1 mm (broad gauge) or 1390 ± 1 mm (standard gauge).
- c) The width and depth of the flangeway through crossings and check rails shall be 45 ± 1 mm.
- d) The design switch toe opening shall be 115mm on single gauge turnouts and 92mm on mixed gauge turnouts.
- e) The throat of the switch, when open, shall be not less than 50mm.
- f) Check rails shall be flared, either with a bend in the rail or by planing, with a lead-in angle of 1 in 18 and a flare opening of 90mm (i.e. flare is 810mm long).
- g) Check rails shall be at the same top of rail level as the running rail.
- h) The crossing nose shall be 14mm wide; the distance from the theoretical point of the crossing to the actual point shall be 14 times the crossing number. The crossing nose shall be 3mm below the plane of the tops of the running rails.
- i) Note that the speed through running line turnouts shall be in accordance with the approach signalling aspects, the trackside speed boards or published speed indications. However, permissible speeds must never exceed the theoretical speeds calculated as follows:

Maximum cant deficiency through a turnout calculated using formulae and criteria in CP-TS-956 (Track geometry) i.e. the formulae for speed through a bend for straight switches and those for determining the speed through an uncanted curve without transition. Where the turnout road is mixed gauge the calculations shall be as for the broad gauge rails. The maximum theoretical speed through the turnout curve shall be the lowest value calculated using the following formulae:

- i. Maximum speed through an uncanted curve = $(6.624 \times \sqrt[3]{R})$ km/h (where R = radius of turnout curve in metres)
- ii. Maximum speed through straight switch = $55 \div \sqrt{A}$ km/h
(where A = angle of switch in degrees. For example, for the switch lengths with heel opening of 146mm and switch tip thickness of 10mm [before chamfering] in common use, the maximum theoretical speeds are as follows:

Length in Imperial units	15ft 0in	20ft 0in	30ft 0in
Length in Metric units	4571mm	6095mm	9142mm
Maximum theoretical speed	42 km/h	49 km/h	60 km/h



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3.0 MONITORING AND MAINTENANCE

3.1 INSPECTION

3.1.1 This section and sections 4.0 to 15.0 prescribe the minimum requirements for the inspection and response to the condition of all points and crossing configurations including those for mixed gauge. Inspections shall include the specific conditions shown in table 3.1.

Table 3.1: Points and crossings inspection

Type of inspection	Specific actions or conditions to look for
Scheduled inspections	
Walking inspections	a) Identify visually, and report, obvious points and crossings defects and conditions (i.e. indicators of a defect) including: <ol style="list-style-type: none"> 1) broken crossings, switch blades or rails; 2) missing components; 3) damage to any component affecting its integrity; 4) flangeway or other obstructions; 5) track geometry defects; 6) wheel marks indicating incorrect wheel/rail relationship; 7) rail creep or rail pulling affecting points and crossings; or 8) any other obvious defects as defined in sub-section 3.2. b) Intervals between walking inspections shall not exceed 31 days.
Detailed inspections	To be carried out in a manner appropriate to the points and crossing type, condition, and rate of deterioration, and other local and seasonal factors, at intervals dictated by necessity but not exceeding one year. A detailed inspection of specific components should also be carried out when suspected defects are identified from conditions determined during walking inspections. Measurements should be taken and recorded for assessment and action where any defect is suspected. A checklist is to be used and each item, as defined in sub-section 3.2, checked off and passed with any defects or defective conditions recorded.
Unscheduled inspections	To be undertaken following the report of suspected sub-standard condition, damage or a derailment and may include a detailed inspection.
Assessment and maintenance actions	The condition assessment, response criteria and assessment responses shall be in accordance with sections 4.0 to 15.0. The following define condition assessment and response criteria for other components relevant to points and crossings: <ol style="list-style-type: none"> a) Track geometry: CP-TS-956 (Track geometry). The track geometry criteria defined in CP-TS-956 (Track geometry) for plain track shall only be used in the non-critical areas of points and crossing structures; b) Ballast: CP-TS-960 (Track support systems); c) Sleeper or fastenings in non-critical areas: CP-TS-960 (Track support systems); d) Rails and welded & non-welded rail joints: CP-TS-961 (Rails and rail joints).

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Inspections should identify suspected defects in points and crossings and their components including the following check list:

- 3.2.1 Turnout and diamond assemblies in respect of:
- missing or broken components;
 - track geometry; and
 - track centre to track centre at fouling points or catch points.
- 3.2.2 Rail condition in respect of:
- rail and weld defects from visual inspection;
 - rail wear.
- 3.2.3 Switches in respect of:
- gauge at toe of switch blade and other locations in the critical area;
 - switch flangeway at throat of switch;
 - switch opening at toe of switch when open;
 - switch opening at toe of switch when closed;
 - alignment of switch blades;
 - heel opening;
 - fit of distance studs to stock rail in accordance with design;
 - condition of chair bolts and distance studs;
 - switch blade toe break;
 - switch blade and stock rail wear;
 - switch blade damaged or crippled;
 - metal flow on all running rails;
 - sleeper plates and switch chairs including support of switch blade;
 - heel block condition;
 - rail joint condition including bolts.
- 3.2.4 Crossings in respect of:
- gauge in critical area;
 - check rail effectiveness;
 - vertical wear on the crossing nose and wing rails;
 - flangeway clearances;
 - flangeway depth;
 - rail alignment;
 - running rail wear;
 - metal flow;
 - crossing nose condition;
 - crossing cracks;
 - broken or cracked crossing blocks;
 - check rail blocks; and
 - check rail and crossing bolts.
- 3.2.5 Check rails.
- check rail effectiveness;
 - flangeway clearances;
 - flangeway depth;
 - check rail blocks; and
 - check rail bolts.
- 3.2.6 Fastenings in respect of:
- damaged fastenings e.g. from incorrect installation, derailment or vandalism; and
 - missing, ineffective (e.g. corrosion, wear, loose), incorrect type of fastenings (clips, insulated spacers, metal spacers, pads and special components).
- 3.2.8 Bearer condition.
- 3.2.9 Ballast in respect of profile and condition.



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3.2.10 Components that may cause track circuit failure.



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3.3 CONDITION ASSESSMENT AND RESPONSE CRITERIA

Sections 4.0 to 15.0 list the condition assessment and response criteria for the various configurations of points and crossings. The following actions apply to all configurations and are to be read in conjunction with the tables in each of sections 4.0 to 15.0:

- a) Where a number of temporary speed restrictions are applied, rectification work should be programmed on a priority basis.
- b) The responses include speed restrictions relating to TransAdelaide's passenger train operations. The corresponding speeds for freight train and work train operations are shown in CP-TS-953 (Infrastructure management and principles).
- c) Where reference is made to "routine inspection," the condition of the asset is subject to gradual deterioration over a period of time and no action apart from routine inspection is necessary until the deterioration reaches the limit specified.
- d) Where reference is made to "increase monitoring", the condition of the asset is subject to a specific defect of a non-critical type and no action apart from increased frequency of inspection is necessary until the occurrence of further deterioration as specified. The increased monitoring frequency is to be determined by knowledge of local factors that may affect the track's rate of deterioration and a knowledge of its performance history. The action prescribed however shall not preclude routine maintenance being carried out. For example where one bolt is broken in a group and "increased monitoring" is prescribed, the bolt could be replaced under routine maintenance. The increased monitoring should be continued until rectification work is carried out.
- e) Where reference is made to "immediate repair," the defect should either be removed before the next train movement or if repairs cannot be made prior to the passage of the next train, the maximum speed nominated should be imposed as a temporary speed restriction along with an appropriate increase in the monitoring [see note (d)]. All train movements shall continue to observe the temporary speed restriction until the track has been repaired to at least the minimum condition requiring a lesser restriction or no restriction.
- f) Where reference is made to "pilot all trains until repaired," the track defect shall be assessed by a qualified person.
 - i. If the assessment concludes that it is safe, further train movements may be permitted under the control of a pilot at the speed nominated by him (but not exceeding 10 km/h) and arrangements shall be made to carry out repairs to restore track to normal speed. All train movements shall continue to be under the control of the pilot until the track has been repaired to at least the minimum condition requiring a lesser restriction or no restriction.
 - ii. If the assessment concludes that it is not safe, immediate repairs must be carried out before any further movements shall be permitted to pass over the defective track. Rectification work where required is to be programmed on a priority basis.
- g) Where in any track configuration, the condition identified is a hazard for one direction only, any speed restrictions imposed need only cover those movements. For some defects in switches, after being assessed by a qualified person, an alternative action to those specified may be either to prohibit facing train movements, or clamp and spike switches, where possible, for movements over one route only.
- h) "Ineffective sleepers" and "ineffective bearers" are defined in CP-TS-960 (Track support systems).
- i) The **critical area for switches** is defined as the area between the toe of the switch and the distance blocks, or heel blocks where distance blocks are not provided.
- j) The **critical area for 'V' crossings** is defined as the area extending over the length of the checkrails protecting the crossing.

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4.0 BROAD GAUGE TURNOUTS

4.1 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR SWITCH AREA

The condition assessment and response criteria for the switch area of broad gauge turnouts are described in tables 4.1 and 4.2.

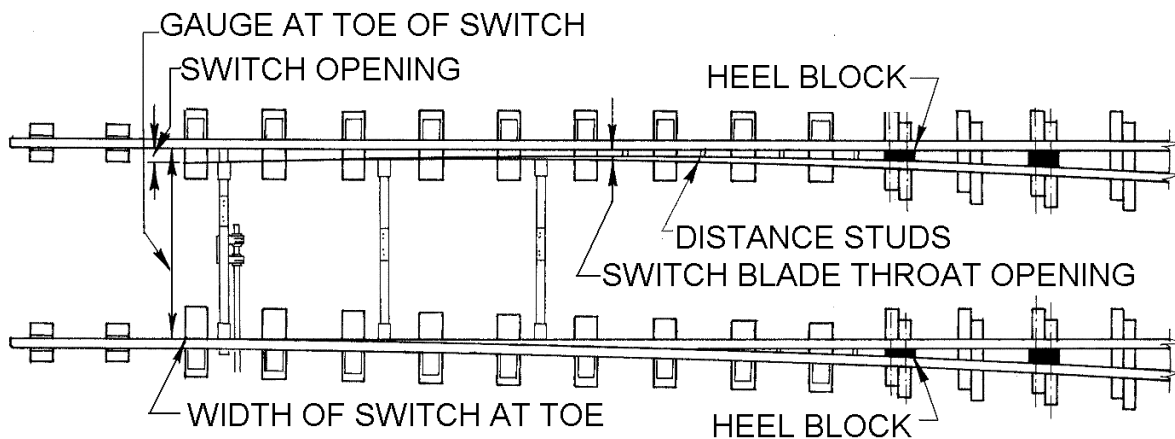
Table 4.1: Switch area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h	40 km/h	20 km/h	pilot all trains until repaired
1. Switch flangeway – see figure 4.1							
Minimum switch blade throat opening – back of switch rail to stock rail	50	40 to 50	-	-	39 to 35	-	< 35
Minimum switch opening	115	95 to 115	85 to 94	-	-	80 to 84	< 80
2. Track gauge at toe of switch – see figure 4.1 and also note [1]							
Gauge at toe of switch between stock rails – - for traditional switches	1610	1610 to 1605	-	1604 to 1602	-	1601 to 1600	<1600
- for tangential switches	1600	1600 to 1595	-	1594 to 1592	-	1591 to 1590	<1590

Notes to table 4.1

- [1] For wide gauge in the switch critical area, the assessment for plain track in CP-TS-956 (Track geometry) shall apply. Note that wide gauge is any gauge wider than 1600mm even at the toe of traditional switches, i.e. the design dimension of 1610mm is to be considered as 10mm wide.

Figure 4.1: Switch assembly





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Table 4.2: Switch area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Heel block - see note [2] and figure 4.1	
cracked	increase monitoring
broken but still effective	immediate repair or impose speed restriction of 65 km/h
missing or broken and ineffective	pilot all trains until repaired
2. Switch chairs	
(any) cracked or loose: or 1 broken or ineffective	increase monitoring
2 consecutive broken/ineffective	immediate repair or impose speed restriction of 65 km/h
more than 2 consecutive broken or ineffective	pilot all trains until repaired
3. Distance studs or chair bolts – to avoid rail roll-over, see figure 4.1	
(any) cracked or loose; or 1 missing or ineffective	increase monitoring
2 consecutive missing or ineffective	immediate repair or impose speed restriction of 65 km/h
more than 2 consecutive missing or ineffective	pilot all trains until repaired
4. Ineffective bearers or fasteners – in critical area, also see clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
more than 2 consecutive	pilot all trains until repaired
5. Bolts – see note [3]	
6. Spreader bar including brackets, bolts, etc.	
missing or broken	pilot all trains until repaired – see also note [4]
7. Switch blade damage - see note [5]	
length of damage < 100mm	routine inspection
length of damage 100 to 199mm	increase monitoring
length of damage ≥ 200mm	pilot all trains until repaired
8. Stock rail or switch blade face wear - angle from vertical at point of wheel flange/rail contact at switch toe - see figure 4.2	
< 18 degrees	routine inspection
18 degrees to < 26 degrees	increase monitoring
≥ 26 degrees	pilot all trains until repaired - see note [6]
9. Switch blade angle from horizontal at any point between 19mm and 30mm below running surface of stock rail - see figure 4.3	
≥ 40 degrees	routine inspection
< 40 degrees	pilot all trains until repaired
10. Stock rail gauge face wear at gauge point - where switch blade contacts stock rail	
<2mm	routine inspection
2mm to < 3mm	increase monitoring
≥ 3mm	pilot all trains until repaired - see note [7]
11. Switch toe height from stock rail running level to top of switch blade, see figure 4.4	
≥ 13mm	routine inspection
> 12mm to < 13mm	increase monitoring
≤12mm	pilot all trains until repaired
12. Switch width at toe - as presented to the wheel - see figure 4.4 and note [8]	
0 to 6mm	increase monitoring
7 to 8mm	immediate repair or impose speed restriction of 20 km/h
>8mm	pilot all trains until repaired



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13. Switch blade crippled - see note [9]		



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Notes to table 4.2

- [2] Applies to fixed heel blocks only. Pivot heel cracks and breaks should be assessed by a qualified worker.
- [3] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, 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 not to be fully tightened so as to allow for design switch movement.
- [4] An alternative action that may be taken is to install a switch clamp and/or spike the switches in accordance with the action specified in clause 3.3(g).
- [5] "Length of damage" implies damage anywhere in the switch blade deeper than 19mm from the running surface. The response applies to chamfered switches only (i.e. not undercut switches). When a worn switch blade at the end of its service life is being replaced, a complete half set of switches should be installed. In table 4.2,
 - i. "length of damage < 100mm" also applies to consecutive areas of damage less than 100mm apart and forming a total length less than 100mm.
 - ii. "length of damage 100 to 199mm" also applies to consecutive areas of damage less than 199mm apart and forming a total length between 100mm and 199mm.
 - iii. "length of damage \geq 200mm" also applies to consecutive areas of damage less than 200mm apart and forming a total length more than 200mm.
- [6] Where the gauge face angle limit is exceeded, the action should be to replace the complete half set of switches.
- [7] It is recommended that the stock rail be replaced. Following repair, it is necessary to check the fit between the switch blade and stock rail. The replacement of switches should be carried out with care where the stock rail is approaching this amount of wear to ensure that a blunt nose is not presented to the wheel.
- [8] Switch width at toe includes the effects of side wear on stock rails and closed gap between switch blade and stock rail. The gap between the switch blade and stock rail should not exceed 3mm at any time.
- [9] A crippled switch blade refers to a switch blade that has suffered damage from a run-through or derailment. Such switch blades may be suitable for temporary repair and re-installation to a geometry suitable for train movements at 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.

Figure 4.2: Stock rail and switch blade wear angle detail:

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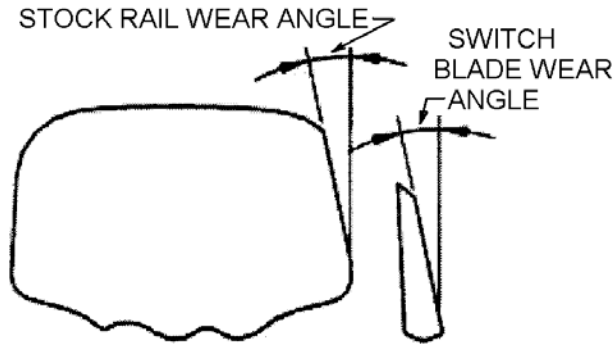


Figure 4.3: Broken or worn switch blade toe detail:

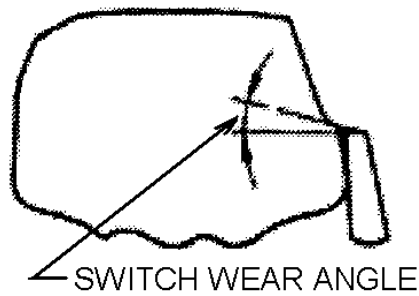


Figure 4.4: Stock rail side wear and switch blade width/height detail:

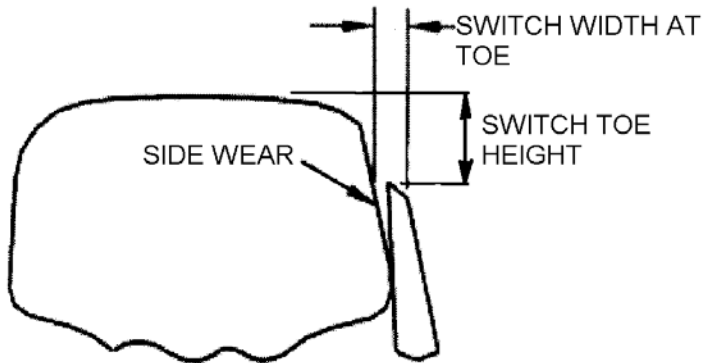
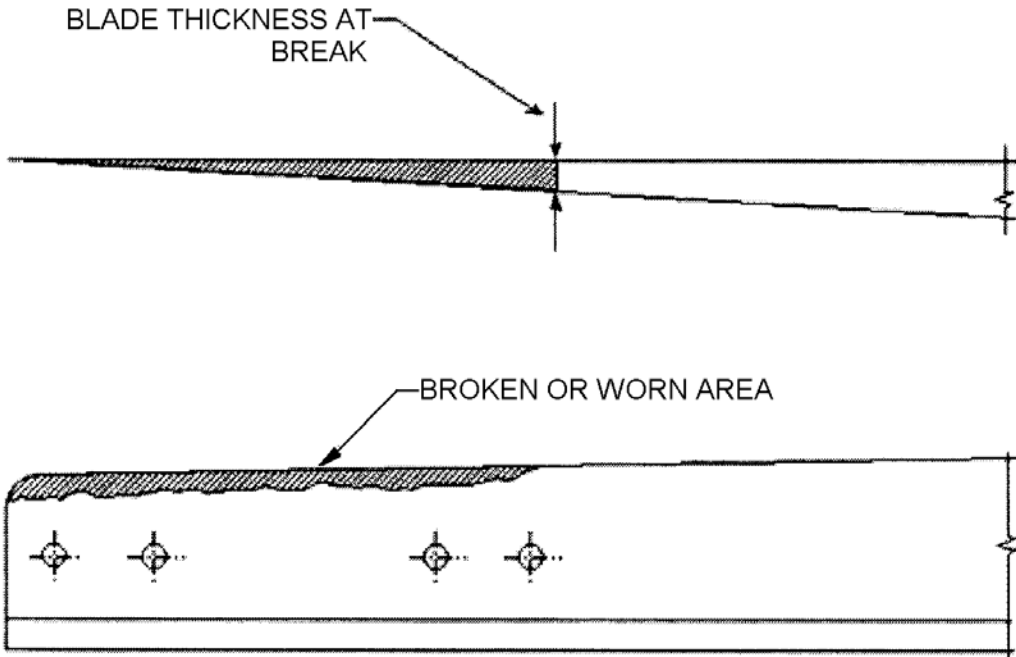


Figure 4.5: Broken or worn switch blade toe detail:



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4.2 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR 'V' CROSSING AREA

The condition assessment and response criteria for the "V" crossing area of broad gauge turnouts are described in tables 4.3 and 4.4.

Table 4.3: 'V' crossing area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h	40 km/h	20 km/h	pilot all trains until repaired
1. Check rail and track gauge – see figure 4.7							
Working face of check rail to 'V' crossing nose – see note [1]	1555	1555 to 1554	1553 to 1551	1550 to 1549	1548 to 1543	-	< 1543
Track gauge – running rail to 'V' crossing nose – see note [2]	1600	1600 to 1596	1595 to 1592	1591 to 1590	-	-	< 1590
2. Worn wing rails and worn or broken 'V' crossing nose – see figures 4.8 to 4.11							
Vertical wear of wing rail	running rail level	0 to 4	-	5 to 10	-	-	> 10
Vertical wear of 'V' crossing nose	3 below running rail level	3 to 8 below running rail level	9 to 13 below running rail level	-	-	-	> 13 below running rail level
Broken crossing nose – thickness of 'V' crossing nose at break (within transfer area)	14 when new	-	14 to 20	-	21 to 25	-	> 25

Notes to table 4.3:

- [1] The main effectiveness of the check rail is its ability to protect the 'V' crossing nose. Wheel contact with the 'V' crossing nose is therefore a vital observation to be made during inspections. Any sign of excessive damage to the 'V' crossing nose is reason for replacement or adjustment of the check rail regardless of the check rail wear.
- [2] For wide gauge in the crossing critical area, see assessment for plain track in CP-TS-956 (Track geometry).



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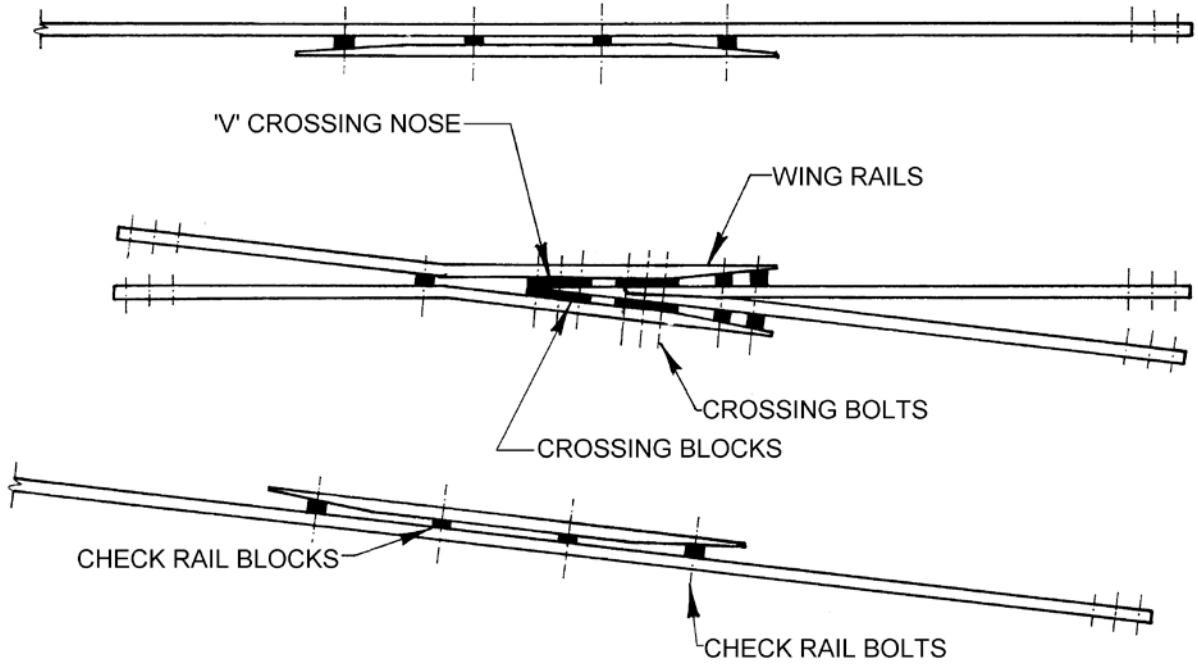
Table 4.4: 'V' crossing area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Ineffective bearers or fasteners - in critical area, see also clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
>2 consecutive	pilot all trains until repaired
2. Cracks in cast 'V' crossings, either solid or rail bound - see note [3]	
cracked: non-critical or critical	increase monitoring
cracked fully: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
cracked fully: affecting the running surface	pilot all trains until repaired
3. Cracks in fabricated 'V' crossings - see note [4]	
cracked: non-critical or critical	increase monitoring
broken: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
broken: affecting the running surface	pilot all trains until repaired
4. Heel rail and other rail defects - refer to CP-TS-961 (Rails and rail joints)	
5. Crossing bolts – see figure 4.6 and note [5]	
6. Crossing and check rail blocks –see figure 4.6 and note [6]	
(any) broken or cracked	increase monitoring
7. Check rail bolts – see figure 4.6 and note [6]	
(any) loose; 1 missing or ineffective	increase monitoring
2 missing or ineffective	immediate repair or impose speed restriction of 65 km/h
> 2 missing or ineffective	immediate repair or impose speed restriction of 20 km/h
8. Crossing flangeway - see note [7]	

Figure 4.6: Typical 'V' crossing assembly (shown for fabricated type)



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Notes to table 4.4

- [3] For cast manganese steel crossings (either solid or rail bound):
- a) “cracked: non-critical” means cracks longitudinally or vertically that may eventually cause a crossing to need repair.
 - b) “cracked: critical” means cracks longitudinally or vertically that may lead to a piece of crossing eventually lifting or breaking out and affecting the integrity of the running surface.
 - c) “cracked fully: not affecting running surface” means:
 - i. a crack that runs the full section of the crossing such that the crossing is in two pieces;
 - ii. all fastenings are secure; and
 - iii. the break does not impact on the integrity of the running surface (e.g. tang area of crossing).
 - d) “cracked fully: affecting running surface” means:
 - i. a crack that runs the full section of the crossing such that the crossing is in two pieces; and
 - ii. the fastenings are not secure; or
 - iii. the break affects the running surface integrity.
- [4] For fabricated crossings:
- a) “cracked: non-critical” means cracks in a location where the rails are held in alignment by the blocks, but may eventually cause a crossing to need repair.
 - b) “cracked: critical” means cracks that if they eventually ran the full section of the rail:
 - i. the rail would be in two pieces; and
 - ii. if the fastenings were not secure, the break would affect the integrity of the running surface.
 - c) “broken: not affecting running surface” means:
 - i. cracks that run the full section of a rail component and it is in two pieces;
 - ii. all fastenings are secure;
 - iii. the rails are held in proper alignment by the blocks; and
 - iv. the break does not impact on the running surface.
 - d) “broken: affecting running surface” means:
 - i. cracks that run the full section of the rail and it is in two pieces.
 - ii. fastenings are not secure;
 - iii. the rails are not held in proper alignment by the blocks;
 - iv. or the break impacts on the running surface.
- [5] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced be tightened. Missing or ineffectiveness bolts should be replaced.
- [6] The end bolts and check blocks of all check rails should be effective.
- [7] Flangeways should be checked for blockages and cleared where blocked.

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Figure 4.7: Typical part section through “V” and “K” crossings (shown for fabricated type)

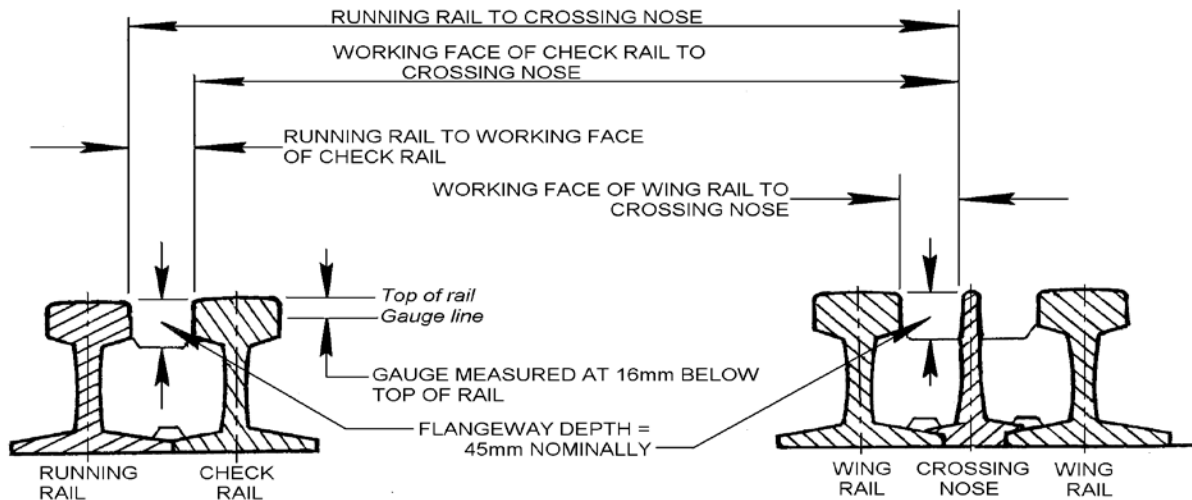


Figure 4.8: Fabricated crossings - detail of worn or broken crossing nose – Note for enlargement of crossing nose see figure 4.9

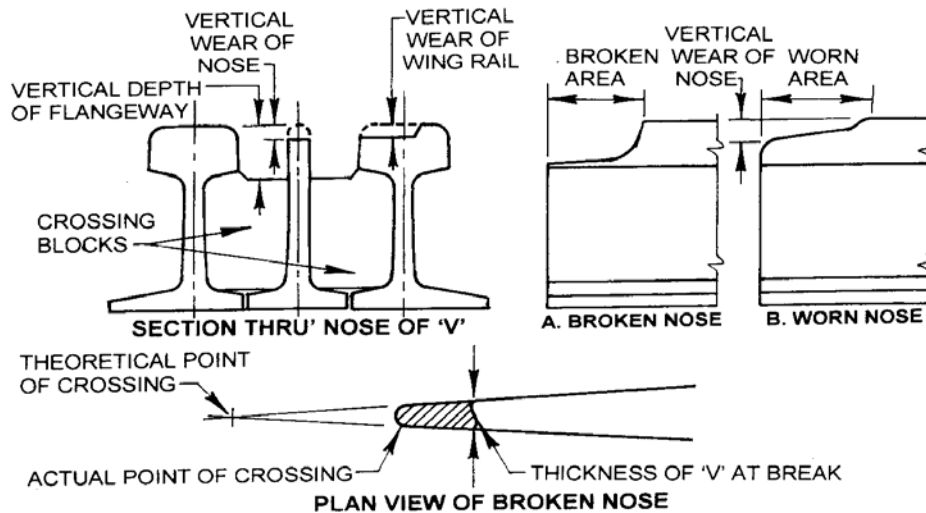
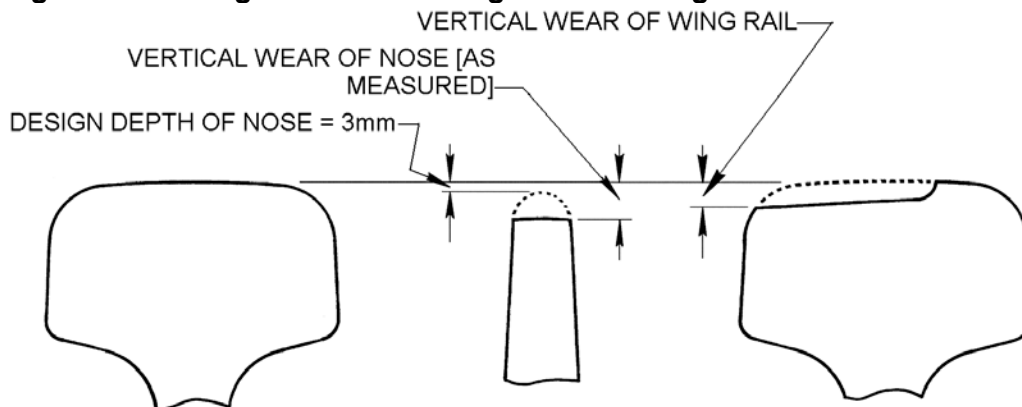


Figure 4.9: Enlargement of crossing nose showing vertical wear



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Figure 4.10: Solid manganese crossing - detail of worn or broken crossing nose – Note:
Details of worn nose and wing rail are similar to those shown for fabricated crossing in figure 4.8

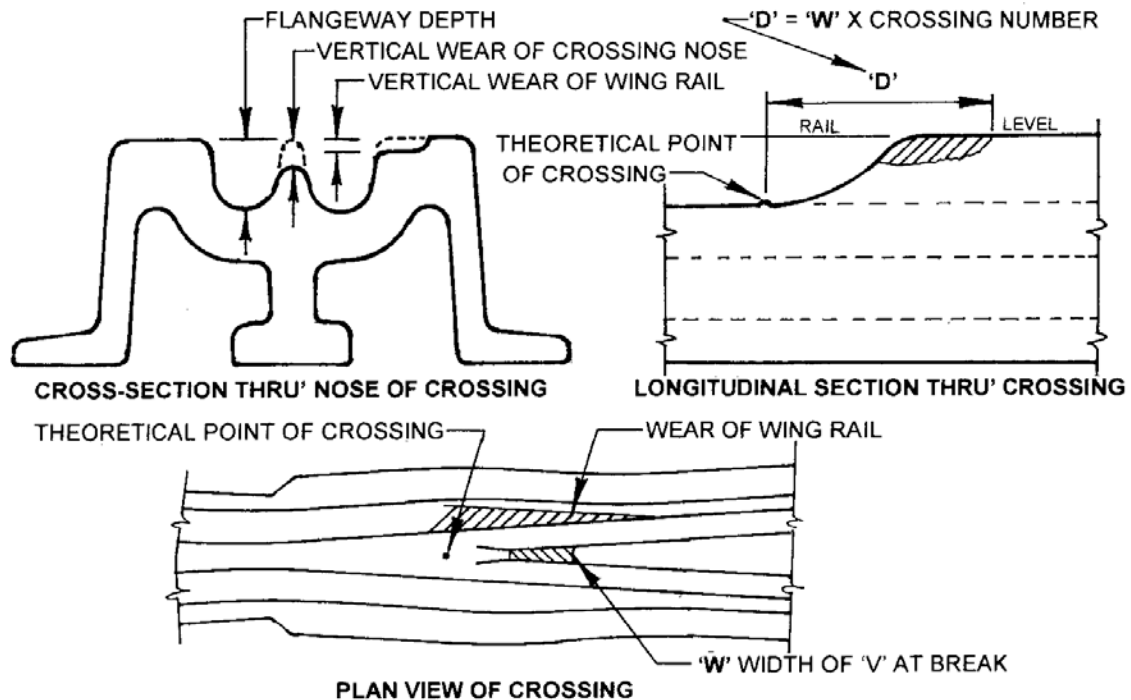
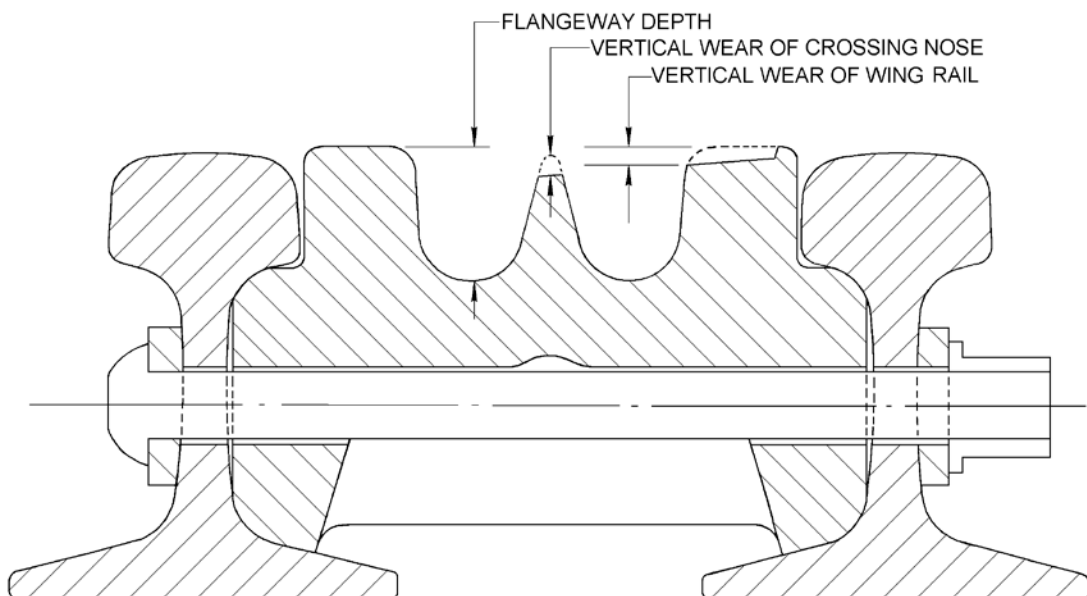


Figure 4.11: Rail bound manganese crossing - detail of worn or broken crossing nose- Note: Details of vertical wear of nose and wing rail are similar to those shown for fabricated crossing in figure 4.9; longitudinal section through nose and plan view of crossing are similar to those shown in figure 4.10





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5.0 BROAD GAUGE DIAMONDS

5.1 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR 'V' CROSSING AREA

The condition assessment and response criteria for the "V" crossing area of broad gauge diamonds are described in tables 5.1 and 5.2.

Table 5.1: 'V' crossing area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h	40 km/h	20 km/h	pilot all trains until repaired
1. Check rail or track gauge – see figure 5.2							
Working face of check rail to 'V' crossing nose – see note [1]	1555	1555 to 1554	1553 to 1551	1550 to 1549	1548 to 1543	-	< 1543
Track gauge – running rail to 'V' crossing nose – see note [2]	1600	1600 to 1596	1595 to 1592	1591 to 1590	-	-	< 1590
2. Worn wing rails and worn or broken 'V' crossing nose – see figures 5.3 to 5.6							
Vertical wear of wing rail	running rail level	0 to 4	-	5 to 10	-	-	>10
Vertical wear of 'V' crossing nose	3 below running rail level	3 to 8 below running rail level	9 to 13 below running rail level	-	-	-	> 13 below running rail level
Broken crossing nose – thickness of 'V' crossing nose at break (within transfer area)	14 when new	-	14 to 20	-	21 to 25	-	> 25

Notes to table 5.1:

- [1] The main effectiveness of the check rail is its ability to protect the 'V' crossing nose. Wheel contact with the 'V' crossing nose is therefore a vital observation to be made during inspections. Any sign of excessive damage to the 'V' crossing nose is reason for replacement or adjustment of the check rail regardless of the check rail wear.
- [2] For wide gauge in the crossing critical area, see assessment for plain track in CP-TS-956 (Track geometry).



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Table 5.2: 'V' crossing area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Ineffective bearers or fasteners - in critical area, see also clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
>2 consecutive	pilot all trains until repaired
2. Cracks in cast 'V' crossings, either solid or rail bound - see note [3]	
cracked: non-critical or critical	increase monitoring
cracked fully: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
cracked fully: affecting the running surface	pilot all trains until repaired
3. Cracks in fabricated 'V' crossings - see note [4]	
cracked: non-critical or critical	increase monitoring
broken: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
broken: affecting the running surface	pilot all trains until repaired
4. Heel rail and other rail defects - refer to CP-TS-961 (Rails and rail joints)	
5. Crossing bolts – see figure 5.1 and note [5]	
6. Crossing and check rail blocks –see figure 5.1 and note [6]	
(any) broken or cracked	increase monitoring
7. Check rail bolts – see figure 5.1 and note [6]	
loose; or 1 missing or ineffective	increase monitoring
2 missing or ineffective	immediate repair or impose speed restriction of 65 km/h
> 2 missing or ineffective	immediate repair or impose speed restriction of 20 km/h
8. Crossing flangeway - see note [7]	

Notes to table 5.2

[3] For cast manganese steel crossings (either solid or rail bound):

- a) "cracked: non-critical" means cracks longitudinally or vertically that may eventually cause a crossing to need repair.
- b) "cracked: critical" means cracks longitudinally or vertically that may lead to a piece of crossing eventually lifting or breaking out and affecting the integrity of the running surface.
- c) "cracked fully: not affecting running surface" means:
 - i) a crack that runs the full section of the crossing such that the crossing is in two pieces;
 - ii) all fastenings are secure; and
 - iii) the break does not impact on the integrity of the running surface (e.g. tang area of crossing).
- d) "cracked fully: affecting running surface" means:
 - i) a crack that runs the full section of the crossing such that the crossing is in two pieces; and
 - ii) the fastenings are not secure; or
 - iii) the break affects the running surface integrity.



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BROAD GAUGE DIAMONDS

[4] For fabricated crossings:

- a) “cracked: non-critical” means cracks in a location where the rails are held in alignment by the blocks, but may eventually cause a crossing to need repair.
- b) “cracked: critical” means cracks that if they eventually ran the full section of the rail:
 - i) the rail would be in two pieces; and
 - ii) if the fastenings were not secure, the break would affect the integrity of the running surface.
- c) “broken: not affecting running surface” means
 - i) cracks that run the full section of a rail component and it is in two pieces;
 - ii) all fastenings are secure;
 - iii) the rails are held in proper alignment by the blocks; and
 - iv) the break does not impact on the running surface.
- d) “broken: affecting running surface” means:
 - i) cracks that run the full section of the rail and it is in two pieces.
 - ii) fastenings are not secure;
 - iii) the rails are not held in proper alignment by the blocks;
 - iv) or the break impacts on the running surface.

[5] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced be tightened. Missing or ineffectiveness bolts should be replaced.

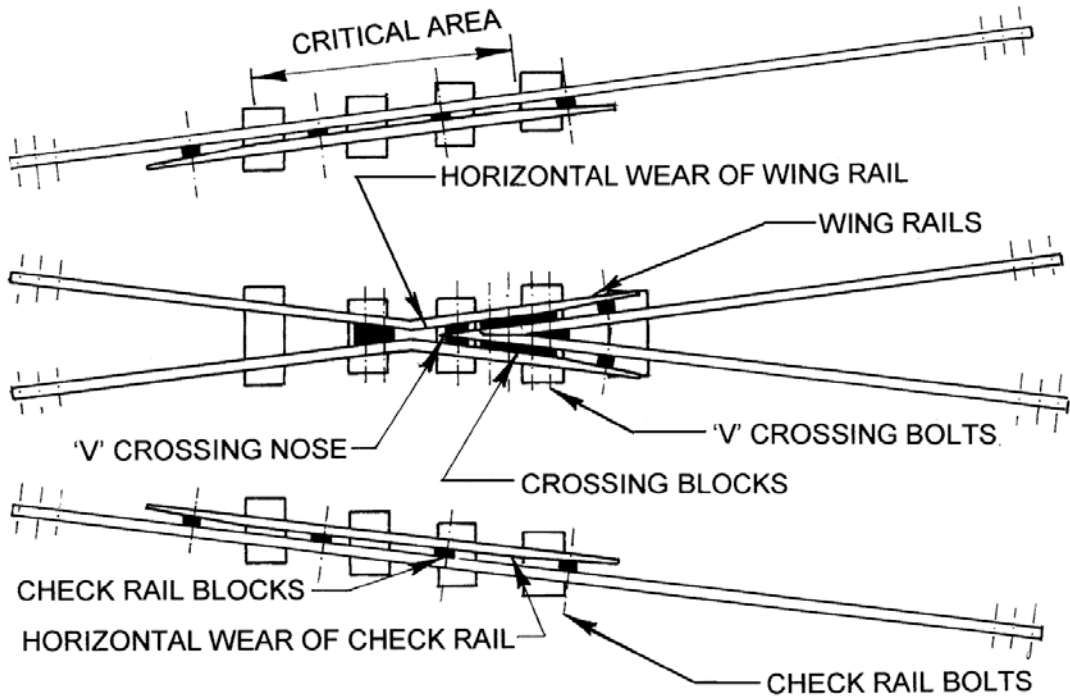
[6] The end bolts and check blocks of all check rails should be effective.

[7] Flangeways should be checked for blockages and cleared where blocked.

Figure 5.1: Typical ‘V’ crossing assembly (shown for fabricated type)



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Figure 5.2: Typical part section through “V” and “K” crossings (shown for fabricated type)

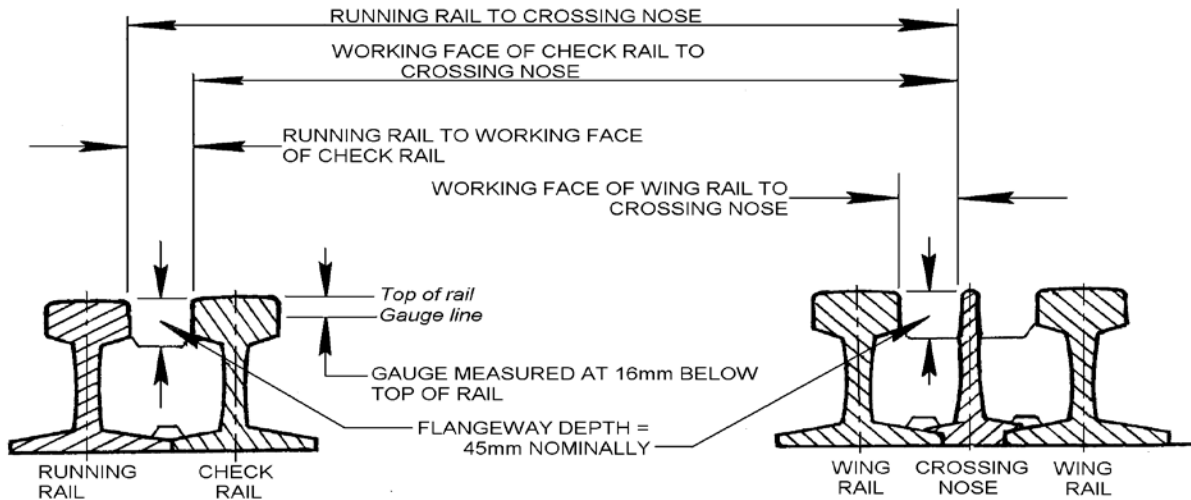


Figure 5.3: Fabricated crossings - detail of worn or broken crossing nose – Note for enlargement of crossing nose see figure 5.4

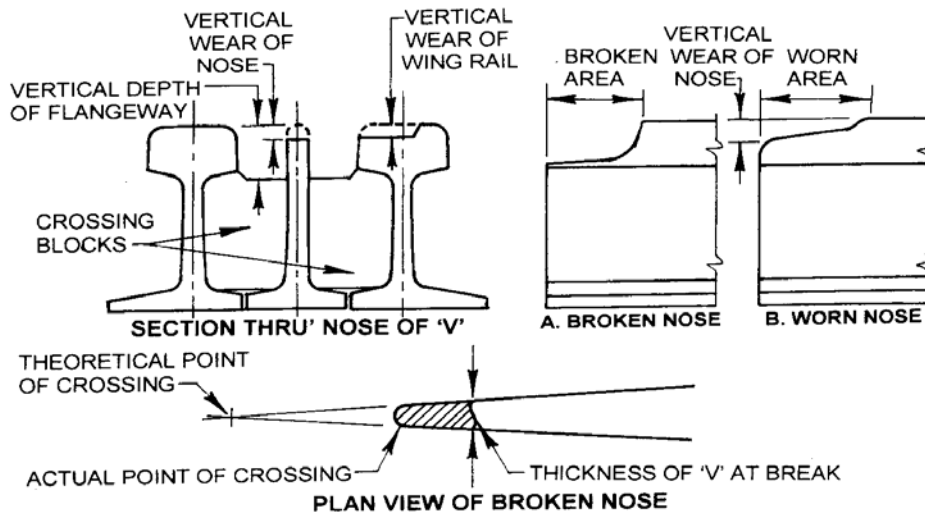
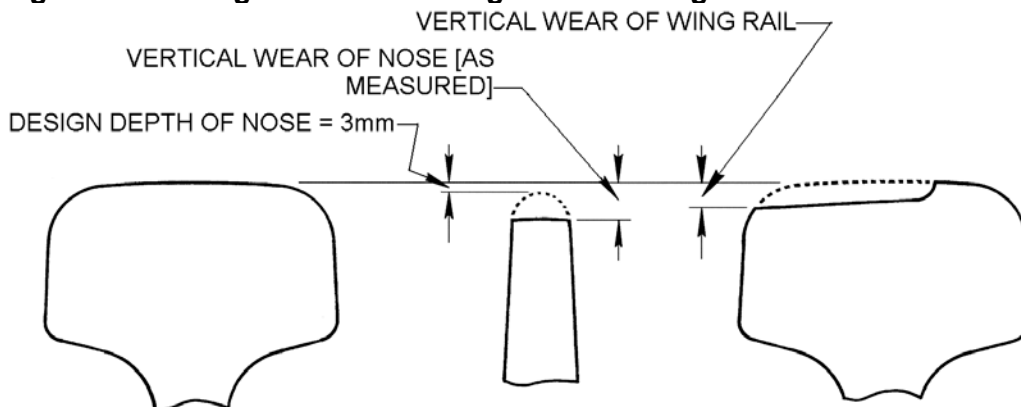


Figure 5.4: Enlargement of crossing nose showing vertical wear



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Figure 5.5: Rail bound manganese crossing - detail of worn or broken crossing nose

Note: Details of vertical wear of nose and wing rail are similar to those shown for fabricated crossing in figures 5.3 and 5.4

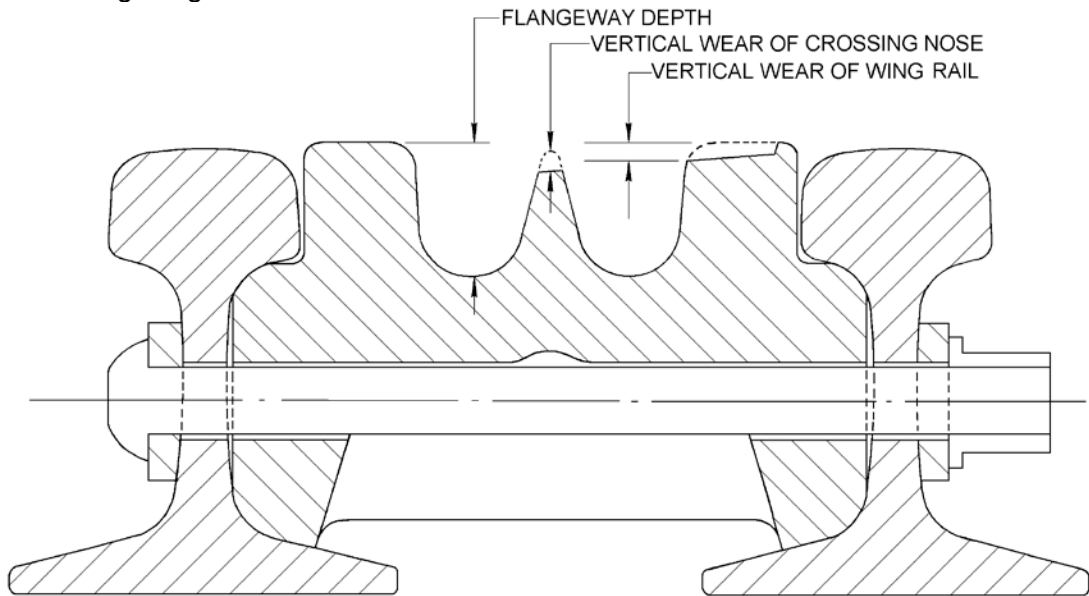
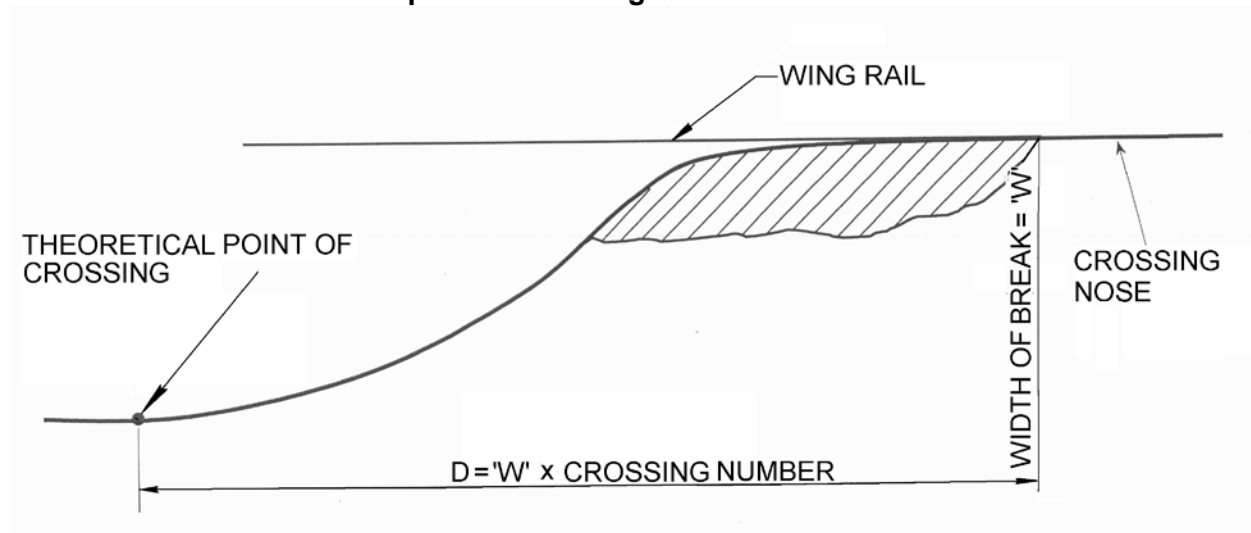


Figure 5.6: Longitudinal section of 'V' crossing nose showing relation of broken or worn nose to theoretical point of crossing





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BROAD GAUGE DIAMONDS

5.2 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR 'K' CROSSING AREA

The condition assessment and response criteria for the "K" crossing area of broad gauge diamonds are described in tables 5.3 and 5.4.

Table 5.3: 'K' crossing area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h	40 km/h	20 km/h	pilot all trains until repaired
1. Check rail and track gauge – see figure 5.2							
Working face of check rail to 'K' crossing nose – see note [1]	1555	1555 to 1554	1553 to 1551	1550 to 1549	1548 to 1543	-	< 1543
Track gauge – running rail to 'K' crossing nose – see note [2]	1600	1600 to 1596	1595 to 1592	1591 to 1590	-	-	< 1590
2. Worn wing rails and worn or broken 'K' crossing nose – see figures 5.3 to 5.6							
Vertical wear of wing rail	running rail level	0 to 4	-	5 to 10	-	-	> 10
Vertical wear of 'K' crossing nose	3 below running rail level	3 to 8 below running rail level	9 to 13 below running rail level	-	-	-	> 13 below running rail level
Broken crossing nose – thickness of 'K' crossing nose at break (within transfer area)	14 when new	-	14 to 20	-	21 to 25	-	> 25

Notes to table 5.3:

- [1] The main effectiveness of the check rail is its ability to protect the 'K' crossing nose. Wheel contact with the 'K' crossing nose is therefore a vital observation to be made during inspections. Any sign of excessive damage to the 'K' crossing nose is reason for replacement or adjustment of the check rail regardless of the check rail wear.
- [2] For wide gauge in the crossing critical area, see assessment for plain track in CP-TS-956 (Track geometry).



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Table 5.4: 'K' crossing area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Ineffective bearers or fasteners - in critical area, see also clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
>2 consecutive	pilot all trains until repaired
2. Cracks in cast 'K' crossings, either solid or rail bound - see note [3]	
cracked: non-critical or critical	increase monitoring
cracked fully: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
cracked fully: affecting the running surface	pilot all trains until repaired
3. Cracks in fabricated 'K' crossings - see note [4]	
cracked: non-critical or critical	increase monitoring
broken: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
broken: affecting the running surface	pilot all trains until repaired
4. Heel rail and other rail defects - refer to CP-TS-961 (Rails and rail joints)	
5. Crossing bolts – see figure 5.7 and note [5]	
6. Crossing and check rail blocks –see figure 5.7 and note [6]	
(any) broken or cracked	increase monitoring
7. Check rail bolts – see figure 5.7 and note [6]	
loose; or 1 missing or ineffective	increase monitoring
2 missing or ineffective	immediate repair or impose speed restriction of 65 km/h
> 2 missing or ineffective	immediate repair or impose speed restriction of 20 km/h
8. Crossing flangeway - see note [7]	

Notes to table 5.4

[3] For cast manganese steel crossings (either solid or rail bound):

- a) “cracked: non-critical” means cracks longitudinally or vertically that may eventually cause a crossing to need repair.
- b) “cracked: critical” means cracks longitudinally or vertically that may lead to a piece of crossing eventually lifting or breaking out and affecting the integrity of the running surface.
- c) “cracked fully: not affecting running surface” means:
 - i) a crack that runs the full section of the crossing such that the crossing is in two pieces;
 - ii) all fastenings are secure; and
 - iii) the break does not impact on the integrity of the running surface (e.g. tang area of crossing).
- d) “cracked fully: affecting running surface” means:
 - i) a crack that runs the full section of the crossing such that the crossing is in two pieces; and
 - ii) the fastenings are not secure; or
 - iii) the break affects the running surface integrity.



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[4] For fabricated crossings:

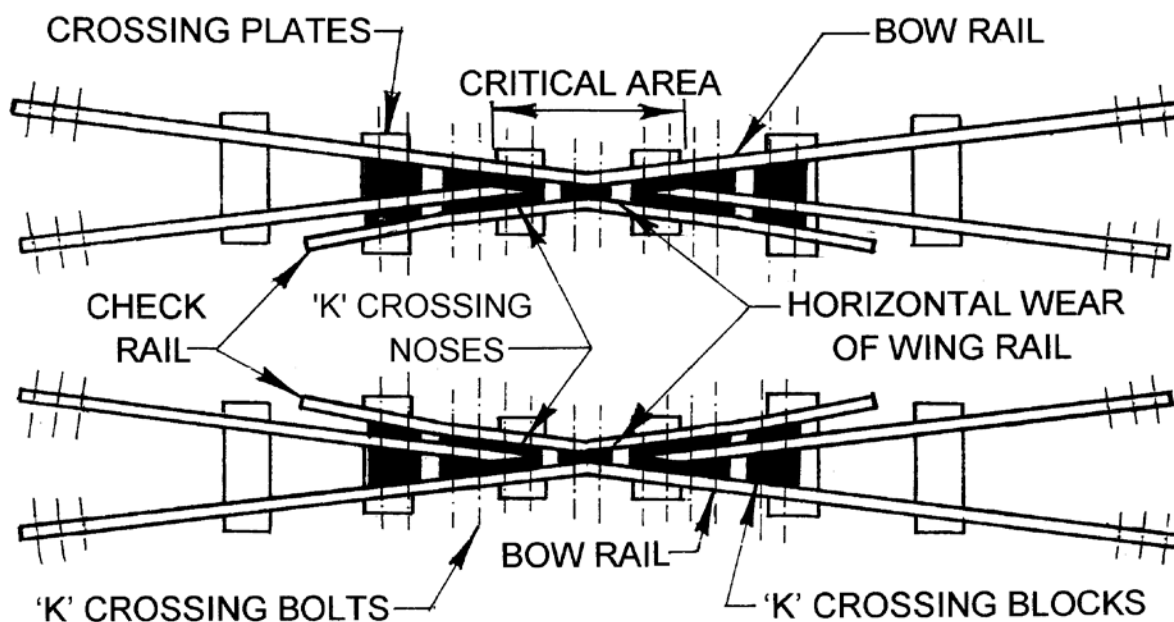
- a) "cracked: non-critical" means cracks in a location where the rails are held in alignment by the blocks, but may eventually cause a crossing to need repair.
- b) "cracked: critical" means cracks that if they eventually ran the full section of the rail:
 - i) the rail would be in two pieces; and
 - ii) if the fastenings were not secure, the break would affect the integrity of the running surface.
- c) "broken: not affecting running surface" means:
 - i) cracks that run the full section of a rail component and it is in two pieces;
 - ii) all fastenings are secure;
 - iii) the rails are held in proper alignment by the blocks; and
 - iv) the break does not impact on the running surface.
- d) "broken: affecting running surface" means:
 - i) cracks that run the full section of the rail and it is in two pieces.
 - ii) fastenings are not secure;
 - iii) the rails are not held in proper alignment by the blocks;
 - iv) or the break impacts on the running surface.

[5] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced be tightened. Missing or ineffectiveness bolts should be replaced.

[6] The end bolts and check blocks of all check rails should be effective.

[7] Flangeways should be checked for blockages and cleared where blocked.

Figure 5.7: Typical 'K' crossing assembly (shown for fabricated type)





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6.0 BROAD GAUGE SINGLE AND DOUBLE COMPOUNDS

6.1 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR SWITCH AREA

The condition assessment and response criteria for the switch area of broad gauge single and double compounds are described in tables 6.1 and 6.2.

Table 6.1: Switch area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h	40 km/h	20 km/h	pilot all trains until repaired
1. Switch flangeway – see figure 6.1							
Minimum switch blade throat opening – back of switch rail to stock rail – see figure 6.1	50	40 to 50	-	-	39 to 35	-	< 35
Minimum switch opening – see figure 6.1	115	95 to 115	85 to 94	-	-	80 to 84	< 80
2. Track gauge at toe of switch – see figure 6.1 and also note [1]							
Gauge at toe of switch between stock rails – - for traditional switches	1610	1610 to 1605	-	1604 to 1602	-	1601 to 1600	<1600
- for tangential switches	1600	1600 to 1595	-	1594 to 1592	-	1591 to 1590	<1590

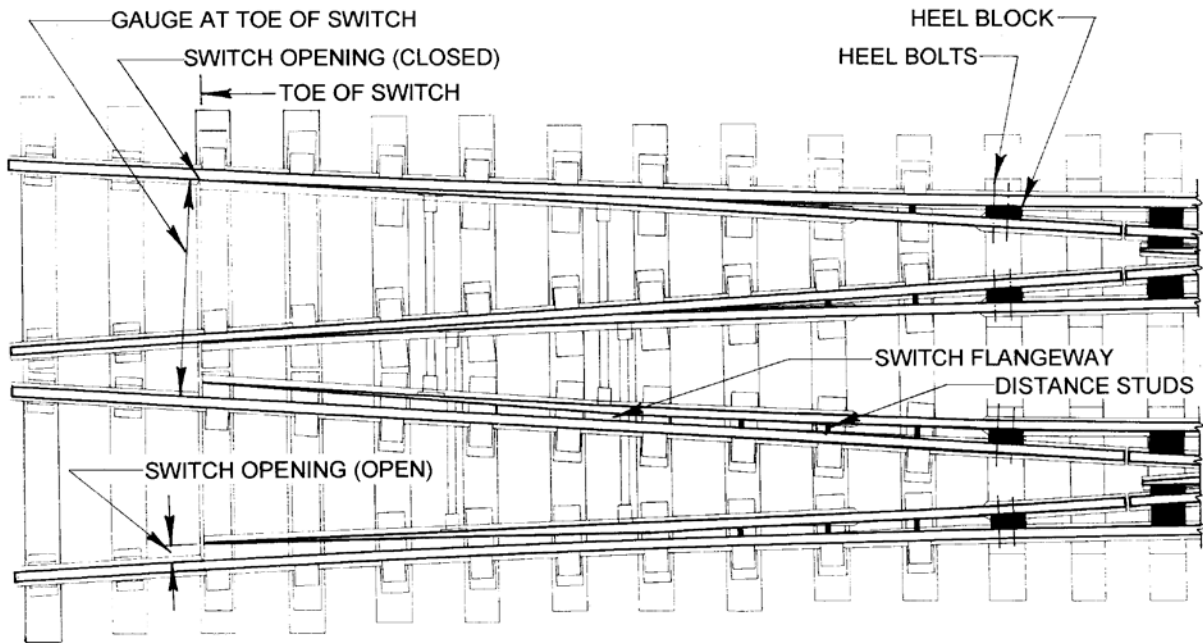
Notes to table 6.1

- [1] For wide gauge in the switch critical area, the assessment for plain track in CP-TS-956 (Track geometry) shall apply. Note that wide gauge is any gauge wider than 1600mm even at the toe of traditional switches, i.e. the design dimension of 1610mm is to be considered as 10mm wide.

Figure 6.1: Switch assembly



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Table 6.2: Switch area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Heel block - see note [2] and figure 6.1	
cracked	increase monitoring
broken but still effective	immediate repair or impose speed restriction of 65 km/h
missing or broken and ineffective	pilot all trains until repaired
2. Switch chairs	
(any) cracked or loose: or 1 broken or ineffective	increase monitoring
2 consecutive broken/ineffective	immediate repair or impose speed restriction of 65 km/h
more than 2 consecutive broken or ineffective	pilot all trains until repaired
3. Distance studs or chair bolts – to avoid rail roll-over, see figure 6.1	
(any) cracked or loose; or 1 missing or ineffective	increase monitoring
2 consecutive missing or ineffective	immediate repair or impose speed restriction of 65 km/h
more than 2 consecutive missing or ineffective	pilot all trains until repaired
4. Ineffective bearers or fasteners – in critical area, also see clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
more than 2 consecutive	pilot all trains until repaired
5. Bolts – see note [3]	
6. Spreader bar including brackets , bolts, etc.	
missing or broken	pilot all trains until repaired – see also note [4]
7. Switch blade damage - see note [5]	
length of damage < 100mm	Routine inspection
length of damage 100 to 199mm	increase monitoring
length of damage ≥ 200mm	pilot all trains until repaired
8. Stock rail or switch blade face wear - angle from vertical at point of wheel flange/rail contact at switch toe - see figure 6.2	
< 18 degrees	routine inspection
18 degrees to < 26 degrees	increase monitoring
≥ 26 degrees	pilot all trains until repaired - see note [6]
9. Switch blade angle from horizontal at any point between 19mm and 30mm below running surface of stock rail - see figure 6.3	
≥ 40 degrees	routine inspection
< 40 degrees	pilot all trains until repaired
10. Stock rail gauge face wear at gauge point - where switch blade contacts stock rail	
<2mm	routine inspection
2mm to < 3mm	increase monitoring
≥ 3mm	pilot all trains until repaired - see note [7]
11. Switch toe height from stock rail running level to top of switch blade, see figure 6.4	
≥ 13mm	routine inspection
> 12mm to < 13mm	increase monitoring
≤12mm	pilot all trains until repaired
12. Switch width at toe - as presented to the wheel - see figure 6.4 and note [8]	
0 to 6mm	increase monitoring
7 to 8mm	immediate repair or impose speed restriction of 20 km/h
>8mm	pilot all trains until repaired



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13. Switch blade crippled - see note [9]

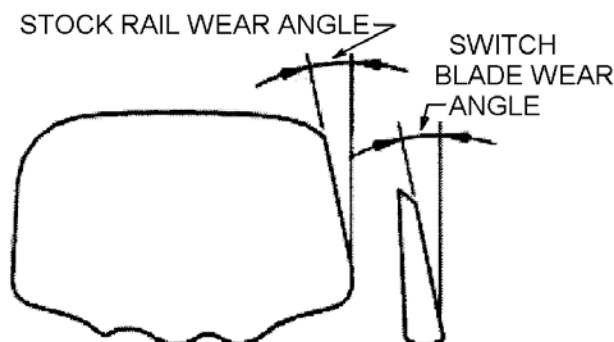
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Notes to table 6.2

- [2] Applies to fixed heel blocks only. Pivot heel cracks and breaks should be assessed by a qualified worker.
- [3] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, 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 not to be fully tightened so as to allow for design switch movement.
- [4] An alternative action that may be taken is to install a switch clamp and/or spike the switches in accordance with the action specified in clause 3.3(g).
- [5] "Length of damage" implies damage anywhere in the switch blade deeper than 19mm from the running surface. The response applies to chamfered switches only (i.e. not undercut switches). When a worn switch blade at the end of its service life is being replaced, a complete half set of switches should be installed. In table 6.2,
 - i. "length of damage < 100mm" also applies to consecutive areas of damage less than 100mm apart and forming a total length less than 100mm.
 - ii. "length of damage 100 to 199mm" also applies to consecutive areas of damage less than 199mm apart and forming a total length between 100mm and 199mm.
 - iii. "length of damage ≥ 200mm" also applies to consecutive areas of damage less than 200mm apart and forming a total length more than 200mm.
- [6] Where the gauge face angle limit is exceeded, the action should be to replace the complete half set of switches.
- [7] It is recommended that the stock rail be replaced. Following repair, it is necessary to check the fit between the switch blade and stock rail. The replacement of switches should be carried out with care where the stock rail is approaching this amount of wear to ensure that a blunt nose is not presented to the wheel.
- [8] Switch width at toe includes the effects of side wear on stock rails and closed gap between switch blade and stock rail. The gap between the switch blade and stock rail should not exceed 3mm at any time.
- [9] A crippled switch blade refers to a switch blade that has suffered damage from a run-through or derailment. Such switch blades may be suitable for temporary repair and re-installation to a geometry suitable for train movements at 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.

Figure 6.2: Stock rail and switch blade wear angle detail:



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Figure 6.3: Broken or worn switch blade toe detail:

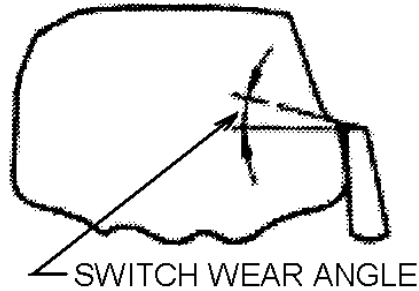


Figure 6.4: Stock rail side wear and switch blade width/height detail:

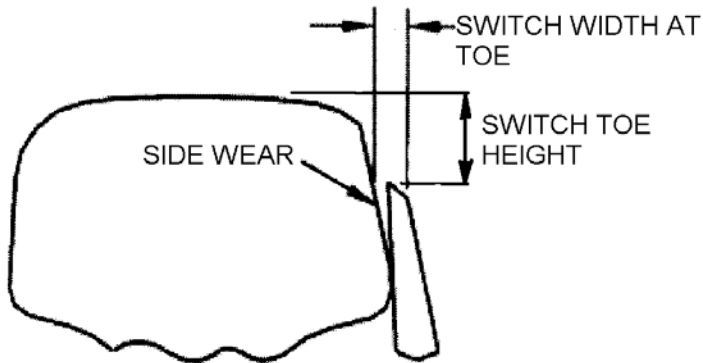
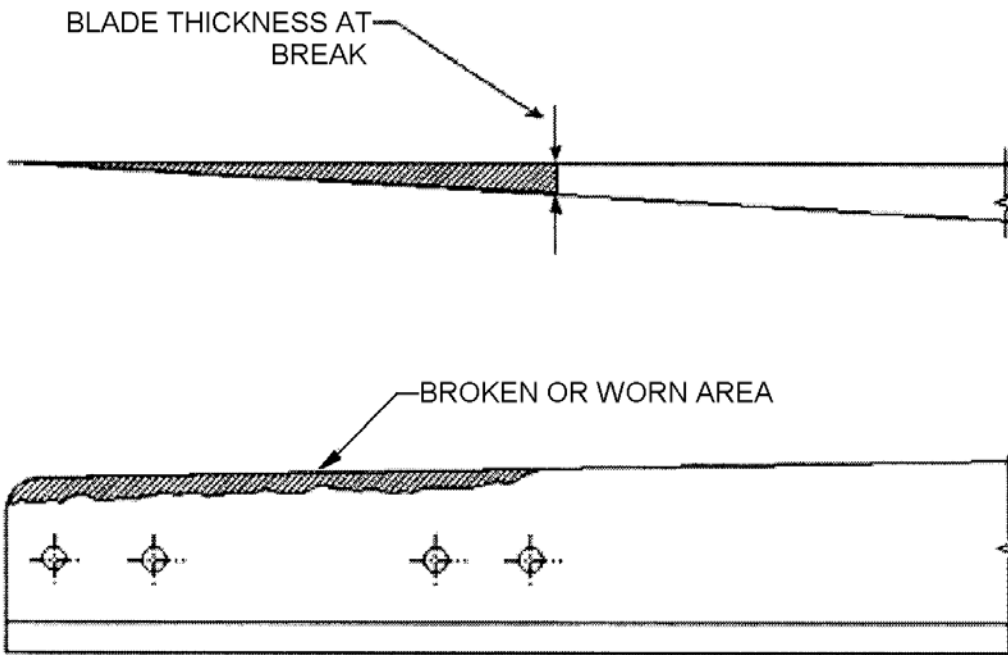


Figure 6.5: Broken or worn switch blade toe detail:





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6.2 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR 'V' CROSSING AREA

The condition assessment and response criteria for the "V" crossing area of broad gauge single and double compounds are described in tables 6.3 and 6.4.

Table 6.3: 'V' crossing area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h	40 km/h	20 km/h	pilot all trains until repaired
1. Check rail and track gauge – see figure 6.7							
Working face of check rail to 'V' crossing nose – see note [1] and figure 6.7	1555	1555 to 1554	1553 to 1551	1550 to 1549	1548 to 1543	-	< 1543
Track gauge – running rail to 'V' crossing nose – see note [2] and figure 6.7	1600	1600 to 1596	1595 to 1592	1591 to 1590	-	-	< 1590
2. Worn wing rails and worn or broken 'V' crossing nose – see figures 6.8 to 6.11							
Vertical wear of wing rail	running rail level	0 to 4	-	5 to 10	-	-	> 10
Vertical wear of 'V' crossing nose	3 below running rail level	3 to 8 below running rail level	9 to 13 below running rail level	-	-	-	> 13 below running rail level
Broken crossing nose – thickness of 'V' crossing nose at break (within transfer area)	14 when new	-	14 to 20	-	21 to 25	-	> 25

Notes to table 6.3:

- [1] The main effectiveness of the check rail is its ability to protect the 'V' crossing nose. Wheel contact with the 'V' crossing nose is therefore a vital observation to be made during inspections. Any sign of excessive damage to the 'V' crossing nose is reason for replacement or adjustment of the check rail regardless of the check rail wear.
- [2] For wide gauge in the crossing critical area, see assessment for plain track in CP-TS-956 (Track geometry).



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Table 6.4: 'V' crossing area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Ineffective bearers or fasteners - in critical area, see also clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
>2 consecutive	pilot all trains until repaired
2. Cracks in cast 'V' crossings, either solid or rail bound - see note [3]	
cracked: non-critical or critical	increase monitoring
cracked fully: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
cracked fully: affecting the running surface	pilot all trains until repaired
3. Cracks in fabricated 'V' crossings - see note [4]	
cracked: non-critical or critical	increase monitoring
broken: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
broken: affecting the running surface	pilot all trains until repaired
4. Heel rail and other rail defects - refer to CP-TS-961 (Rails and rail joints)	
5. Crossing bolts – see figure 6.6 and note [5]	
6. Crossing and check rail blocks –see figure 6.6 and note [6]	
(any) broken or cracked	increase monitoring
7. Check rail bolts – see figure 6.6 and note [6]	
(any) loose; or 1 missing or ineffective	increase monitoring
2 missing or ineffective	immediate repair or impose speed restriction of 65 km/h
> 2 missing or ineffective	immediate repair or impose speed restriction of 20 km/h
8. Crossing flangeway - see note [7]	

Notes to table 6.4

[3] For cast manganese steel crossings (either solid or rail bound):

- a) “cracked: non-critical” means cracks longitudinally or vertically that may eventually cause a crossing to need repair.
- b) “cracked: critical” means cracks longitudinally or vertically that may lead to a piece of crossing eventually lifting or breaking out and affecting the integrity of the running surface.
- c) “cracked fully: not affecting running surface” means:
 - i) a crack that runs the full section of the crossing such that the crossing is in two pieces;
 - ii) all fastenings are secure; and
 - iii) the break does not impact on the integrity of the running surface (e.g. tang area of crossing).
- d) “cracked fully: affecting running surface” means:
 - i) a crack that runs the full section of the crossing such that the crossing is in two pieces; and
 - ii) the fastenings are not secure; or
 - iii) the break affects the running surface integrity.

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[4] For fabricated crossings:

- a) “cracked: non-critical” means cracks in a location where the rails are held in alignment by the blocks, but may eventually cause a crossing to need repair.
- b) “cracked: critical” means cracks that if they eventually ran the full section of the rail:
 - i) the rail would be in two pieces; and
 - ii) if the fastenings were not secure, the break would affect the integrity of the running surface.
- c) “broken: not affecting running surface” means:
 - i) cracks that run the full section of a rail component and it is in two pieces;
 - ii) all fastenings are secure;
 - iii) the rails are held in proper alignment by the blocks; and
 - iv) the break does not impact on the running surface.
- d) “broken: affecting running surface” means:
 - i) cracks that run the full section of the rail and it is in two pieces.
 - ii) fastenings are not secure;
 - iii) the rails are not held in proper alignment by the blocks;
 - iv) or the break impacts on the running surface.

[5] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced be tightened. Missing or ineffectiveness bolts should be replaced.

[6] The end bolts and check blocks of all check rails should be effective.

[7] Flangeways should be checked for blockages and cleared where blocked.

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Figure 6.6: Typical 'V' crossing assembly (shown for rail bound manganese type)

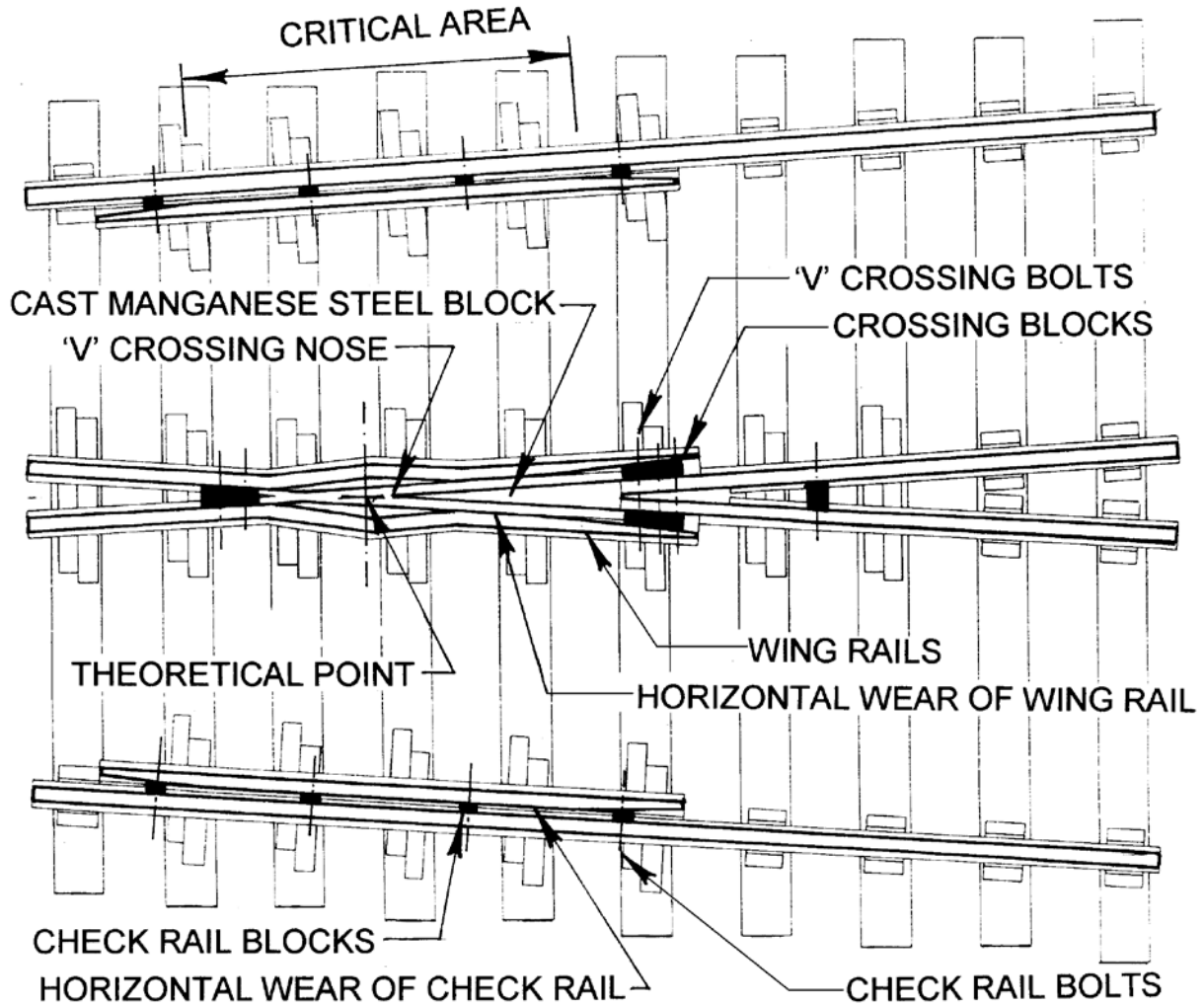
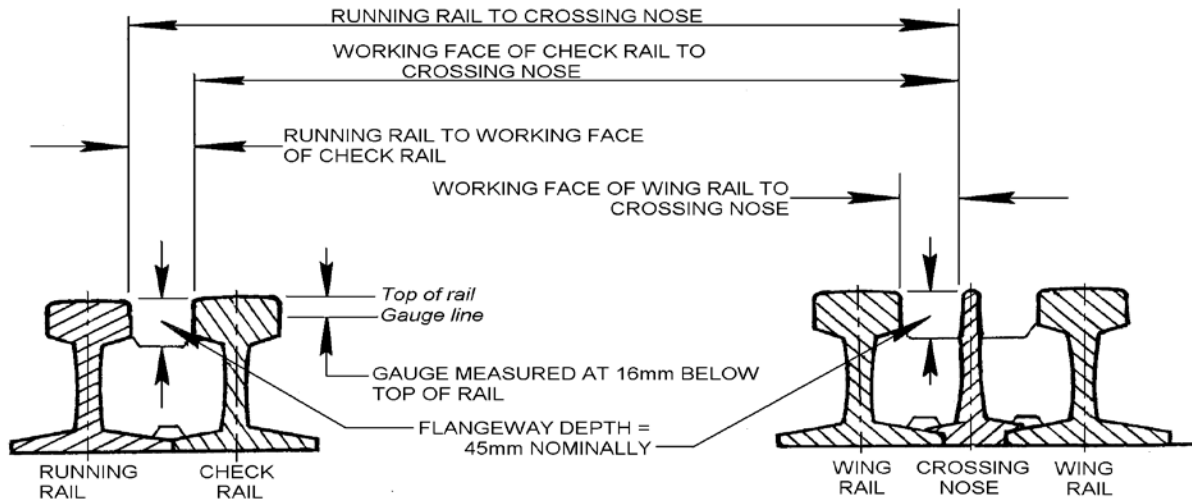


Figure 6.7: Typical part section through "V" and "K" crossings (shown for fabricated type)



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Figure 6.8: Fabricated crossings - detail of worn or broken crossing nose – Note for enlargement of crossing nose see figure 6.9

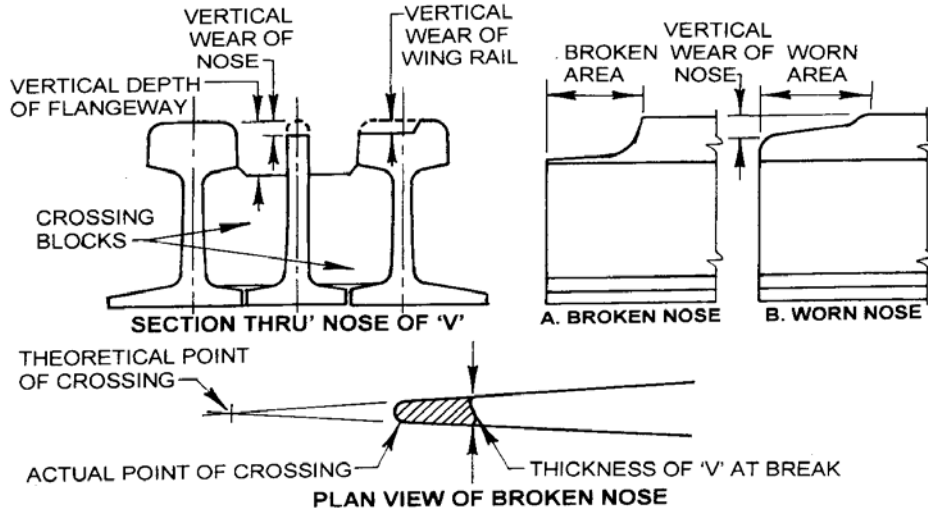
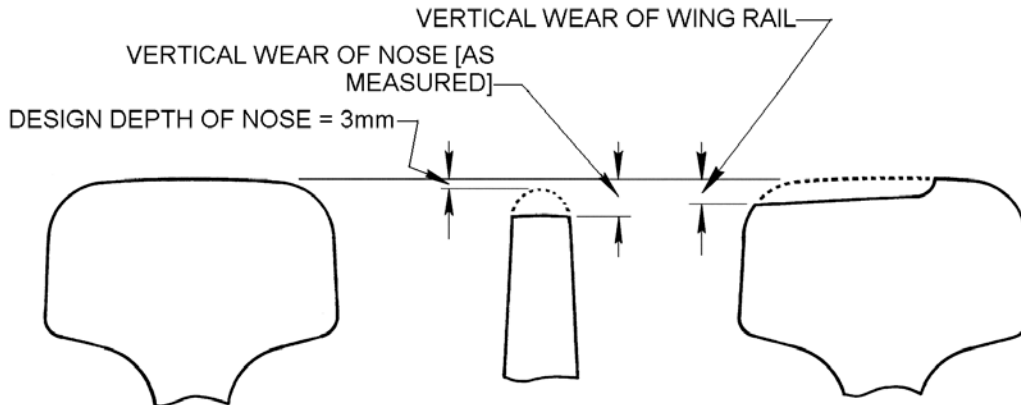


Figure 6.9: Enlargement of crossing nose showing vertical wear



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Figure 6.10: Rail bound manganese crossing - detail of worn or broken crossing nose

Note: Details of vertical wear of nose and wing rail are similar to those shown for fabricated crossing in figures 6.8 and 6.9

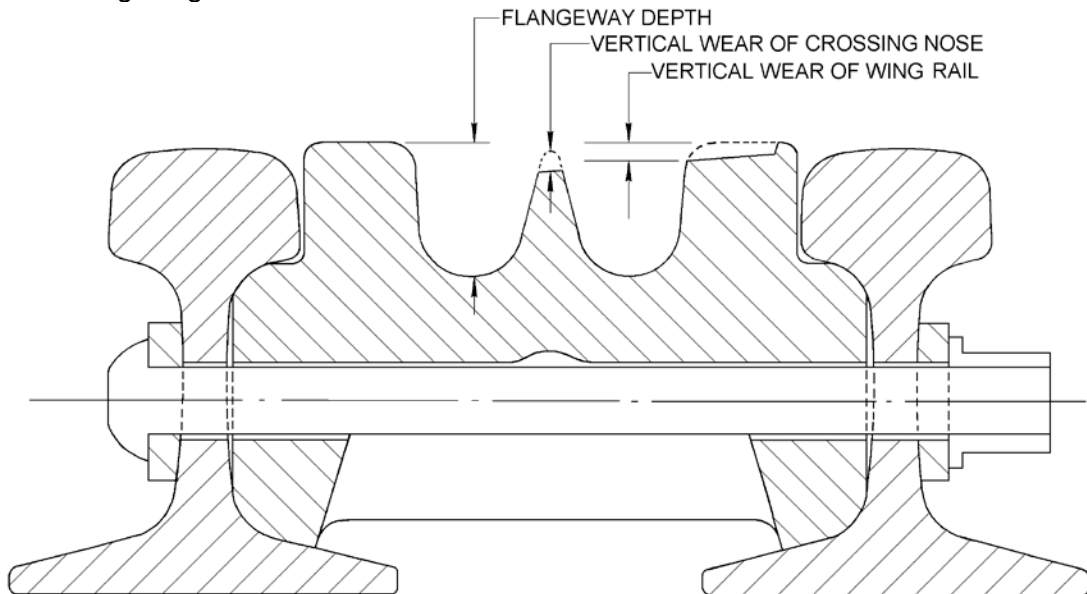
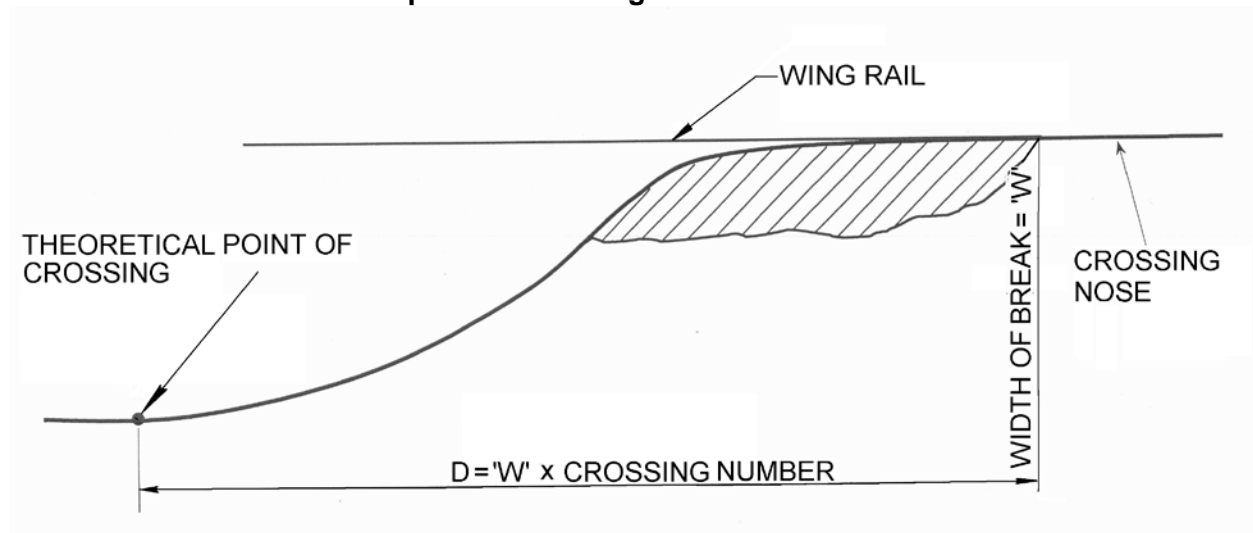


Figure 6.11: Longitudinal section of 'V' crossing nose showing relation of broken or worn nose to theoretical point of crossing





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6.3 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR 'K' CROSSING AREA

The condition assessment and response criteria for the "K" crossing area of broad gauge single and double compounds are described in tables 6.5 and 6.6.

Table 6.5: 'K' crossing area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h	40 km/h	20 km/h	pilot all trains until repaired
1. Check rail and track gauge – see figure 6.7							
Working face of check rail to 'K' crossing nose – see note [1]	1555	1555 to 1554	1553 to 1551	1550 to 1549	1548 to 1543	-	< 1543
Track gauge – running rail to 'K' crossing nose – see note [2]	1600	1600 to 1596	1595 to 1592	1591 to 1590	-	-	< 1590
2. Worn wing rails and worn or broken 'K' crossing nose – see figures 6.8 to 6.11							
Vertical wear of wing rail	running rail level	0 to 4	-	5 to 10	-	-	>10
Vertical wear of 'K' crossing nose	3 below running rail level	3 to 8 below running rail level	9 to 13 below running rail level	-	-	-	> 13 below running rail level
Broken crossing nose – thickness of 'K' crossing nose at break (within transfer area)	14 when new	-	14 to 20	-	21 to 25	-	> 25

Notes to table 6.5:

- [1] The main effectiveness of the check rail is its ability to protect the 'K' crossing nose. Wheel contact with the 'K' crossing nose is therefore a vital observation to be made during inspections. Any sign of excessive damage to the 'K' crossing nose is reason for replacement or adjustment of the check rail regardless of the check rail wear.
- [2] For wide gauge in the crossing critical area, see assessment for plain track in CP-TS-956 (Track geometry).



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Table 6.6: 'K' crossing area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Ineffective bearers or fasteners - in critical area, see also clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
>2 consecutive	pilot all trains until repaired
2. Cracks in cast 'K' crossings, either solid or rail bound - see note [3]	
cracked: non-critical or critical	increase monitoring
cracked fully: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
cracked fully: affecting the running surface	pilot all trains until repaired
3. Cracks in fabricated 'K' crossings - see note [4]	
cracked: non-critical or critical	increase monitoring
broken: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
broken: affecting the running surface	pilot all trains until repaired
4. Heel rail and other rail defects - refer to CP-TS-961 (Rails and rail joints)	
5. Crossing bolts – see figure 6.12 and note [5]	
6. Crossing and check rail blocks –see figure 6.12 and note [6]	
(any) broken or cracked	increase monitoring
7. Check rail bolts – see figure 6.12 and note [6]	
(any) loose; or 1 missing or ineffective	increase monitoring
2 missing or ineffective	immediate repair or impose speed restriction of 65 km/h
> 2 missing or ineffective	immediate repair or impose speed restriction of 20 km/h
8. Crossing flangeway - see note [7]	

Notes to table 6.6

[3] For cast manganese steel crossings (either solid or rail bound):

- a) “cracked: non-critical” means cracks longitudinally or vertically that may eventually cause a crossing to need repair.
- b) “cracked: critical” means cracks longitudinally or vertically that may lead to a piece of crossing eventually lifting or breaking out and affecting the integrity of the running surface.
- c) “cracked fully: not affecting running surface” means:
 - i) a crack that runs the full section of the crossing such that the crossing is in two pieces;
 - ii) all fastenings are secure; and
 - iii) the break does not impact on the integrity of the running surface (e.g. tang area of crossing).
- d) “cracked fully: affecting running surface” means:
 - i) a crack that runs the full section of the crossing such that the crossing is in two pieces; and
 - ii) the fastenings are not secure; or
 - iii) the break affects the running surface integrity.



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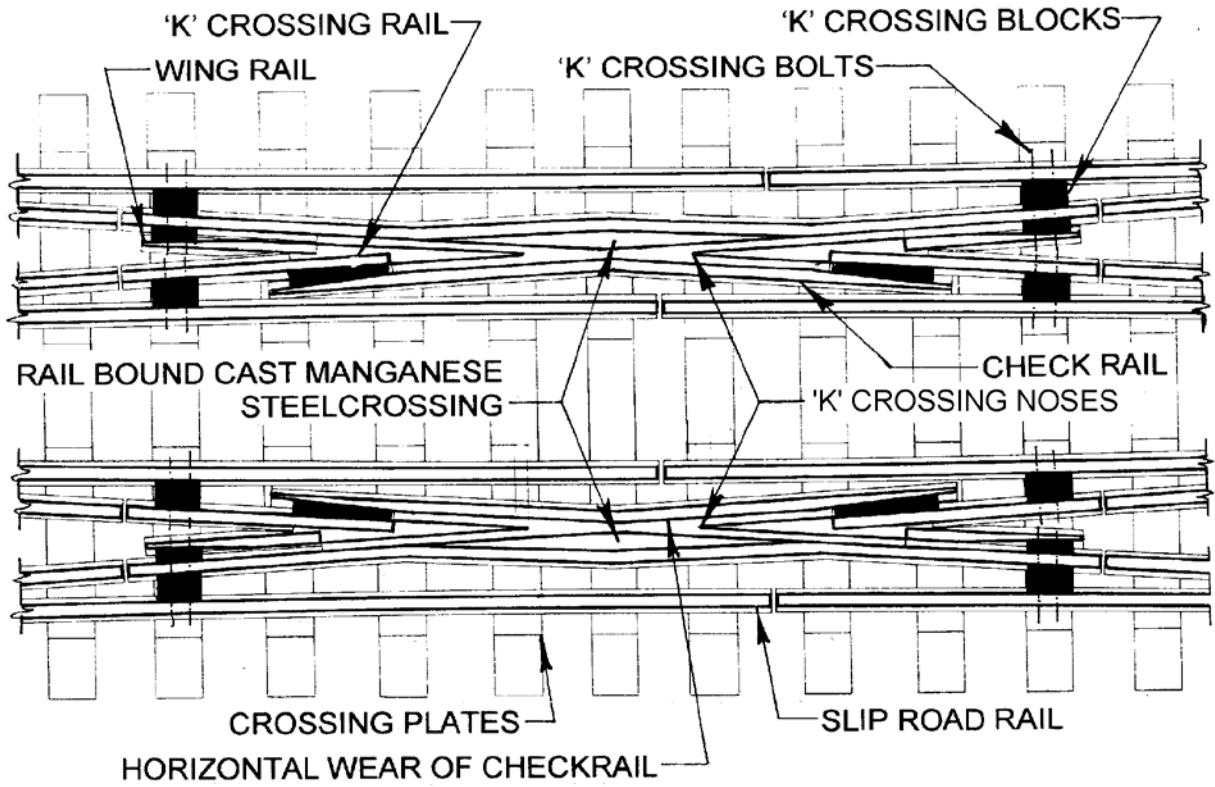
BROAD GAUGE SINGLE AND DOUBLE COMPOUNDS

- [4] For fabricated crossings:
- a) “cracked: non-critical” means cracks in a location where the rails are held in alignment by the blocks, but may eventually cause a crossing to need repair.
 - b) “cracked: critical” means cracks that if they eventually ran the full section of the rail:
 - i) the rail would be in two pieces; and
 - ii) if the fastenings were not secure, the break would affect the integrity of the running surface.
 - c) “broken: not affecting running surface” means:
 - i) cracks that run the full section of a rail component and it is in two pieces;
 - ii) all fastenings are secure;
 - iii) the rails are held in proper alignment by the blocks; and
 - iv) the break does not impact on the running surface.
 - d) “broken: affecting running surface” means:
 - i) cracks that run the full section of the rail and it is in two pieces.
 - ii) fastenings are not secure;
 - iii) the rails are not held in proper alignment by the blocks;
 - iv) or the break impacts on the running surface.
- [5] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced by tightened. Missing or ineffectiveness bolts should be replaced.
- [6] The end bolts and check blocks of all check rails should be effective.
- [7] Flangeways should be checked for blockages and cleared where blocked.

Figure 6.12: Typical ‘K’ crossing assembly (shown for rail bound manganese type)



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7.0 BROAD GAUGE CATCH POINTS

7.1 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR SWITCH AREA

The condition assessment and response criteria for the switch area of broad gauge catchpoints are described in tables 7.1 and 7.2.

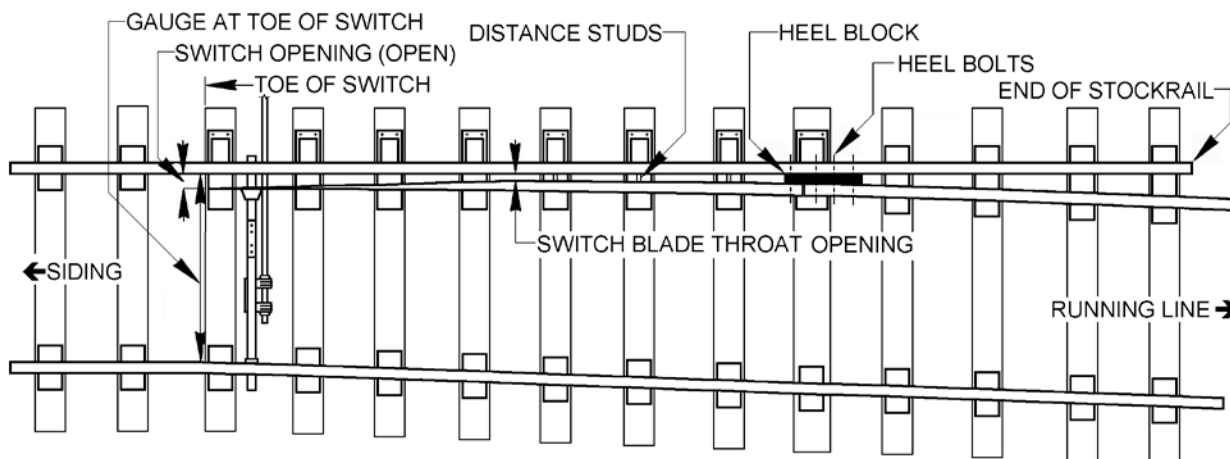
Table 7.1: Switch area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h	40 km/h	20 km/h	pilot all trains until repaired
1. Switch flangeway – see figure 7.1							
Minimum switch blade throat opening – back of switch rail to stock rail	50	40 to 50	-	-	39 to 35	-	< 35
Minimum switch opening	115	95 to 115	85 to 94	-	-	80 to 84	< 80
2. Track gauge at toe of switch – see figure 7.1 and also note [1]							
Gauge at toe of switch between stock rails – - for traditional switches	1610	1610 to 1605	1604 to 1602	-	-	1601 to 1600	<1600
- for tangential switches	1600	1600 to 1595	1594 to 1592	-	-	1591 to 1590	<1590

Notes to table 7.1

- [1] For wide gauge in the switch critical area, the assessment for plain track in CP-TS-956 (Track geometry) shall apply. Note that wide gauge is any gauge wider than 1600mm even at the toe of traditional switches, i.e. the design dimension of 1610mm is to be considered as 10mm wide.

Figure 7.1: Switch assembly





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Table 7.2: Switch area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Heel block - see note [2] and figure 7.1	
cracked	increase monitoring
broken but still effective	immediate repair or impose speed restriction of 65 km/h
missing or broken and ineffective	pilot all trains until repaired
2. Switch chairs	
(any) cracked or loose: or 1 broken or ineffective	increase monitoring
2 consecutive broken/ ineffective	immediate repair or impose speed restriction of 65 km/h
more than 2 consecutive broken or ineffective	pilot all trains until repaired
3. Distance studs or chair bolts – to avoid rail roll-over, see figure 7.1	
(any) cracked or loose; or 1 missing or ineffective	increase monitoring
2 consecutive missing or ineffective	immediate repair or impose speed restriction of 65 km/h
more than 2 consecutive missing or ineffective	pilot all trains until repaired
4. Ineffective bearers or fasteners – in critical area, also see clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
more than 2 consecutive	pilot all trains until repaired
5. Bolts – see note [3]	
6. Spreader bar including brackets, bolts, etc.	
missing or broken	pilot all trains until repaired – see also note [4]
7. Switch blade damage - see note [5]	
length of damage < 100mm	Routine inspection
length of damage 100 to 199mm	increase monitoring
length of damage ≥ 200mm	pilot all trains until repaired
8. Stock rail or switch blade face wear - angle from vertical at point of wheel flange/rail contact at switch toe - see figure 7.2	
< 18 degrees	routine inspection
18 degrees to < 26 degrees	increase monitoring
≥ 26 degrees	pilot all trains until repaired - see note [6]
9. Switch blade angle from horizontal at any point between 19mm and 30mm below running surface of stock rail - see figure 7.3	
≥ 40 degrees	routine inspection
< 40 degrees	pilot all trains until repaired
10. Stock rail gauge face wear at gauge point - where switch blade contacts stock rail	
<2mm	routine inspection
2mm to < 3mm	increase monitoring
≥ 3mm	pilot all trains until repaired - see note [7]
11. Switch toe height from stock rail running level to top of switch blade, see figure 7.4	
≥ 13mm	routine inspection
> 12mm to < 13mm	increase monitoring
≤12mm	pilot all trains until repaired
12. Switch width at toe - as presented to the wheel - see figure 7.4 and note [8]	
0 to 6mm	increase monitoring
7 to 8mm	immediate repair or impose speed restriction of 20 km/h
>8mm	pilot all trains until repaired



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13. Switch blade crippled - see note [9]		

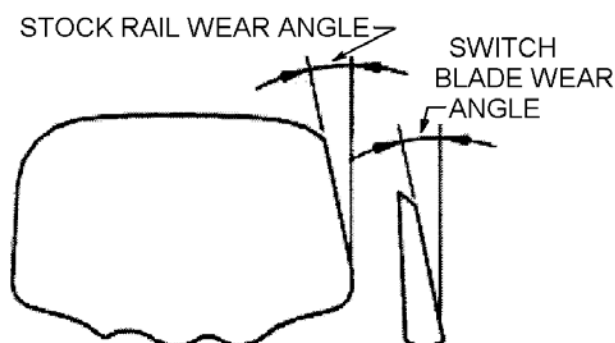
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Notes to table 7.2

- [2] Applies to fixed heel blocks only. Pivot heel cracks and breaks should be assessed by a qualified worker.
- [3] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, 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 not to be fully tightened so as to allow for design switch movement.
- [4] An alternative action that may be taken is to install a switch clamp and/or spike the switch in accordance with the action specified in clause 3.3(g).
- [5] "Length of damage" implies damage anywhere in the switch blade deeper than 19mm from the running surface. The response applies to chamfered switches only (i.e. not undercut switches). When a worn switch blade at the end of its service life is being replaced, a complete half set of switches should be installed. In table 7.2,
 - i. "length of damage < 100mm" also applies to consecutive areas of damage less than 100mm apart and forming a total length less than 100mm.
 - ii. "length of damage 100 to 199mm" also applies to consecutive areas of damage less than 199mm apart and forming a total length between 100mm and 199mm.
 - iii. "length of damage \geq 200mm" also applies to consecutive areas of damage less than 200mm apart and forming a total length more than 200mm.
- [6] Where the gauge face angle limit is exceeded, the action should be to replace the complete half set of switches.
- [7] It is recommended that the stock rail be replaced. Following repair, it is necessary to check the fit between the switch blade and stock rail. The replacement of switches should be carried out with care where the stock rail is approaching this amount of wear to ensure that a blunt nose is not presented to the wheel.
- [8] Switch width at toe includes the effects of side wear on stock rails and closed gap between switch blade and stock rail. The gap between the switch blade and stock rail should not exceed 3mm at any time.
- [9] A crippled switch blade refers to a switch blade that has suffered damage from a run-through or derailment. Such switch blades may be suitable for temporary repair and re-installation to a geometry suitable for train movements at 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.

Figure 7.2: Stock rail and switch blade wear angle detail:



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BROAD GAUGE CATCHPOINTS

Figure 7.3: Broken or worn switch blade toe detail:

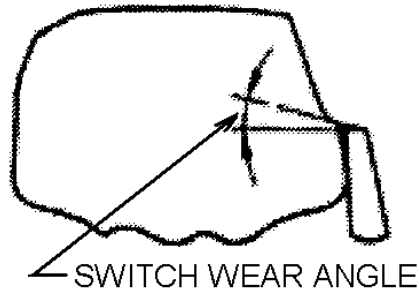


Figure 7.4: Stock rail side wear and switch blade width/height detail:

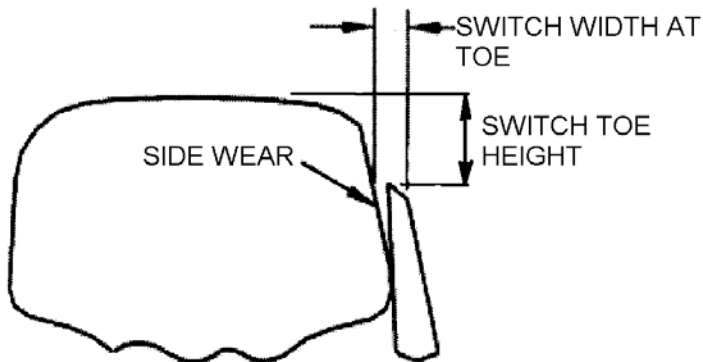
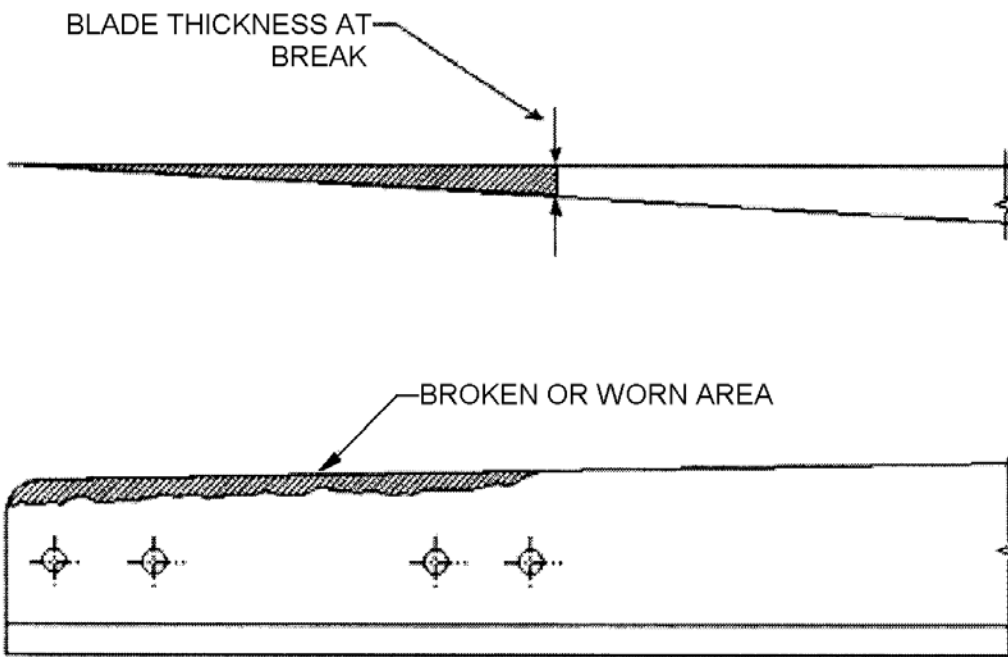


Figure 7.5: Broken or worn switch blade toe detail:





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8.0 MIXED GAUGE DIAMONDS

8.1 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR 'V' CROSSING AREA

The condition assessment and response criteria for the "V" crossing area of mixed gauge diamonds are described in tables 8.1 and 8.2.

Table 8.1: 'V' crossing area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h	40 km/h	20 km/h	pilot all trains until repaired
1. Check rail and track gauge – see figures 8.3 and 8.4							
Working face of broad gauge check rail to crossing nose – see note [1]	1555	1555 to 1554	1553 to 1551	1550 to 1549	1548 to 1543	-	< 1543
Working face of standard gauge check rail to crossing nose – see note [1]	1390	1390 to 1389	1388 to 1386	1385 to 1384	1383 to 1378	-	< 1378
Track gauge – broad gauge running rail to crossing nose – see note [2]	1600	1600 to 1596	1595 to 1592	1591 to 1590	-	-	< 1590
Track gauge – standard gauge running rail to crossing nose – see note [2]	1435	1435 to 1431	1430 to 1427	1426 to 1425	-	-	< 1425
2. Worn wing rails and worn or broken 'V' crossing nose – see figure 8.5 to 8.8							
Vertical wear of wing rail	running rail level	0 to 4	-	5 to 10	-	-	>10
Vertical wear of 'V' crossing nose	3 below running rail level	3 to 8 below running rail level	9 to 13 below running rail level	-	-	-	> 13 below running rail level
Broken crossing nose – thickness of 'V' crossing nose at break (within transfer area)	14 when new	-	14 to 20	-	21 to 25	-	> 25

Notes to table 8.1:

- [1] The main effectiveness of the check rail is its ability to protect the 'V' crossing nose. Wheel contact with the 'V' crossing nose is therefore a vital observation to be made during inspections. Any sign of excessive damage to the 'V' crossing nose is reason for replacement or adjustment of the check rail regardless of the check rail wear.
- [2] For wide gauge in the crossing critical area, see assessment for plain track in CP-TS-956 (Track geometry).



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Table 8.2: 'V' crossing area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Ineffective bearers or fasteners - in critical area, see also clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
>2 consecutive	pilot all trains until repaired
2. Cracks in cast 'V' crossings, either solid or rail bound - see note [3]	
cracked: non-critical or critical	increase monitoring
cracked fully: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
cracked fully: affecting the running surface	pilot all trains until repaired
3. Cracks in fabricated 'V' crossings - see note [4]	
cracked: non-critical or critical	increase monitoring
broken: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
broken: affecting the running surface	pilot all trains until repaired
4. Heel rail and other rail defects - refer to CP-TS-961 (Rails and rail joints)	
5. Crossing bolts – see figures 8.1 and 8.2 and note [5]	
6. Crossing and check rail blocks –see figures 8.1 and 8.2 and note [6]	
(any) broken or cracked	increase monitoring
7. Check rail bolts – see figure 8.1 and 8.2 and note [6]	
loose; or 1 missing or ineffective	increase monitoring
2 missing or ineffective	immediate repair or impose speed restriction of 65 km/h
> 2 missing or ineffective	immediate repair or impose speed restriction of 20 km/h
8. Crossing flangeway - see note [7]	

Notes to table 8.2

[3] For cast manganese steel crossings (either solid or rail bound):

- a) "cracked: non-critical" means cracks longitudinally or vertically that may eventually cause a crossing to need repair.
- b) "cracked: critical" means cracks longitudinally or vertically that may lead to a piece of crossing eventually lifting or breaking out and affecting the integrity of the running surface.
- c) "cracked fully: not affecting running surface" means:
 - i) a crack that runs the full section of the crossing such that the crossing is in two pieces;
 - ii) all fastenings are secure; and
 - iii) the break does not impact on the integrity of the running surface (e.g. tang area of crossing).
- d) "cracked fully: affecting running surface" means:
 - i) a crack that runs the full section of the crossing such that the crossing is in two pieces; and
 - ii) the fastenings are not secure; or
 - iii) the break affects the running surface integrity.



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[4] For fabricated crossings:

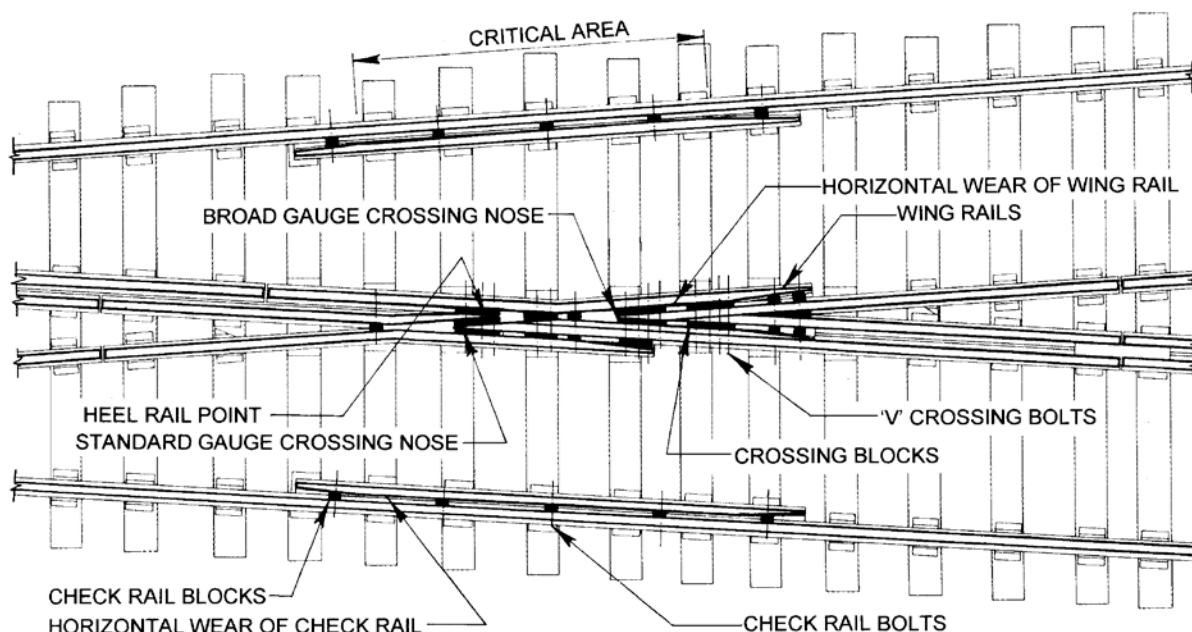
- a) “cracked: non-critical” means cracks in a location where the rails are held in alignment by the blocks, but may eventually cause a crossing to need repair.
- b) “cracked: critical” means cracks that if they eventually ran the full section of the rail:
 - i) the rail would be in two pieces; and
 - ii) if the fastenings were not secure, the break would affect the integrity of the running surface.
- c) “broken: not affecting running surface” means cracks that run the full section of a rail component and it is in two pieces;
 - i) all fastenings are secure;
 - ii) the rails are held in proper alignment by the blocks; and
 - iii) the break does not impact on the running surface.
- d) “broken: affecting running surface” means:
 - i) cracks that run the full section of the rail and it is in two pieces.
 - ii) fastenings are not secure;
 - iii) the rails are not held in proper alignment by the blocks;
 - iv) or the break impacts on the running surface.

[5] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced be tightened. Missing or ineffectiveness bolts should be replaced.

[6] The end bolts and check blocks of all check rails should be effective.

[7] Flangeways should be checked for blockages and cleared where blocked.

Figure 8.1: Typical ‘V’ crossing assembly (shown for fabricated type)



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Figure 8.2: Typical 'V' crossing assembly (shown for rail bound manganese type)

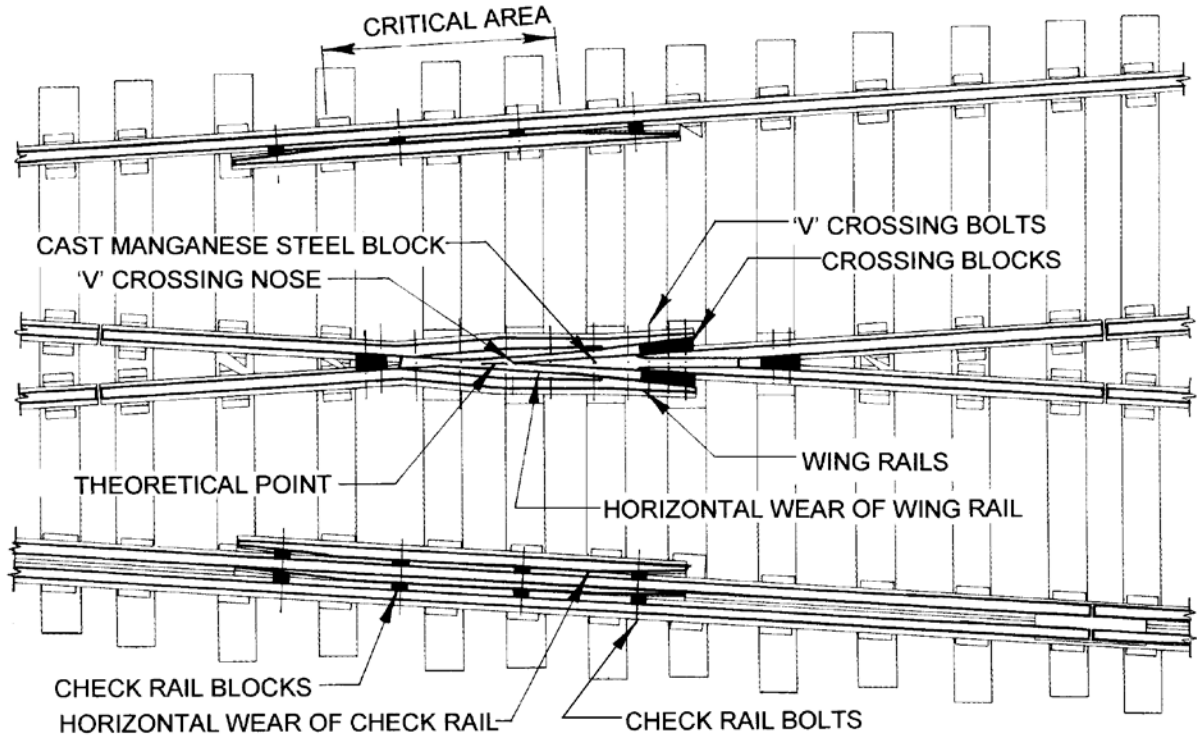
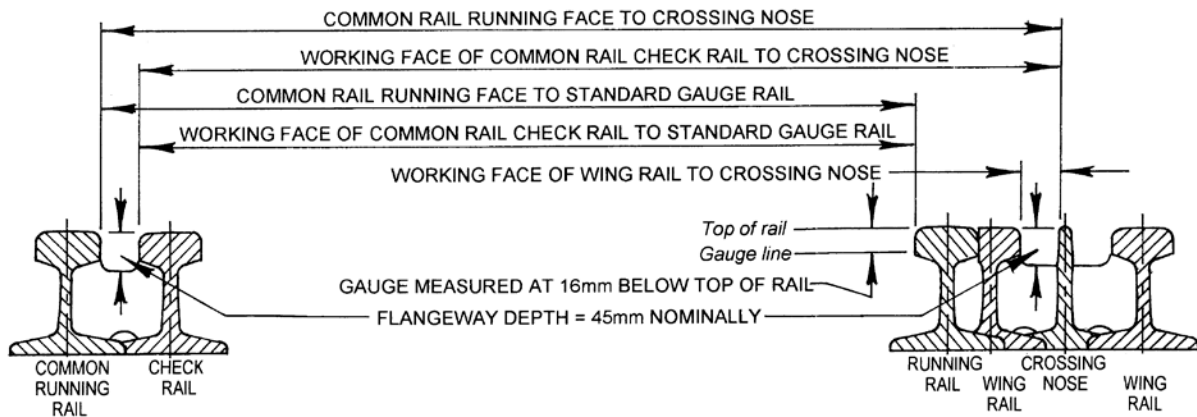


Figure 8.3: Typical part section through 'V' and 'K' crossings (shown for fabricated types)



NOTE: THE CROSS-SECTION SHOWN IS TYPICAL OF CROSS-SECTIONS TO THE LEFT AND RIGHT OF THE 'V' CROSSINGS. FOR THE OTHER CROSS-SECTIONS, THE SAME DISTANCES (WHERE APPLICABLE) ARE TO BE MEASURED AND ASSESSED IN ACCORDANCE WITH THE TABLES.

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Figure 8.4: Part section through 'V' and 'K' crossings (shown for rail bound manganese types)

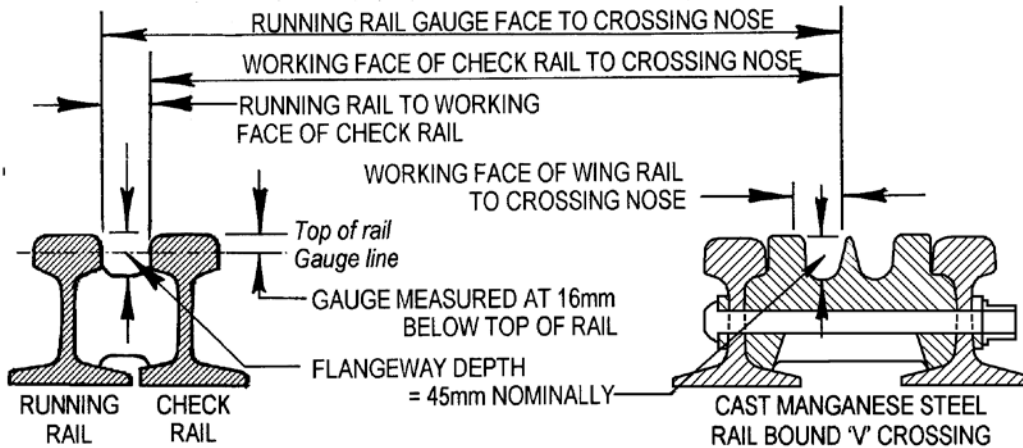


Figure 8.5: Fabricated crossings - detail of worn or broken crossing nose – Note: For enlargement of crossing nose see figure 8.6

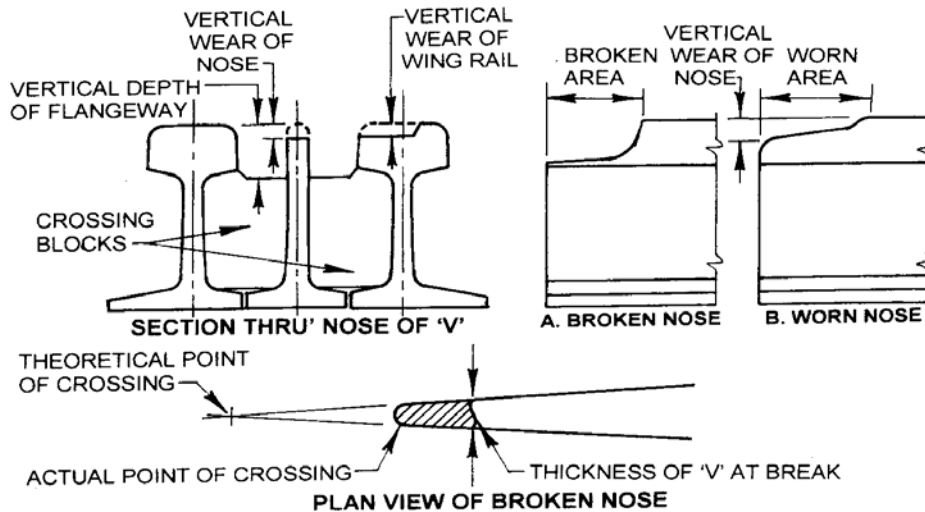
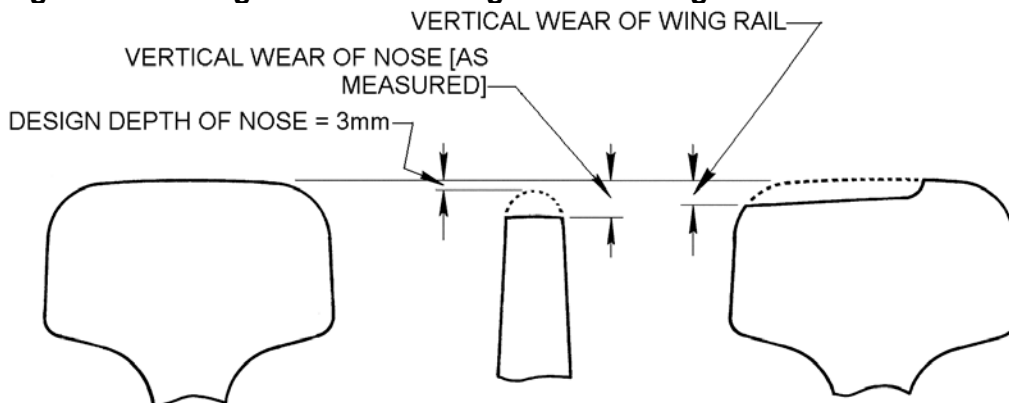


Figure 8.6: Enlargement of crossing nose showing vertical wear



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Figure 8.7: Rail bound manganese crossing - detail of worn or broken crossing nose

Note: Details of vertical wear of nose and wing rail are similar to those shown for fabricated crossing in figure 8.5

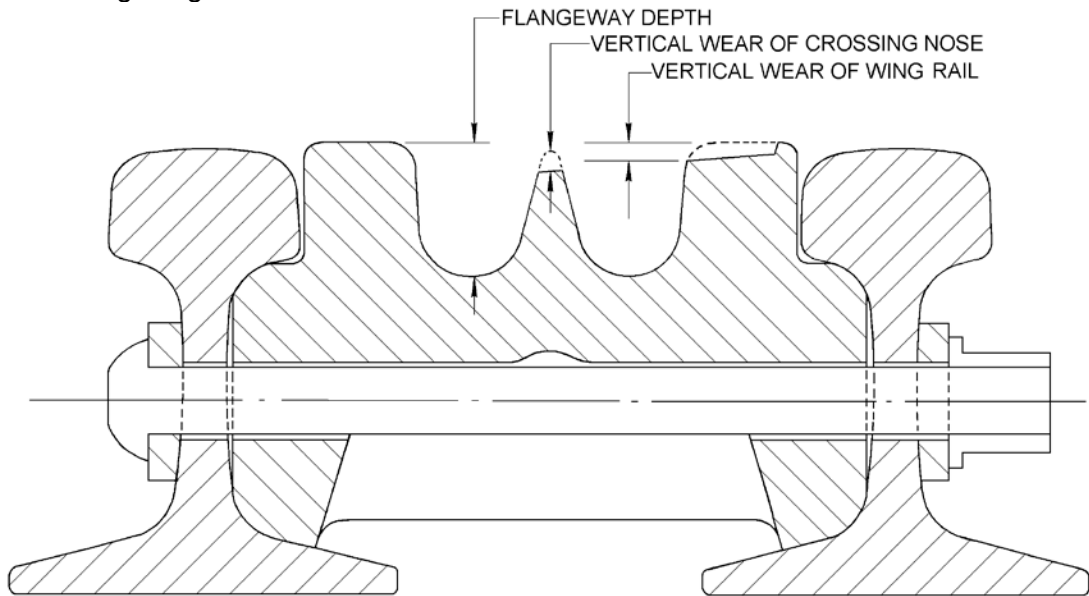
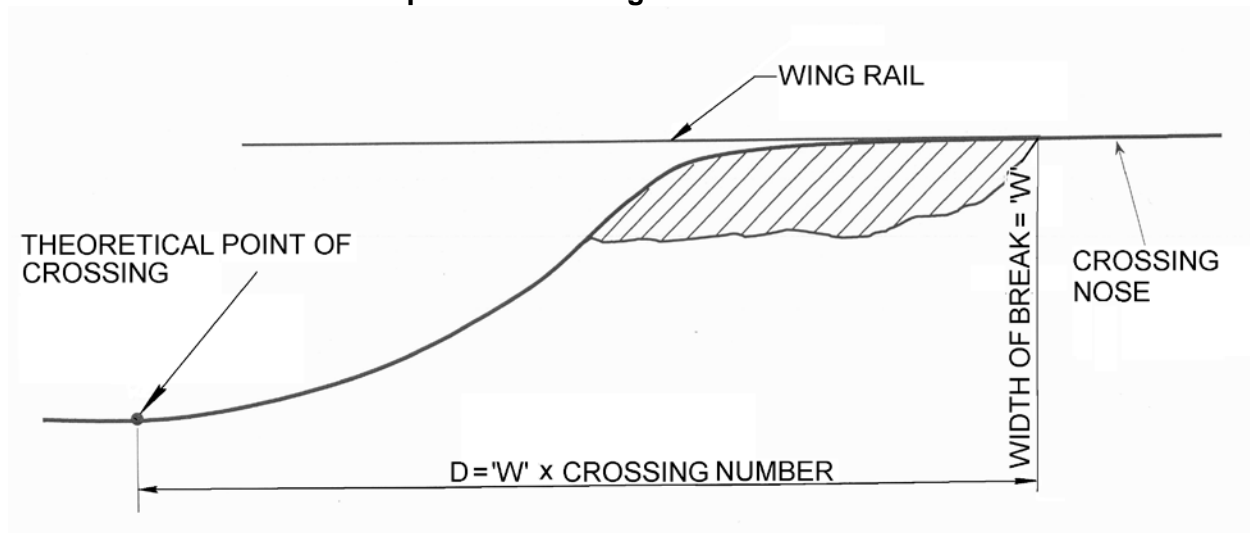


Figure 8.8: Longitudinal section of 'V' crossing nose showing relation of broken or worn nose to theoretical point of crossing





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8.2 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR 'K' CROSSING AREA

The condition assessment and response criteria for the "K" crossing area of mixed gauge diamonds are described in tables 8.3 and 8.4.

Table 8.3: 'K' crossing area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h	40 km/h	20 km/h	pilot all trains until repaired
1. Check rail and track gauge – see figures 8.3 and 8.4							
Working face of broad gauge check rail to crossing nose – see note [1]	1555	1555 to 1554	1553 to 1551	1550 to 1549	1548 to 1543	-	< 1543
Working face of standard gauge check rail to crossing nose – see note [1]	1390	1390 to 1389	1388 to 1386	1385 to 1384	1383 to 1378	-	< 1378
Track gauge – broad gauge running rail to crossing nose – see note [2]	1600	1600 to 1596	1595 to 1592	1591 to 1590	-	-	< 1590
Track gauge – standard gauge running rail to crossing nose – see note [2]	1435	1435 to 1431	1430 to 1427	1426 to 1425	-	-	< 1425
2. Worn wing rails and worn or broken 'K' crossing nose – see figures 8.5 to 8.8							
Vertical wear of wing rail	running rail level	0 to 4	-	5 to 10	-	-	>10
Vertical wear of 'K' crossing nose	3 below running rail level	3 to 8 below running rail level	9 to 13 below running rail level	-	-	-	> 13 below running rail level
Broken crossing nose – thickness of 'K' crossing nose at break (within transfer area)	14 when new	-	14 to 20	-	21 to 25	-	> 25

Notes to table 8.3:

- [1] The main effectiveness of the check rail is its ability to protect the 'K' crossing nose. Wheel contact with the 'K' crossing nose is therefore a vital observation to be made during inspections. Any sign of excessive damage to the 'K' crossing nose is reason for replacement or adjustment of the check rail regardless of the check rail wear.
- [2] For wide gauge in the crossing critical area, see assessment for plain track in CP-TS-956 (Track geometry).



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Table 8.4: 'K' crossing area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Ineffective bearers or fasteners - in critical area, see also clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
>2 consecutive	pilot all trains until repaired
2. Cracks in cast 'K' crossings, either solid or rail bound - see note [3]	
cracked: non-critical or critical	increase monitoring
cracked fully: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
cracked fully: affecting the running surface	pilot all trains until repaired
3. Cracks in fabricated 'K' crossings - see note [4]	
cracked: non-critical or critical	increase monitoring
broken: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
broken: affecting the running surface	pilot all trains until repaired
4. Heel rail and other rail defects - refer to CP-TS-961 (Rails and rail joints)	
5. Crossing bolts – see figure 8.9 and note [5]	
6. Crossing and check rail blocks –see figure 8.9 and note [6]	
(any) broken or cracked	increase monitoring
7. Check rail bolts – see figure 8.9 and note [6]	
loose; or 1 missing or ineffective	increase monitoring
2 missing or ineffective	immediate repair or impose speed restriction of 65 km/h
> 2 missing or ineffective	immediate repair or impose speed restriction of 20 km/h
8. Crossing flangeway - see note [7]	

Notes to table 8.4

[3] For cast manganese steel crossings (either solid or rail bound):

- a) "cracked: non-critical" means cracks longitudinally or vertically that may eventually cause a crossing to need repair.
- b) "cracked: critical" means cracks longitudinally or vertically that may lead to a piece of crossing eventually lifting or breaking out and affecting the integrity of the running surface.
- c) "cracked fully: not affecting running surface" means:
 - i) a crack that runs the full section of the crossing such that the crossing is in two pieces;
 - ii) all fastenings are secure; and
 - iii) the break does not impact on the integrity of the running surface (e.g. tang area of crossing).
- d) "cracked fully: affecting running surface" means:
 - i) a crack that runs the full section of the crossing such that the crossing is in two pieces; and
 - ii) the fastenings are not secure; or
 - iii) the break affects the running surface integrity.



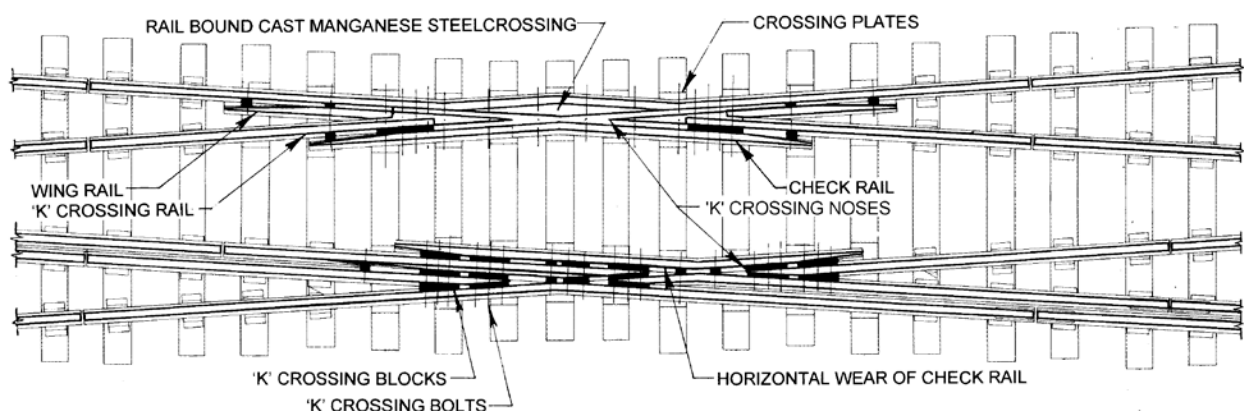
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- [4] For fabricated crossings:
- a) “cracked: non-critical” means cracks in a location where the rails are held in alignment by the blocks, but may eventually cause a crossing to need repair.
 - b) “cracked: critical” means cracks that if they eventually ran the full section of the rail:
 - i) the rail would be in two pieces; and
 - ii) if the fastenings were not secure, the break would affect the integrity of the running surface.
 - c) “broken: not affecting running surface” means:
 - i) cracks that run the full section of a rail component and it is in two pieces;
 - ii) all fastenings are secure;
 - iii) the rails are held in proper alignment by the blocks; and
 - iv) the break does not impact on the running surface.
 - d) “broken: affecting running surface” means:
 - i) cracks that run the full section of the rail and it is in two pieces.
 - ii) fastenings are not secure;
 - iii) the rails are not held in proper alignment by the blocks;
 - iv) or the break impacts on the running surface.
- [5] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced be tightened. Missing or ineffectiveness bolts should be replaced.
- [6] The end bolts and check blocks of all check rails should be effective.
- [7] Flangeways should be checked for blockages and cleared where blocked.

Figure 8.9: Typical ‘K’ crossing assembly (with fabricated double ‘K’ and rail bound manganese single ‘K’)





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9.0 FIXED POINT CROSSOVERS

9.1 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR FIXED POINT AREA

The condition assessment and response criteria for fixed point crossovers are described in tables 9.5 and 9.6.

Table 9.1: Fixed point area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h	40 km/h	20 km/h	pilot all trains until repaired
1. Check rail and track gauge – see figure 9.1							
Gauge face of broad gauge running rail to back of fixed point nose – see note [1]	1545	1545 to 1544	1543 to 1541	-	-	-	< 1541
Working face of standard gauge check rail to gauge face of point of fixed point – see note [1]	1390	1390 to 1389	1388 to 1378	-	-	-	< 1378
Track gauge – broad gauge – see note [2]	1600	1600 to 1596	1595 to 1590	-	-	-	< 1590
Track gauge – standard gauge – see note [2]	1435	1435 to 1431	1430 to 1425	-	-	-	< 1425
2. Worn outer rails and worn or broken fixed point nose – see figures 9.2 and 9.3							
Vertical wear of outer rails of fixed point	running rail level	0 to 4 below running rail level	5 to 10 below running rail level	-	-	-	>10 below running rail level
Vertical wear of fixed point nose	6 below running rail level	6 to 8 below running rail level	9 to 13 below running rail level	-	-	-	> 13 below running rail level
Depth of fixed point block – see figure 9.2 and note [3]	25.5 below running rail level	25.5 to 29 below running rail level	-	-	-	-	> 30 below running rail level
Fixed point – width of point at break	14 when new	-	14 to 25	-	-	-	> 25

Notes to table 9.1:

- [1] The main effectiveness of the check rails are their ability to protect the fixed point nose. Wheel contact with the fixed point nose is therefore a vital observation to be made during inspections. Any sign of excessive damage to the fixed point nose is reason for replacement or adjustment of the track elements regardless of the check rail wear.



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- [2] For wide gauge outside the fixed point critical area, see assessment for plain track in CP-TS-956 (Track geometry).
- [3] When depth of fixed point block reaches 29mm, arrangements should be made for building up the block by welding or replacing complete fixed point unit.



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Table 9.2: Fixed point area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Ineffective bearers or fasteners - in critical area, see also clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
>2 consecutive	pilot all trains until repaired
2. Cracks in fixed point block - see note [4]	
cracked: non-critical or critical	increase monitoring
broken: not affecting the running surface	immediate repair or impose speed restriction of 5 km/h
broken: affecting the running surface	pilot all trains until repaired
3. Running rail defects - refer to CP-TS-961 (Rails and rail joints)	
4. Crossing bolts - see note [5]	
5. Check rail blocks –see note [6]	
(any) broken or cracked	increase monitoring
6. Check rail bolts – see note [6]	
(any) loose; 1 missing or ineffective	increase monitoring
2 missing or ineffective	immediate repair or impose speed restriction of 65 km/h
> 2 missing or ineffective	immediate repair or impose speed restriction of 20 km/h
7. All flangeways - see note [7]	

Notes to table 9.6

[4] For cast steel block (rail bound):

- a) “cracked: non-critical” means cracks longitudinally or vertically that may eventually cause a crossing to need repair.
- b) “cracked: critical” means cracks longitudinally or vertically that may lead to a piece of crossing eventually lifting or breaking out and affecting the integrity of the running surface.
- c) “cracked fully: not affecting running surface” means:
 - i) a crack that runs the full section of the crossing such that the crossing is in two pieces;
 - ii) all fastenings are secure; and
 - iii) the break does not impact on the integrity of the running surface (e.g. tang area of crossing).
- d) “cracked fully: affecting running surface” means:
 - i) a crack that runs the full section of the crossing such that the crossing is in two pieces; and
 - ii) the fastenings are not secure; or
 - iii) the break affects the running surface integrity.

[5] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced be tightened. Missing or ineffectiveness bolts should be replaced.

[6] The end bolts and check blocks of all check rails should be effective.



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[7] Flangeways should be checked for blockages and cleared where blocked.

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Figure 9.1: Fixed point crossover assembly

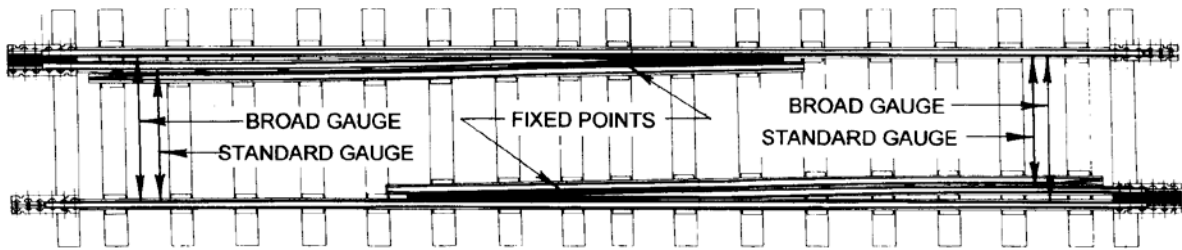


Figure 9.2: Part section through fixed point

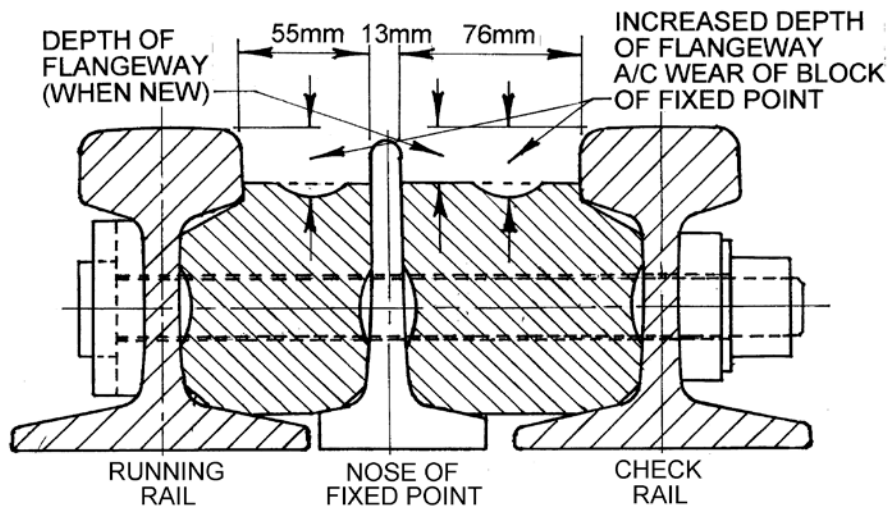
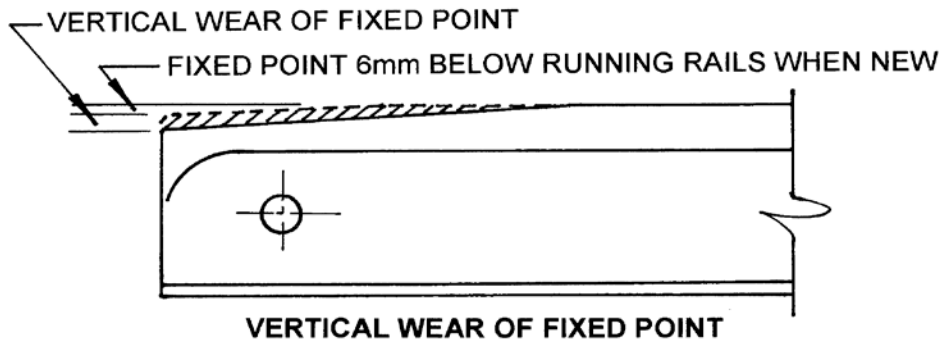


Figure 9.3: Detail of worn or broken fixed point nose



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10.0 PORT ADELAIDE 'A' CABIN JUNCTION

10.1 MIXED GAUGE TRACKWORK

10.1.1 Track layout

Figure 10.1 (right) shows in diagrammatic form (i.e. not to scale) the layout of tracks and points and crossings at the junction of lines at Port Adelaide 'A' cabin. The outer rails of the tracks shown represent broad gauge. The standard gauge is shown with an additional rail inside the broad gauge rail on either the left or the right hand side to reflect the arrangement of tracks on the ground.

10.1.2 Consideration of criteria – mixed gauge turnouts

The following sub-sections consider criteria for monitoring and maintenance of the mixed gauge points and crossings as follows:

- 10.2** (clause 10.2.1) - Switches for turnouts types 29 and 40;
- 10.2** (clause 10.2.2) - Switches and fixed points for turnouts types 27 and 32;
- 10.3** - 'K' crossings for turnouts types 27, 30 and 40;
- 10.4** - 'V' crossings for turnouts types 27, 29, 32 and 40

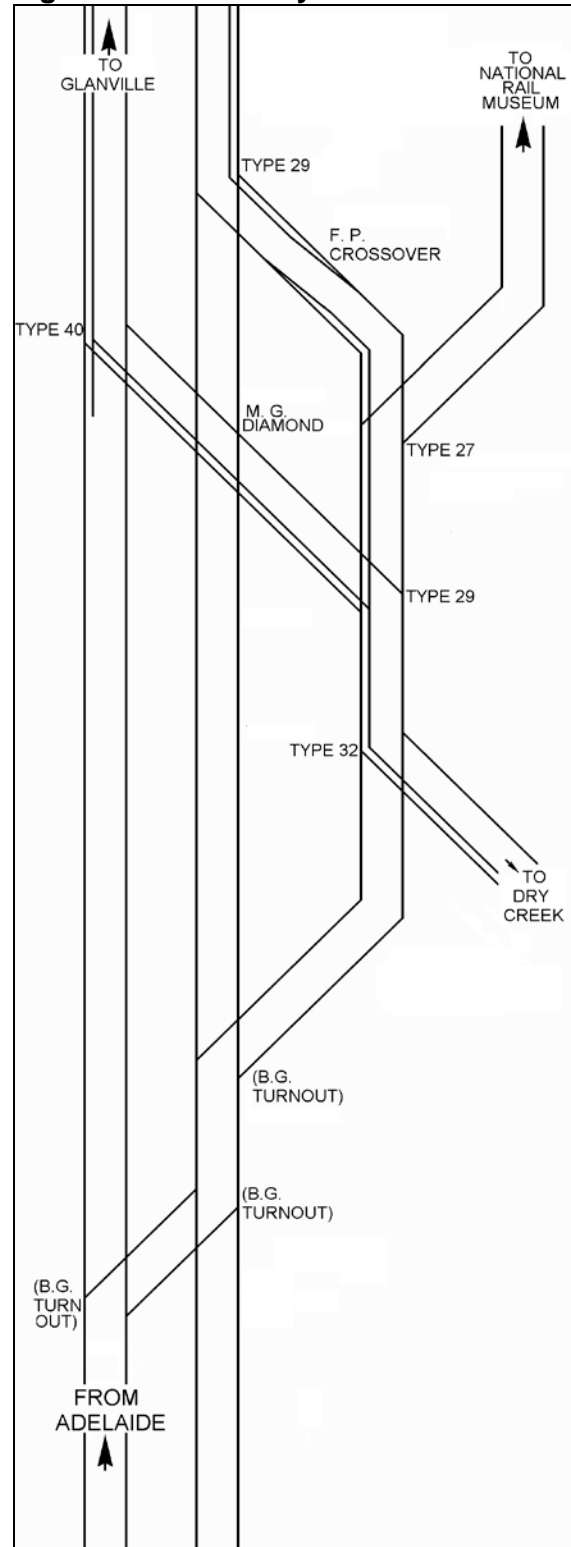
10.1.3 Consideration of criteria – mixed gauge diamond

Criteria for monitoring and maintenance of the mixed gauge diamond on the up Adelaide running line, are described in section 8.0 "Mixed gauge diamonds."

10.1.4 Consideration of criteria – fixed point crossover

Criteria for monitoring and maintenance of the fixed point crossover on the up Dry Creek running line, are described in section 9.0 "Fixed point crossover."

Figure 10.1: Track layout Port Adelaide





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10.2 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR SWITCH AND FIXED POINT AREA

10.2.1 Condition assessment and response criteria for switch area – types 29 and 40

The condition assessment and response criteria for the switch area of types 29 and 40 mixed gauge turnout are described in tables 10.1 and 10.3.

Table 10.1: Switch area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h - see note [1]	40 km/h - see note [1]	20 km/h - see note [1]	pilot all trains until repaired
1. Switch flangeway – see figure 10.2							
Minimum switch blade throat opening (flangeway) – back of switch rail to stock rail	45	40 to 45	-	-	39 to 35	-	< 35
Minimum switch opening	92	-	85 to 92	-	-	80 to 84	< 80
2. Track gauge at toe of switch (broad gauge) see figure 10.2 and also note [2]							
Gauge at toe of switch between stock rails (for traditional switches)	1610	1610 to 1605	-	1604 to 1602	-	1601 to 1600	<1600
3. Track gauge at toe of switch (standard gauge) – see figure 10.2 and also note [2]							
Gauge at toe of switch between stock rails (for traditional switches)	1445	1445 to 1440	-	1439 to 1437	-	1436 to 1435	<1435

Notes to tables 10.1 and 10.2

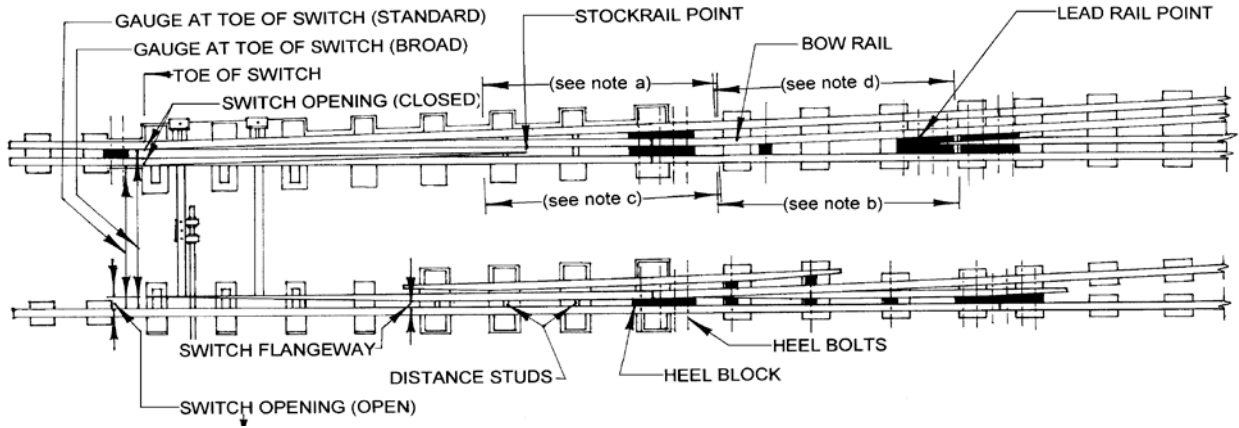
[1] Where the speed is limited to 15km/h because of fixed points, the criteria shown under 65, 40 and 20km/h shall only call for increased monitoring.

[2] For wide gauge in the switch critical area, the assessment for plain track in CP-TS-956 (Track geometry) shall apply. Note that wide gauge is any gauge wider than 1600mm or 1435mm even at the toe of traditional switches, i.e. the design dimension of 1610mm or 1445mm is to be considered as 10mm wide.

Figure 10.2: Typical switch and ‘K’ crossing assembly – shown for type 29:



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10.2.2 Condition assessment and response criteria for switch and fixed point area – types 27 and 32

The condition assessment and response criteria for the switch and fixed point area of types 27 and 32 mixed gauge turnout are described in tables 10.2 and 10.3.

Table 10.2: Switch area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h	40 km/h	20 km/h	pilot all trains until repaired
1. Switch flangeway – see figure 10.3							
Minimum switch blade throat opening – back of switch rail to stock rail	45	45 to 40	39 to 35	-	-	-	< 35
Minimum switch or fixed point opening	92	-	92 to 80	-	-	-	< 80
2. Worn outer rails and worn or broken fixed point nose – see figures 10.3, 10.4 and 10.5							
Vertical wear of outer rails of fixed point	running rail level	0 to 4 below running rail level	5 to 10 below running rail level	-	-	-	>10 below running rail level
Vertical wear of fixed point nose	6 below running rail level	6 to 8 below running rail level	9 to 13 below running rail level	-	-	-	> 13 below running rail level
Depth of fixed point block – see figure 10.4 and note [3]	25.5 below running rail level	25.5 to 29 below running rail level	-	-	-	-	> 30 below running rail level
Fixed point – width of point at break	14 when new	-	14 to 25	-	-	-	> 25
3. Track gauge at toe of switch (broad gauge) see figure 10.3 and also note [2]							
Gauge at toe of switch between stock rails (for traditional switches)	1610	1610 to 1605	1604 to 1600	-	-	-	<1600
4. Track gauge at toe of switch (standard gauge) – see figure 10.3 and also note [2]							
Gauge at toe of switch between stock rails (for traditional switches)	1445	1445 to 1440	1439 to 1435	-	-	-	<1435

Notes to table 10.2

- [3] Although the nose of the fixed point is designed to be nominally 6mm below the level of the wing rails, the wear on the nose is measured in mm below the wing rail running surface. When depth of fixed point block reaches 29mm, arrangements should be made for building up the block by welding or replacing the complete fixed point unit. The main effectiveness of the check rails are their ability to protect the fixed point nose. Wheel contact with the fixed point nose is therefore a vital observation to be made during inspections. Any sign of excessive damage to the fixed point nose is reason for replacement or adjustment of the track elements regardless of the check rail wear.

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Figure 10.3: Typical switch, fixed point and 'K' crossing assembly – shown for type 27:

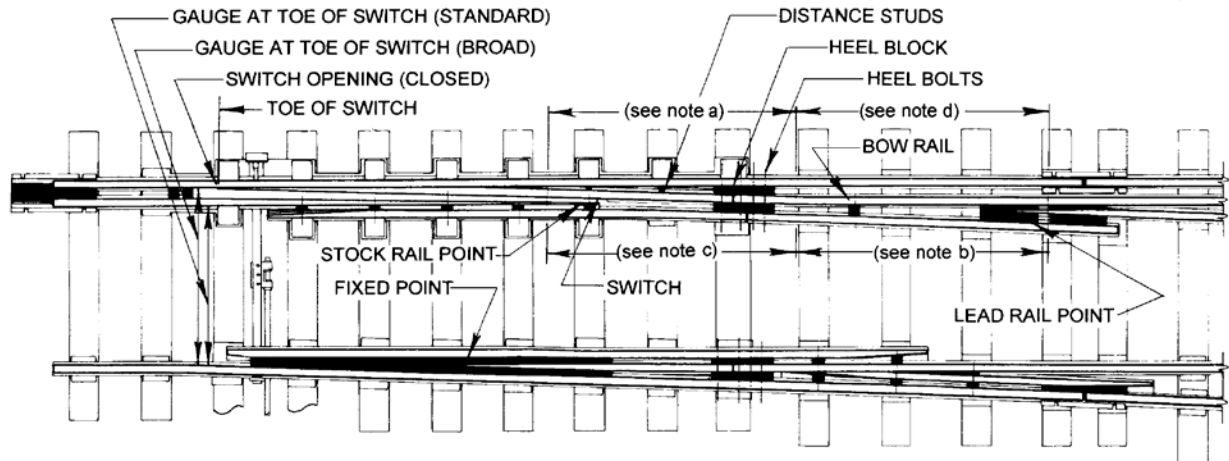


Figure 10.4: Part section through fixed point

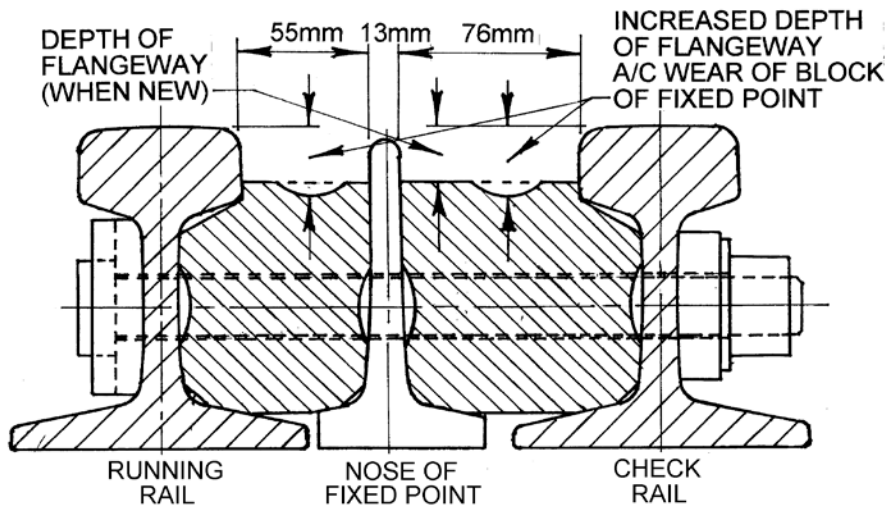
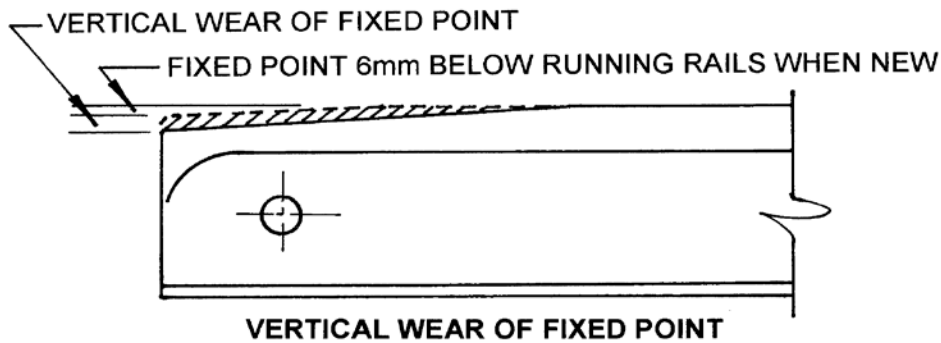


Figure 10.5: Detail of worn or broken fixed point nose





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Table 10.3: Switch and fixed point area assessment responses for key component condition:

COMPONENT AND CONDITION	ACTION
1. Heel block - see note [4] and figures 10.2 and 10.3	
2. Switch chairs	
(any) cracked or loose: or 1 broken or ineffective	increase monitoring
2 consecutive broken or ineffective	immediate repair or impose speed restriction of 65 km/h
more than 2 consecutive broken or ineffective	pilot all trains until repaired
3. Distance studs or chair bolts - see figures 10.2 and 10.3	
(any) cracked or loose; or 1 missing or ineffective	increase monitoring
2 consecutive missing or ineffective	immediate repair or impose speed restriction of 65 km/h
more than 2 consecutive missing or ineffective	pilot all trains until repaired
4. Ineffective bearers or fasteners – in critical area, also see clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
more than 2 consecutive	pilot all trains until repaired
5. Bolts – see note [5]	
6. Spreader bar including brackets, bolts, etc.	
missing or broken	pilot all trains until repaired – see also note [6]
7. Switch blade damage - see note [7]	
length of damage < 100mm	Routine inspection
length of damage 100 to 199mm	increase monitoring
length of damage ≥ 200mm	pilot all trains until repaired
8. Stock rail or switch blade face wear - angle from vertical at point of wheel flange/rail contact at switch toe - see figure 10.6	
< 18 degrees	routine inspection
18 degrees to < 26 degrees	increase monitoring
≥ 26 degrees	pilot all trains until repaired - see note [8]
9. Switch blade angle from horizontal at any point between 19mm and 30mm below running surface of stock rail - see figure 10.7	
≥ 40 degrees	routine inspection
< 40 degrees	pilot all trains until repaired
10. Stock rail gauge face wear at gauge point - where switch blade contacts stock rail	
<2mm	routine inspection
2mm to < 3mm	increase monitoring
≥ 3mm	pilot all trains until repaired - see note [9]
11. Switch toe height from stock rail running level to top of switch blade, see figure 10.8	
≥ 13mm	routine inspection
> 12mm to < 13mm	increase monitoring
≤12mm	pilot all trains until repaired
12. Switch width at toe - as presented to the wheel - see figure 10.8 and note [10]	
0 to 6mm	increase monitoring
7 to 8mm	immediate repair or impose speed restriction of 20 km/h
>8mm	pilot all trains until repaired
13. Switch blade crippled - see note [11]	

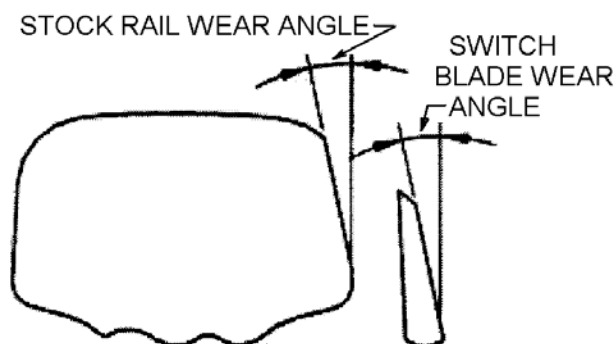
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Notes to table 10.3

- [4] Pivot heel cracks and breaks should be assessed by a qualified worker.
- [5] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, 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 not to be fully tightened so as to allow for design switch movement.
- [6] An alternative action that may be taken is to install a switch clamp and/or spike the switch in accordance with the action specified in clause 3.3(g).
- [7] “Length of damage” implies damage anywhere in the switch blade deeper than 19mm from the running surface. The response applies to chamfered switches only (i.e. not undercut switches). When a worn switch blade at the end of its service life is being replaced, a complete half set of switches should be installed. In table 10.3,
 - i. “length of damage < 100mm” also applies to consecutive areas of damage less than 100mm apart and forming a total length less than 100mm.
 - ii. “length of damage 100 to 199mm” also applies to consecutive areas of damage less than 199mm apart and forming a total length between 100mm and 199mm.
 - iii. “length of damage \geq 200mm” also applies to consecutive areas of damage less than 200mm apart and forming a total length more than 200mm.
- [8] Where the gauge face angle limit is exceeded, the action should be to replace the complete half set of switches.
- [9] It is recommended that the stock rail be replaced. Following repair, it is necessary to check the fit between the switch blade and stock rail. The replacement of switches should be carried out with care where the stock rail is approaching this amount of wear to ensure that a blunt nose is not presented to the wheel.
- [10] Switch width at toe includes the effects of side wear on stock rails and closed gap between switch blade and stock rail. The gap between the switch blade and stock rail should not exceed 3mm at any time.
- [11] 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 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 reduced speed of operation both in terms of geometry and structural integrity. The reduced speed of operation should not exceed 40km/h.

Figure 10.6: Stock rail and switch blade wear angle detail:



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Figure 10.7: Broken or worn switch blade toe detail:

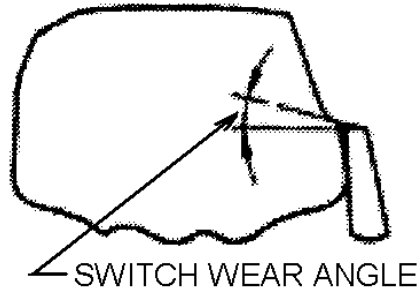


Figure 10.8: Stock rail side wear and switch blade width/height detail:

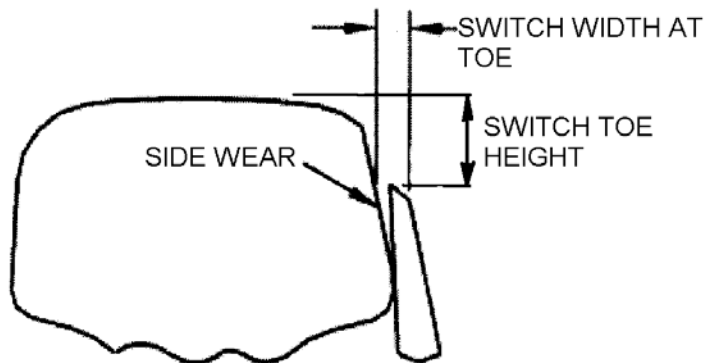
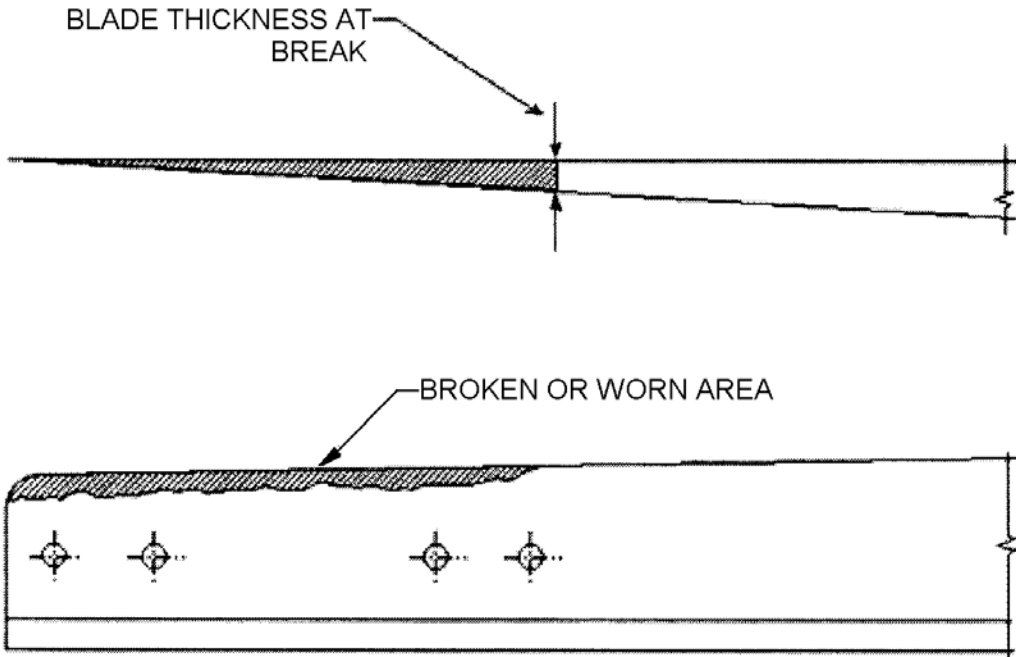


Figure 10.9: Broken or worn switch blade toe detail:



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10.3 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR 'K' CROSSING AREA

The condition assessment and response criteria for the 'K' crossing area of types 27, 29 and 40 mixed gauge turnouts are described in tables 10.4 and 10.5.

Table 10.4: 'K' crossing area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h – see note [1]	40 km/h – see note [1]	20 km/h – see note [1]	pilot all trains until repaired
1. Track gauge at stock rail point – see figure 10.2 and note [2]							
Back of stock rail point to gauge face of furthest common rail	1555	1555 to 1554	-	-	-	1554 to 1553	< 1553
Gauge face of stock rail point to back of check rail on nearest common rail	1390	1390 to 1389	-	-	-	1389 to 1388	< 1388
2. Track gauge at lead rail point – see figures 10.2 and 10.10 and note [2]							
Back of lead rail point to gauge face of nearest common rail	1390	1390 to 1389	-	-	-	1389 to 1388	< 1388
Gauge face of lead rail point to back of check rail on furthest common rail	1555	1555 to 1554	-	-	-	1554 to 1553	< 1553
Gauge face of standard gauge rail adjacent to lead rail point to gauge face of furthest common rail	1653 (i.e. 6mm tight gauge)	1653 to 1655	-	-	-	1656 to 1659	> 1659
3. Worn wing rails and worn or broken 'K' crossing nose – see figures 10.13 and 10.14							
Vertical wear of wing rail	running rail level	0 to 4	-	5 to 10	-	-	>10
Vertical wear of 'K' crossing nose	3 below running rail level	3 to 8 below running rail level	9 to 13 below running rail level	-	-	-	> 13 below running rail level
Broken crossing nose – thickness of 'K' crossing nose at break (within transfer area)	14 when new	-	14 to 20	-	21 to 25	-	> 25



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Notes to table 10.3:

- [1] Where the speed is limited to 15km/h because of fixed points, the criteria shown under 65, 40 and 20km/h shall only call for increased monitoring.
- [2] ‘K’ crossing area: The main effectiveness of the check rail is its ability to protect the ‘K’ crossing nose. Wheel contact with the ‘K’ crossing nose is therefore a vital observation to be made during inspections. Any sign of excessive damage to the ‘K’ crossing nose is reason for replacement or adjustment of the check rail regardless of the check rail wear. For the purposes of this section of this part of the Code of Practice, the two “points” of the ‘K’ crossing shall be referred to as the “stock rail point” or the “lead rail point” in accordance with figures 10.2 and 10.3. The “bow rail” is the running rail, which supports rail wheels while crossing the flangeway between it and the two points of the ‘K’ crossing. The critical area for track gauge shall be:
- On the **broad gauge** - between the bend in the “bow rail” and along the bow rail to a point opposite the **stock rail point** and 400mm beyond this point of the ‘K’ crossing measured parallel to the centreline of the broad gauge track.
 - On the **broad gauge** - between the bend in the “bow rail” and across the flangeway to the **lead rail point** and 400mm beyond this point of the ‘K’ crossing measured parallel to the centreline of the broad gauge track.
 - On the **standard gauge** - between the bend in the “bow rail” and across the flangeway to the **stock rail point** and 400mm beyond this point of the ‘K’ crossing measured parallel to the centreline of the standard gauge track.
 - On the **standard gauge** - between the bend in the “bow rail” and along the bow rail to a point opposite the **lead rail point** and 400mm beyond this point of the ‘K’ crossing measured parallel to the centreline of the standard gauge track.

Table 10.5: ‘K’ crossing area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Cracks in fabricated ‘K’ crossings - see note [3]	
cracked: non-critical or critical	increase monitoring
broken: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
broken: affecting the running surface	pilot all trains until repaired
2. Heel rail and other rail defects - refer to CP-TS-961 (Rails and rail joints)	
3. Crossing bolts – see note [4]	
4. Crossing and check rail blocks –see figures 10.2 and 10.3 and note [5]	
(any) broken or cracked	increase monitoring
5. Check rail bolts – see note [5]	
(any) loose; 1 missing or ineffective	increase monitoring
2 missing or ineffective	immediate repair or impose speed restriction of 65 km/h
> 2 missing or ineffective	immediate repair or impose speed restriction of 20 km/h
6. Crossing flangeway - see note [6]	



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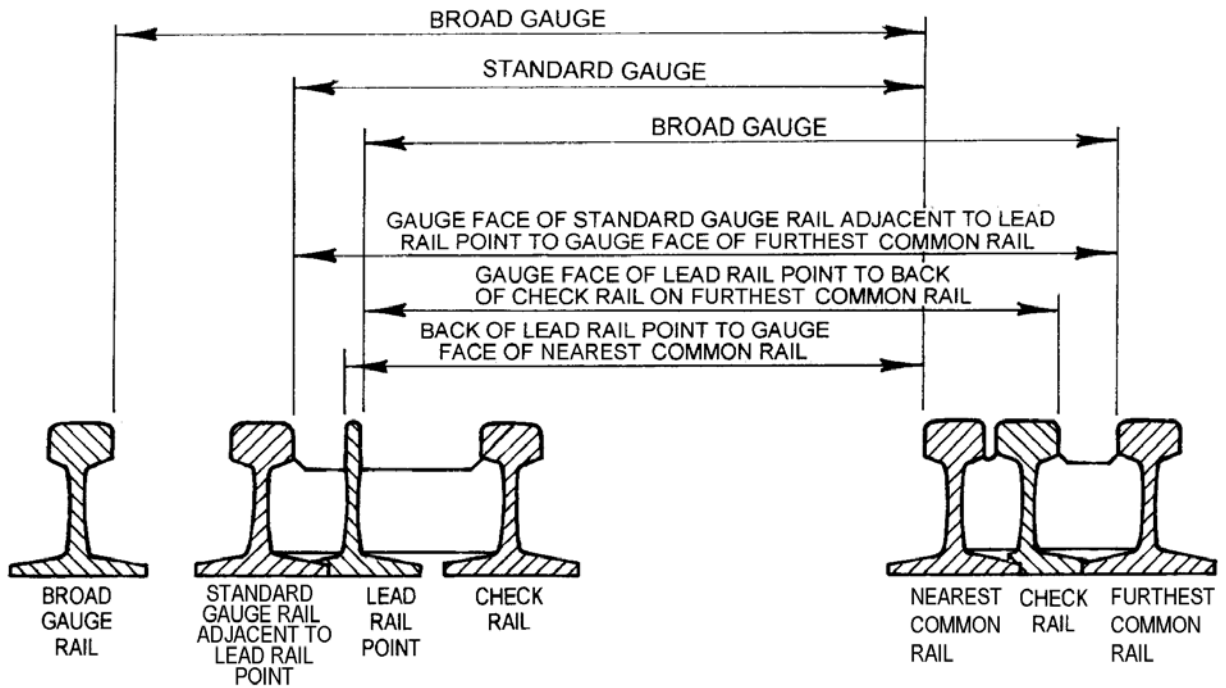
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Notes to table 10.5

- [3] For fabricated crossings:
- a) “cracked: non-critical” means cracks in a location where the rails are held in alignment by the blocks, but may eventually cause a crossing to need repair.
 - b) “cracked: critical” means cracks that if they eventually ran the full section of the rail:
 - i) the rail would be in two pieces; and
 - ii) if the fastenings were not secure, the break would affect the integrity of the running surface.
 - c) “broken: not affecting running surface” means:
 - i) cracks that run the full section of a rail component and it is in two pieces;
 - ii) all fastenings are secure;
 - iii) the rails are held in proper alignment by the blocks; and
 - iv) the break does not impact on the running surface.
 - d) “broken: affecting running surface” means:
 - i) cracks that run the full section of the rail and it is in two pieces.
 - ii) fastenings are not secure;
 - iii) the rails are not held in proper alignment by the blocks;
 - iv) or the break impacts on the running surface.
- [4] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced be tightened. Missing or ineffectiveness bolts should be replaced.
- [5] The end bolts and check blocks of all check rails should be effective.
- [6] Flangeways should be checked for blockages and cleared where blocked.

Figure 10.10: Typical part section through “K” crossing at lead rail point – shown for type 27:

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10.4 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR 'V' CROSSING AREA

The condition assessment and response criteria for the 'V' crossing area of types 27, 29, 32 and 40 mixed gauge turnouts are described in tables 10.6 and 10.7.

Table 10.6: 'V' crossing area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h – see note [1]	40 km/h – see note [1]	20 km/h – see note [1]	pilot all trains until repaired
1. Check rail and track gauge – see figure 10.12							
Working face of broad gauge check rail to crossing nose – see note [2]	1555	1555 to 1554	1553 to 1551	1550 to 1549	1548 to 1543	-	< 1543
Working face of standard gauge check rail to crossing nose – see note [2]	1390	1390 to 1389	1388 to 1386	1385 to 1384	1383 to 1378	-	< 1378
Track gauge – broad gauge running rail to crossing nose – see note [3]	1600	1600 to 1596	1595 to 1592	1591 to 1590	-	-	< 1590
Track gauge – standard gauge running rail to crossing nose – see note [3]	1435	1435 to 1431	1430 to 1427	1426 to 1425	-	-	< 1425
2. Worn wing rails and worn or broken 'V' crossing nose – see figures 10.13 and 10.14							
Vertical wear of wing rail	running rail level	0 to 4	-	5 to 10	-	-	>10
Vertical wear of 'V' crossing nose	3 below running rail level	3 to 8 below running rail level	9 to 13 below running rail level	-	-	-	> 13 below running rail level
Broken crossing nose – thickness of 'V' crossing nose at break (within transfer area)	14 when new	-	14 to 20	-	21 to 25	-	> 25

Notes to table 10.6:

- [1] Where the speed is limited to 15km/h because of fixed points, the criteria shown under 65, 40 and 20km/h shall only call for increased monitoring.
- [2] The main effectiveness of the check rail is its ability to protect the 'V' crossing nose. Wheel contact with the 'V' crossing nose is therefore a vital observation to be made during inspections. Any sign of excessive damage to the 'V' crossing nose is reason for replacement or adjustment of the check rail regardless of the check rail wear.



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[3] For wide gauge in the crossing critical area, see assessment for plain track in CP-TS-956 (Track geometry).



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Table 10.7: ‘V’ crossing area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Ineffective bearers or fasteners - in critical area, see also clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
>2 consecutive	pilot all trains until repaired
2. Cracks in fabricated ‘V’ crossings - see note [4]	
cracked: non-critical or critical	increase monitoring
broken: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
broken: affecting the running surface	pilot all trains until repaired
3. Heel rail and other rail defects - refer to CP-TS-961 (Rails and rail joints)	
4. Crossing bolts – see figure 10.11 and note [5]	
5. Crossing and check rail blocks –see figure 10.11 and note [6]	
(any) broken or cracked	increase monitoring
6. Check rail bolts – see figure 10.11 and note [6]	
(any) loose; 1 missing or ineffective	increase monitoring
2 missing or ineffective	immediate repair or impose speed restriction of 65 km/h
> 2 missing or ineffective	immediate repair or impose speed restriction of 20 km/h
7. Crossing flangeway - see note [7]	

Notes to table 10.7

[4] For fabricated crossings:

- a) “cracked: non-critical” means cracks in a location where the rails are held in alignment by the blocks, but may eventually cause a crossing to need repair.
- b) “cracked: critical” means cracks that if they eventually ran the full section of the rail:
 - i) the rail would be in two pieces; and
 - ii) if the fastenings were not secure, the break would affect the integrity of the running surface.
- c) “broken: not affecting running surface” means:
 - i) cracks that run the full section of a rail component and it is in two pieces;
 - ii) all fastenings are secure;
 - iii) the rails are held in proper alignment by the blocks; and
 - iv) the break does not impact on the running surface.
- d) “broken: affecting running surface” means:
 - i) cracks that run the full section of the rail and it is in two pieces.
 - ii) fastenings are not secure;
 - iii) the rails are not held in proper alignment by the blocks;
 - iv) or the break impacts on the running surface.

[5] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced be tightened. Missing or ineffectiveness bolts should be replaced.

[6] The end bolts and check blocks of all check rails should be effective.



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[7] Flangeways should be checked for blockages and cleared where blocked.

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PORT ADELAIDE - TYPES 27, 29, 32 AND 40 MIXED GAUGE TURNOUTS – 'V' CROSSINGS

Figure 10.11: Typical 'V' crossing assembly – shown for type 29

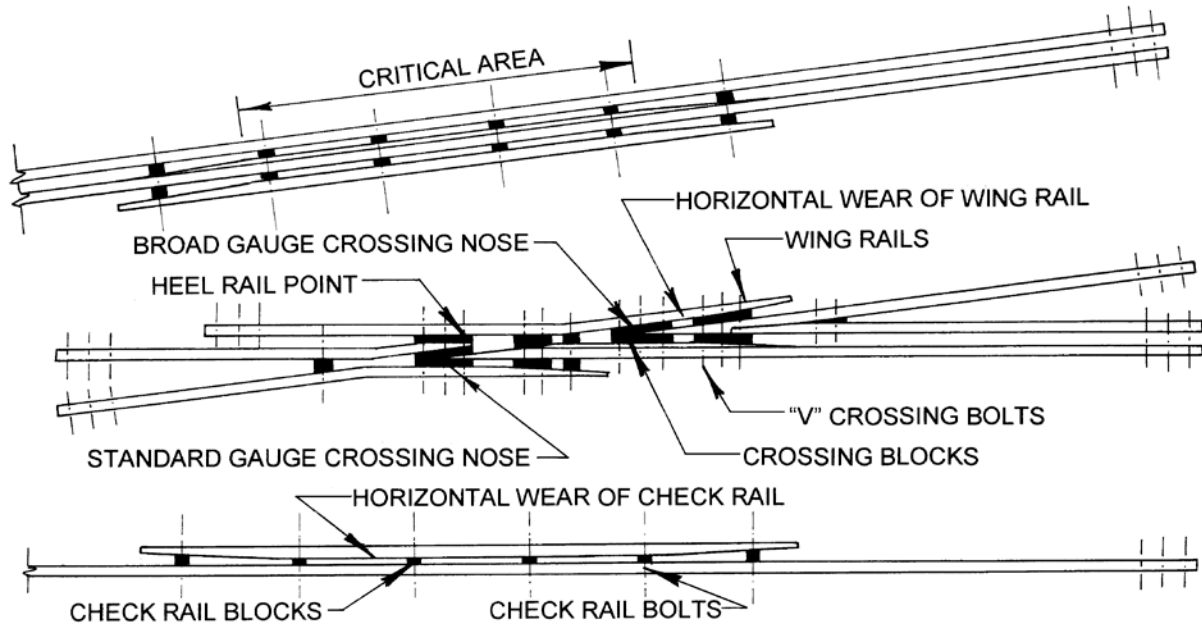
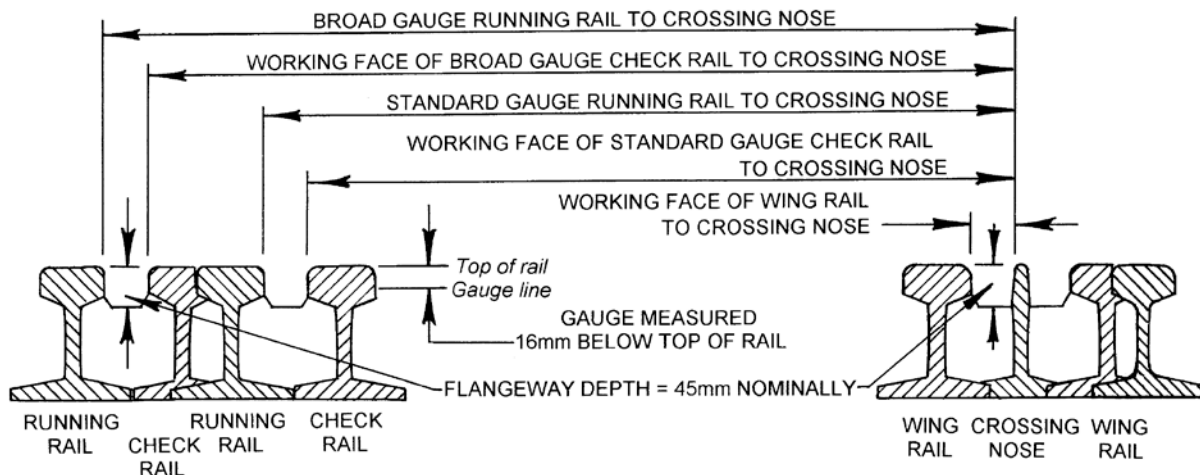


Figure 10.12: Typical part section through "V" crossings – shown for type 29



NOTE: THE CROSS-SECTION SHOWN IS TYPICAL OF CROSS-SECTIONS TO THE LEFT AND RIGHT OF THE 'V' CROSSINGS. FOR THE OTHER CROSS-SECTIONS, THE SAME DISTANCES (WHERE APPLICABLE) ARE TO BE MEASURED AND ASSESSED IN ACCORDANCE WITH THE TABLES.

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Figure 10.13: Fabricated crossings - detail of worn or broken crossing nose – Note: For enlargement of crossing nose see figure 10.14

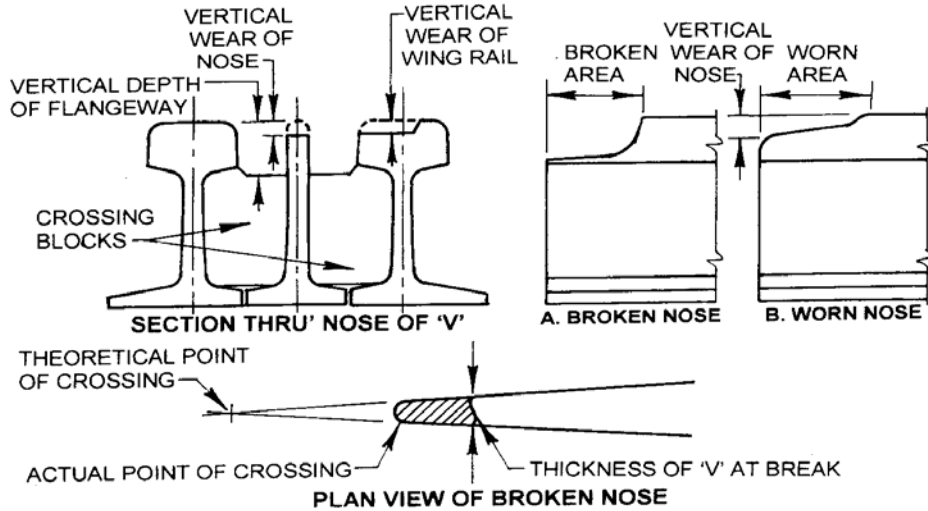
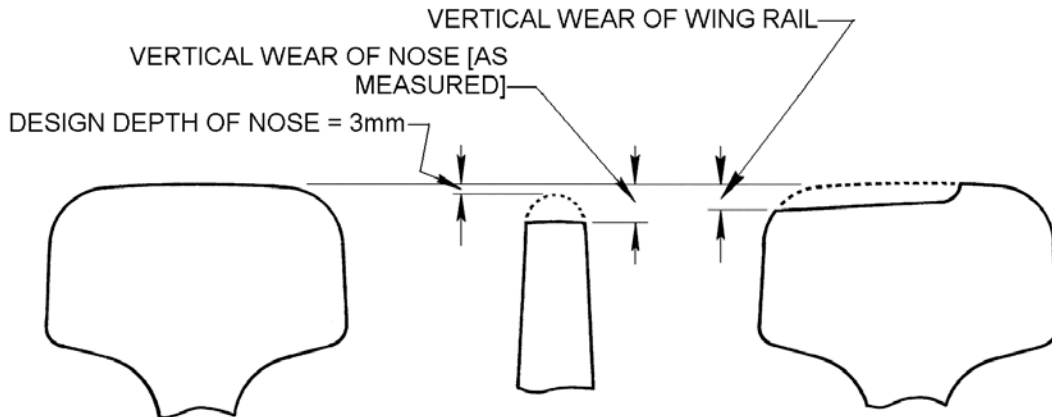


Figure 10.14: Enlargement of crossing nose showing vertical wear



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TRANSADELAIDE INFRASTRUCTURE SERVICES****PART 13: POINTS AND CROSSINGS****DOC. NO. CP-TS-963****Issue: 1****Date: 04/09/07****Page: 90 of 90****11.0 GLANVILLE JUNCTION****11.1 MIXED GAUGE TRACKWORK****11.1.1 Track layout**

Figure 11.1 (right) shows in diagrammatic form (i.e. not to scale) the layout of tracks and points and crossings at the junction of lines to Outer Harbour and Birkenhead at Glanville. The outer rails of the tracks shown represent broad gauge. The standard gauge is shown with an additional rail inside the broad gauge rail on either the left or the right hand side to reflect the arrangement of tracks on the ground.

11.1.2 Consideration of criteria – mixed gauge turnouts

The following sub-sections consider criteria for monitoring and maintenance of the mixed gauge points and crossings as follows:

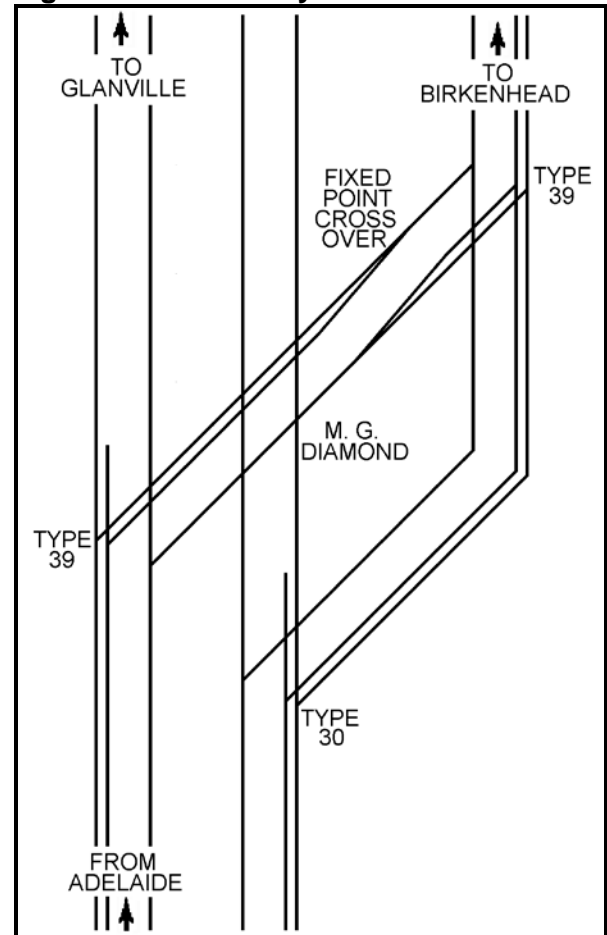
- 11.2** - Switches for turnouts types 30 and 39;
- 11.3** - 'K' crossings for turnouts types 30 and 39;
- 11.4** - 'V' crossings for turnouts types 30 and 39.

11.1.3 Consideration of criteria – mixed gauge diamond

Criteria for monitoring and maintenance of the mixed gauge diamond on the up Adelaide running line, are described in sub-section 8.0 "Mixed gauge diamonds."

11.1.4 Consideration of criteria – fixed point crossover

Criteria for monitoring and maintenance of the fixed point crossover on the up Birkenhead running line, are described in sub-section 11.0 "Fixed point crossover."

Figure 11.1: Track layout Glanville

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GLANVILLE - TYPES 30 AND 39 MIXED GAUGE TURNOUTS – SWITCHES

11.2 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR SWITCH AREA – TYPES 30 AND 39

The condition assessment and response criteria for the switch area of types 30 and 39 mixed gauge turnout are described in tables 11.1 and 11.2.

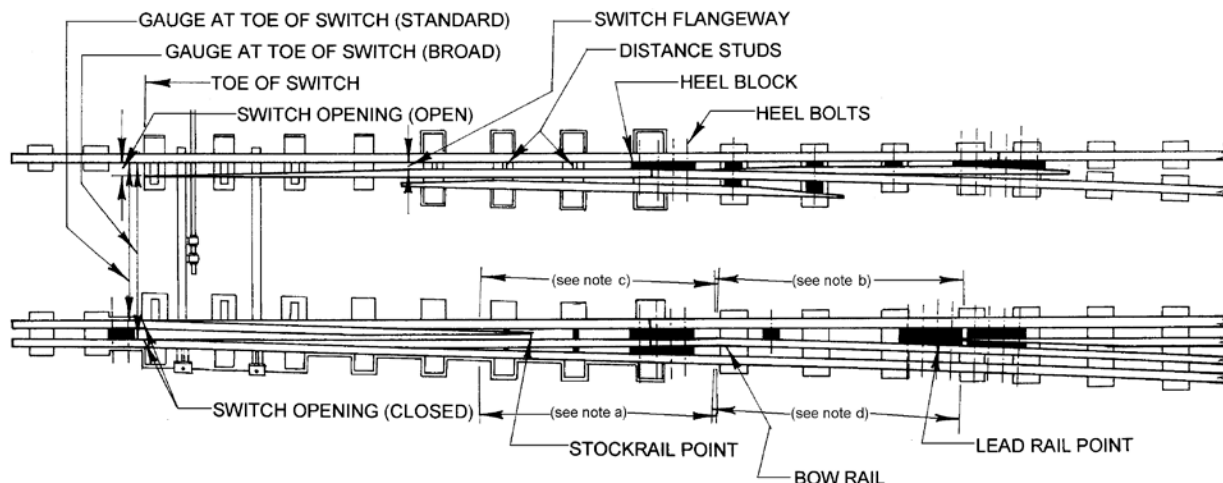
Table 11.1: Switch area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h - see note [1]	40 km/h - see note [1]	20 km/h - see note [1]	pilot all trains until repaired
1. Switch flangeway – see figure 11.2							
Minimum switch blade throat opening (flangeway) – back of switch rail to stock rail	45	40 to 45	-	-	39 to 35	-	< 35
Minimum switch opening	92	-	85 to 92	-	-	80 to 84	< 80
2. Track gauge at toe of switch (broad gauge) see figure 11.2 and also note [2]							
Gauge at toe of switch between stock rails (for traditional switches)	1610	1610 to 1605	-	1604 to 1602	-	1601 to 1600	<1600
3. Track gauge at toe of switch (standard gauge) – see figure 11.2 and also note [2]							
Gauge at toe of switch between stock rails (for traditional switches)	1445	1445 to 1440	-	1439 to 1437	-	1436 to 1435	<1435

Notes to table 11.1

- [1] Where the speed is limited to 15km/h because of fixed points, the criteria shown under 65, 40 and 20km/h shall only call for increased monitoring.
- [2] For wide gauge in the switch critical area, the assessment for plain track in CP-TS-956 (Track geometry) shall apply. Note that wide gauge is any gauge wider than 1600mm or 1435mm even at the toe of traditional switches, i.e. the design dimension of 1610mm or 1445mm is to be considered as 10mm wide.

Figure 11.2: Typical switch and ‘K’ crossing assembly – shown for type 30:





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Table 11.2: Switch area assessment responses for key component condition:

COMPONENT AND CONDITION	ACTION
1. Heel block - see note [3] and figure 11.2	
2. Switch chairs	
(any) cracked or loose: or 1 broken or ineffective	increase monitoring
2 consecutive broken or ineffective	immediate repair or impose speed restriction of 65 km/h
more than 2 consecutive broken or ineffective	pilot all trains until repaired
3. Distance studs or chair bolts - see figure 11.2	
(any) cracked or loose; or 1 missing or ineffective	increase monitoring
2 consecutive missing or ineffective	immediate repair or impose speed restriction of 65 km/h
more than 2 consecutive missing or ineffective	pilot all trains until repaired
4. Ineffective bearers or fasteners – in critical area, also see clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
more than 2 consecutive	pilot all trains until repaired
5. Bolts – see note [4]	
6. Spreader bar including brackets, bolts, etc.	
missing or broken	pilot all trains until repaired – see also note [5]
7. Switch blade damage - see note [6]	
length of damage < 100mm	Routine inspection
length of damage 100 to 199mm	increase monitoring
length of damage ≥ 200mm	pilot all trains until repaired
8. Stock rail or switch blade face wear - angle from vertical at point of wheel flange/rail contact at switch toe - see figure 11.3	
< 18 degrees	routine inspection
18 degrees to < 26 degrees	increase monitoring
≥ 26 degrees	pilot all trains until repaired - see note [7]
9. Switch blade angle from horizontal at any point between 19mm and 30mm below running surface of stock rail - see figure 11.4	
≥ 40 degrees	routine inspection
< 40 degrees	pilot all trains until repaired
10. Stock rail gauge face wear at gauge point - where switch blade contacts stock rail	
<2mm	routine inspection
2mm to < 3mm	increase monitoring
≥ 3mm	pilot all trains until repaired - see note [8]
11. Switch toe height from stock rail running level to top of switch blade, see figure 11.5	
≥ 13mm	routine inspection
> 12mm to < 13mm	increase monitoring
≤12mm	pilot all trains until repaired
12. Switch width at toe - as presented to the wheel - see figure 11.5 and note [9]	
0 to 6mm	increase monitoring
7 to 8mm	immediate repair or impose speed restriction of 20 km/h
>8mm	pilot all trains until repaired
13. Switch blade crippled - see note [10]	

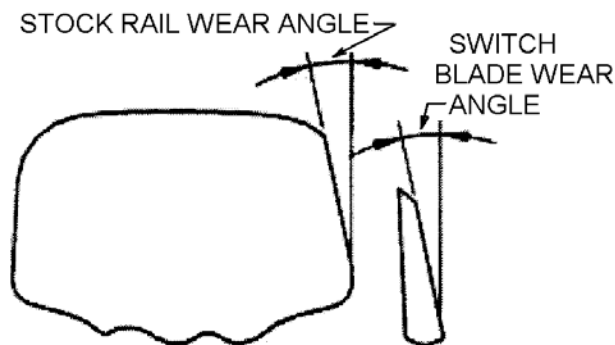
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Notes to table 11.3

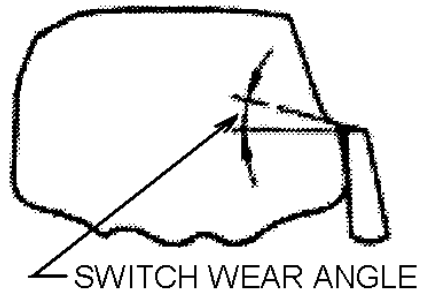
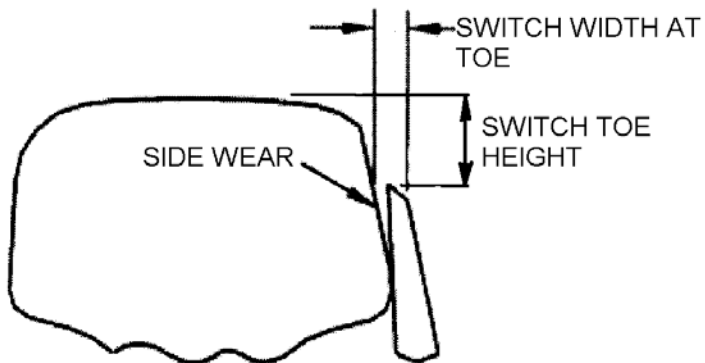
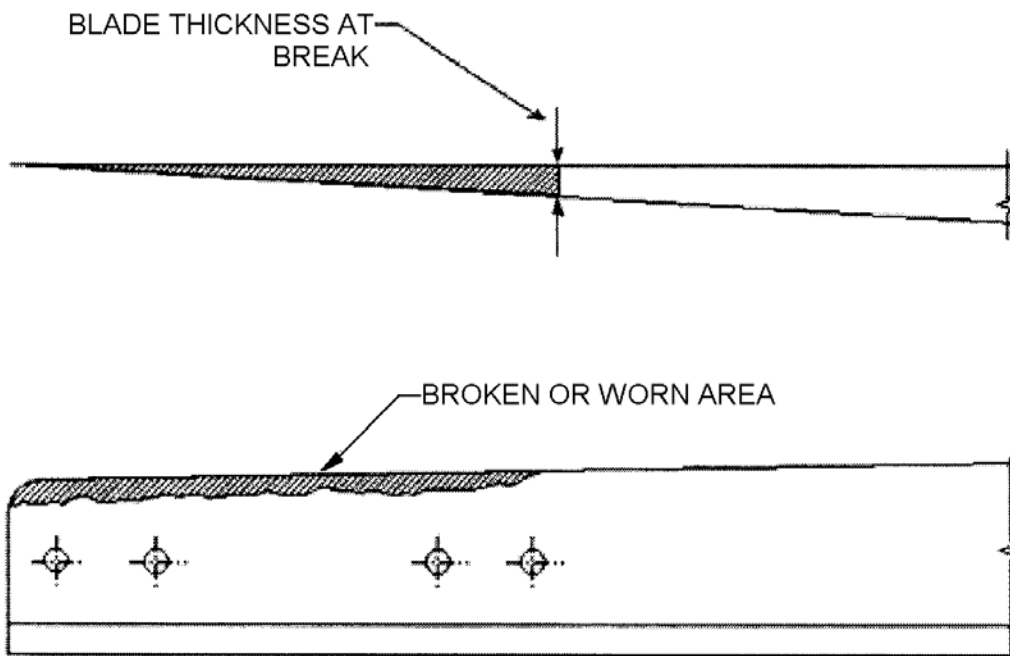
- [3] Pivot heel cracks and breaks should be assessed by a qualified worker.
- [4] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced. Pivot heel blocks generally may be made up of connections, which require some bolts not to be fully tightened so as to allow for design switch movement.
- [5] An alternative action that may be taken is to install a switch clamp and/or spike the switch in accordance with the action specified in clause 3.3(g).
- [6] “Length of damage” implies damage anywhere in the switch blade deeper than 19mm from the running surface. The response applies to chamfered switches only (i.e. not undercut switches). When a worn switch blade at the end of its service life is being replaced, a complete half set of switches should be installed. In table 11.2,
 - i. “length of damage < 100mm” also applies to consecutive areas of damage less than 100mm apart and forming a total length less than 100mm.
 - ii. “length of damage 100 to 199mm” also applies to consecutive areas of damage less than 199mm apart and forming a total length between 100mm and 199mm.
 - iii. “length of damage \geq 200mm” also applies to consecutive areas of damage less than 200mm apart and forming a total length more than 200mm.
- [7] Where the gauge face angle limit is exceeded, the action should be to replace the complete half set of switches.
- [8] It is recommended that the stock rail be replaced. Following repair, it is necessary to check the fit between the switch blade and stock rail. The replacement of switches should be carried out with care where the stock rail is approaching this amount of wear to ensure that a blunt nose is not presented to the wheel.
- [9] Switch width at toe includes the effects of side wear on stock rails and closed gap between switch blade and stock rail. The gap between the switch blade and stock rail should not exceed 3mm at any time.
- [10] 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 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 reduced speed of operation both in terms of geometry and structural integrity. The reduced speed of operation should not exceed 40km/h.

Figure 11.3: Stock rail and switch blade wear angle detail:



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Figure 11.4: Broken or worn switch blade toe detail:**Figure 11.5: Stock rail side wear and switch blade width/height detail:****Figure 11.6: Broken or worn switch blade toe detail:**



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GLANVILLE - TYPES 30 AND 39 MIXED GAUGE TURNOUTS – 'K' CROSSINGS

11.3 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR 'K' CROSSING AREA

The condition assessment and response criteria for the 'K' crossing area of types 30 and 39 mixed gauge turnouts are described in tables 11.4 and 11.5.

Table 11.3: 'K' crossing area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h – see note [1]	40 km/h – see note [1]	20 km/h – see note [1]	pilot all trains until repaired
1. Track gauge at stock rail point – see figure 11.2 and note [2]							
Back of stock rail point to gauge face of furthest common rail	1555	1555 to 1554	-	-	-	1554 to 1553	< 1553
Gauge face of stock rail point to back of check rail on nearest common rail	1390	1390 to 1389	-	-	-	1389 to 1388	< 1388
2. Track gauge at lead rail point – see figures 11.2 and 11.7 and note [2]							
Back of lead rail point to gauge face of nearest common rail	1390	1390 to 1389	-	-	-	1389 to 1388	< 1388
Gauge face of lead rail point to back of check rail on furthest common rail	1555	1555 to 1554	-	-	-	1554 to 1553	< 1553
Gauge face of standard gauge rail adjacent to lead rail point to gauge face of furthest common rail	1653 (i.e. 6mm tight gauge)	1653 to 1655	-	-	-	1656 to 1659	> 1659
3. Worn wing rails and worn or broken 'K' crossing nose – see figures 11.10 and 11.11							
Vertical wear of wing rail	running rail level	0 to 4	-	5 to 10	-	-	>10
Vertical wear of 'K' crossing nose	3 below running rail level	3 to 8 below running rail level	9 to 13 below running rail level	-	-	-	> 13 below running rail level
Broken crossing nose – thickness of 'K' crossing nose at break (within transfer area)	14 when new	-	14 to 20	-	21 to 25	-	> 25



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Notes to table 11.3:

- [1] Where the speed is limited to 15km/h because of fixed points, the criteria shown under 65, 40 and 20km/h shall only call for increased monitoring.
- [2] ‘K’ crossing area: The main effectiveness of the check rail is its ability to protect the ‘K’ crossing nose. Wheel contact with the ‘K’ crossing nose is therefore a vital observation to be made during inspections. Any sign of excessive damage to the ‘K’ crossing nose is reason for replacement or adjustment of the check rail regardless of the check rail wear. For the purposes of this section of this part of the Code of Practice, the two “points” of the ‘K’ crossing shall be referred to as the “stock rail point” or the “lead rail point” in accordance with figure 11.2. The “bow rail” is the running rail, which supports rail wheels while crossing the flangeway between it and the two points of the ‘K’ crossing. The critical area for track gauge shall be:
- On the **broad gauge** - between the bend in the “bow rail” and along the bow rail to a point opposite the **stock rail point** and 400mm beyond this point of the ‘K’ crossing measured parallel to the centreline of the broad gauge track.
 - On the **broad gauge** - between the bend in the “bow rail” and across the flangeway to the **lead rail point** and 400mm beyond this point of the ‘K’ crossing measured parallel to the centreline of the broad gauge track.
 - On the **standard gauge** - between the bend in the “bow rail” and across the flangeway to the **stock rail point** and 400mm beyond this point of the ‘K’ crossing measured parallel to the centreline of the standard gauge track.
 - On the **standard gauge** - between the bend in the “bow rail” and along the bow rail to a point opposite the **lead rail point** and 400mm beyond this point of the ‘K’ crossing measured parallel to the centreline of the standard gauge track.

Table 11.4: ‘K’ crossing area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Cracks in fabricated ‘K’ crossings - see note [3]	
cracked: non-critical or critical	increase monitoring
broken: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
broken: affecting the running surface	pilot all trains until repaired
2. Heel rail and other rail defects - refer to CP-TS-961 (Rails and rail joints)	
3. Crossing bolts – see note [4]	
4. Crossing and check rail blocks –see figure 11.2 and note [5]	
(any) broken or cracked	increase monitoring
5. Check rail bolts – see note [5]	
(any) loose; 1 missing or ineffective	increase monitoring
2 missing or ineffective	immediate repair or impose speed restriction of 65 km/h
> 2 missing or ineffective	immediate repair or impose speed restriction of 20 km/h
6. Crossing flangeway - see note [6]	

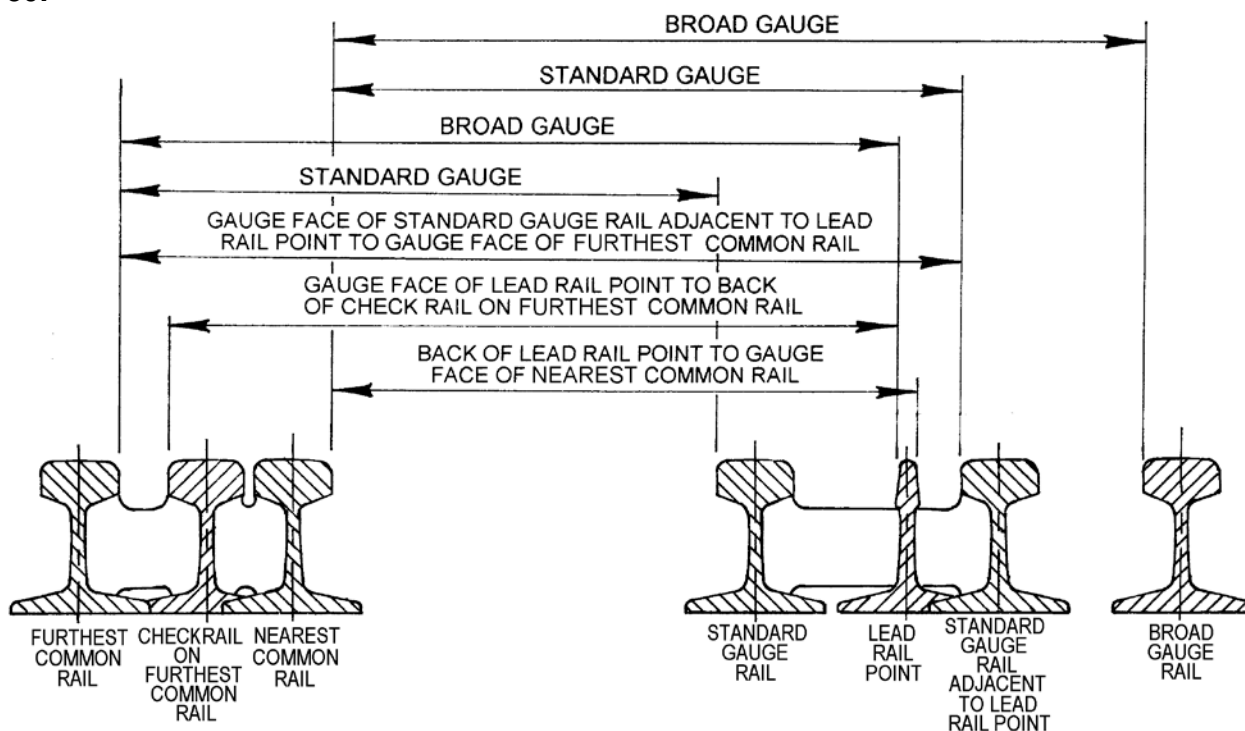
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Notes to table 11.4

- [3] For fabricated crossings:
- a) “cracked: non-critical” means cracks in a location where the rails are held in alignment by the blocks, but may eventually cause a crossing to need repair.
 - b) “cracked: critical” means cracks that if they eventually ran the full section of the rail:
 - i) the rail would be in two pieces; and
 - ii) if the fastenings were not secure, the break would affect the integrity of the running surface.
 - c) “broken: not affecting running surface” means:
 - i) cracks that run the full section of a rail component and it is in two pieces;
 - ii) all fastenings are secure;
 - iii) the rails are held in proper alignment by the blocks; and
 - iv) the break does not impact on the running surface.
 - d) “broken: affecting running surface” means:
 - i) cracks that run the full section of the rail and it is in two pieces.
 - ii) fastenings are not secure;
 - iii) the rails are not held in proper alignment by the blocks;
 - iv) or the break impacts on the running surface.
- [4] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced be tightened. Missing or ineffectiveness bolts should be replaced.
- [5] The end bolts and check blocks of all check rails should be effective.
- [6] Flangeways should be checked for blockages and cleared where blocked.

Figure 11.7: Typical part section through “K” crossing at lead rail point – shown for type 30:





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GLANVILLE - TYPES 30 AND 39 MIXED GAUGE TURNOUTS – ‘V’ CROSSINGS

11.4 CONDITION ASSESSMENT AND RESPONSE CRITERIA FOR ‘V’ CROSSING AREA

The condition assessment and response criteria for the ‘V’ crossing area of types 27, 29, 32 and 40 mixed gauge turnouts are described in tables 11.5 and 11.6.

Table 11.5: ‘V’ crossing area assessment responses for critical dimensions

Component parameter	Design dimension (in mm)	Range for routine inspection (in mm)	Range for increased monitoring (in mm)	Range (in mm) for immediate repair or impose speed restriction shown – [see clause 3.3 (b)]:			
				65 km/h – see note [1]	40 km/h – see note [1]	20 km/h – see note [1]	pilot all trains until repaired
1. Check rail and track gauge – see figures 11.8 and 11.9							
Working face of broad gauge check rail to crossing nose – see note [2]	1555	1555 to 1554	1553 to 1551	1550 to 1549	1548 to 1543	-	< 1543
Working face of standard gauge check rail to crossing nose – see note [2]	1390	1390 to 1389	1388 to 1386	1385 to 1384	1383 to 1378	-	< 1378
Track gauge – broad gauge running rail to crossing nose – see note [3]	1600	1600 to 1596	1595 to 1592	1591 to 1590	-	-	< 1590
Track gauge – standard gauge running rail to crossing nose – see note [3]	1435	1435 to 1431	1430 to 1427	1426 to 1425	-	-	< 1425
2. Worn wing rails and worn or broken ‘V’ crossing nose – see figures 11.10 and 11.11							
Vertical wear of wing rail	running rail level	0 to 4	-	5 to 10	-	-	>10
Vertical wear of ‘V’ crossing nose	3 below running rail level	3 to 8 below running rail level	9 to 13 below running rail level	-	-	-	> 13 below running rail level
Broken crossing nose – thickness of ‘V’ crossing nose at break (within transfer area)	14 when new	-	14 to 20	-	21 to 25	-	> 25

Notes to table 11.5:

- [1] Where the speed is limited to 15km/h because of fixed points, the criteria shown under 65, 40 and 20km/h shall only call for increased monitoring.
- [2] The main effectiveness of the check rail is its ability to protect the ‘V’ crossing nose. Wheel contact with the ‘V’ crossing nose is therefore a vital observation to be made during inspections. Any sign of excessive damage to the ‘V’ crossing nose is reason for replacement or adjustment of the check rail regardless of the check rail wear.
- [3] For wide gauge in the crossing critical area, see assessment for plain track in CP-TS-956 (Track geometry).



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Table 11.6: ‘V’ crossing area assessment responses for key component condition

COMPONENT AND CONDITION	ACTION
1. Ineffective bearers or fasteners - in critical area, see also clause 3.3 (h)	
1 only	increase monitoring
2 consecutive	immediate repair or impose speed restriction of 40 km/h
>2 consecutive	pilot all trains until repaired
2. Cracks in fabricated ‘V’ crossings - see note [4]	
cracked: non-critical or critical	increase monitoring
broken: not affecting the running surface	immediate repair or impose speed restriction of 65 km/h
broken: affecting the running surface	pilot all trains until repaired
3. Heel rail and other rail defects - refer to CP-TS-961 (Rails and rail joints)	
4. Crossing bolts – see figure 11.8 and note [5]	
5. Crossing and check rail blocks –see figure 11.8 and note [6]	
(any) broken or cracked	increase monitoring
6. Check rail bolts – see figure 11.8 and note [6]	
(any) loose; 1 missing or ineffective	increase monitoring
2 missing or ineffective	immediate repair or impose speed restriction of 65 km/h
> 2 missing or ineffective	immediate repair or impose speed restriction of 20 km/h
7. Crossing flangeway - see note [7]	

Notes to table 11.6

[4] For fabricated crossings:

- a) “cracked: non-critical” means cracks in a location where the rails are held in alignment by the blocks, but may eventually cause a crossing to need repair.
- b) “cracked: critical” means cracks that if they eventually ran the full section of the rail:
 - i) the rail would be in two pieces; and
 - ii) if the fastenings were not secure, the break would affect the integrity of the running surface.
- c) “broken: not affecting running surface” means:
 - i) cracks that run the full section of a rail component and it is in two pieces;
 - ii) all fastenings are secure;
 - iii) the rails are held in proper alignment by the blocks; and
 - iv) the break does not impact on the running surface.
- d) “broken: affecting running surface” means:
 - i) cracks that run the full section of the rail and it is in two pieces.
 - ii) fastenings are not secure;
 - iii) the rails are not held in proper alignment by the blocks;
 - iv) or the break impacts on the running surface.

[5] Where individual defects have been identified, a qualified worker should assess the effectiveness of the bolts. Ineffective bolts include bent, cracked, or broken bolts. Loose bolts should be tightened. Missing or ineffective bolts should be replaced be tightened. Missing or ineffectiveness bolts should be replaced.

[6] The end bolts and check blocks of all check rails should be effective.

[7] Flangeways should be checked for blockages and cleared where blocked.

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Figure 11.8: Typical ‘V’ crossing assembly – shown for type 30

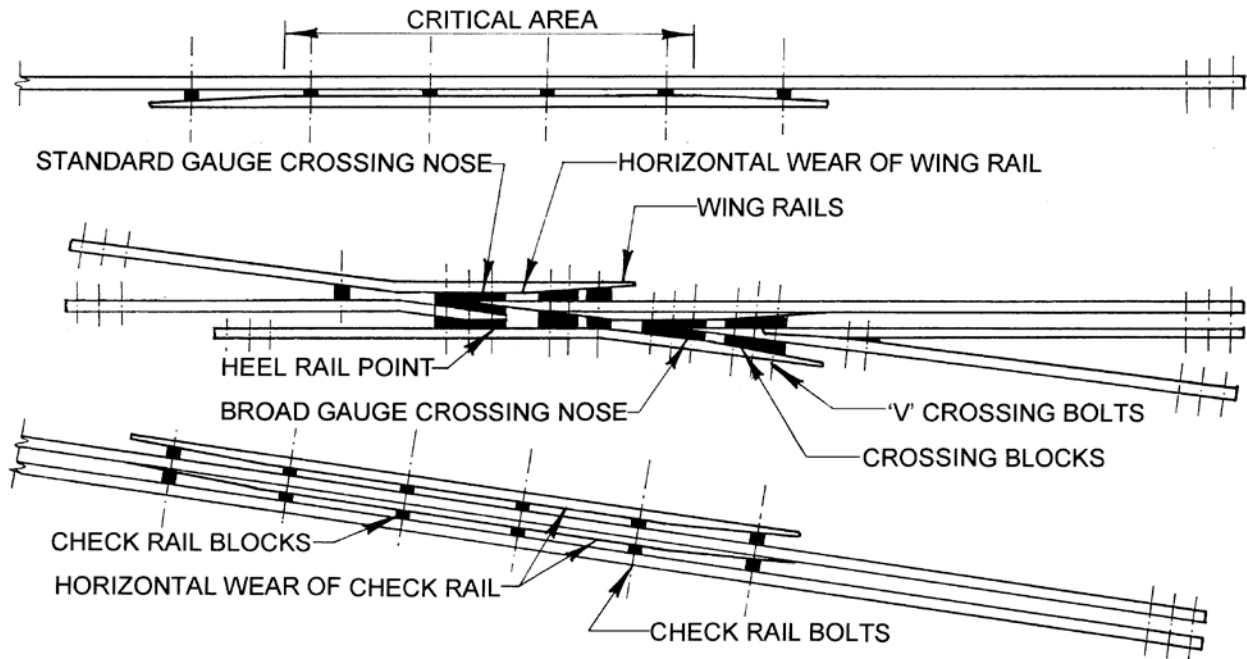
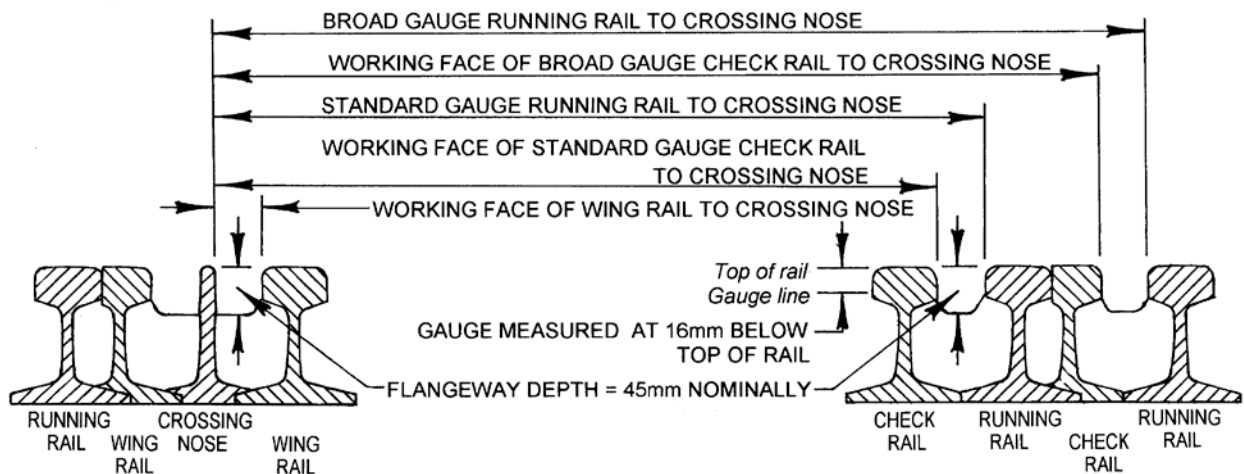


Figure 11.9: Typical part section through “V” crossings – shown for type 30



NOTE: THE CROSS-SECTION SHOWN IS TYPICAL OF CROSS-SECTIONS TO THE LEFT AND RIGHT OF THE ‘V’ CROSSINGS. FOR THE OTHER CROSS-SECTIONS, THE SAME DISTANCES (WHERE APPLICABLE) ARE TO BE MEASURED AND ASSESSED IN ACCORDANCE WITH THE TABLES.

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Figure 11.10: Fabricated crossings - detail of worn or broken crossing nose – Note: For enlargement of crossing nose see figure 11.11

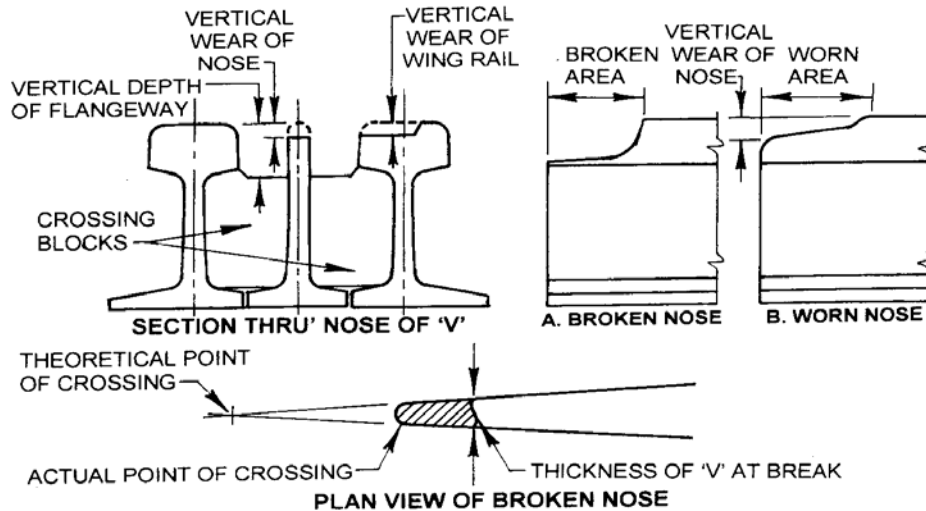
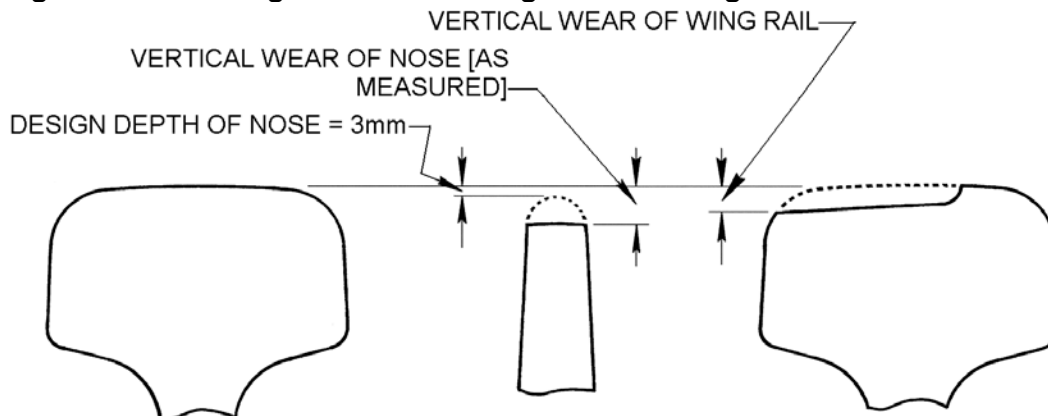


Figure 11.11: Enlargement of crossing nose showing vertical wear





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12.0 DOCUMENTATION

12.1 POINTS AND CROSSINGS RECORD

A record shall be maintained of all points and crossings, including mixed gauge points and crossings in accordance with QP-IS-501 (Document and Data Control).

12.2 INSPECTION REPORTS

All inspection reports shall be maintained in accordance with CPRD/PRC/046 Records Management.