

Category 1 Standard

S1175

Track - Inspection of Cast Crossings and Cast Vees



**Please read the Written Notices
attached to this standard**

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Contents

1	Purpose	3
2	Scope	3
3	Requirements	3
3.1	Safety considerations	3
3.2	Training and Competence	3
3.3	Inspection	5
3.4	Minimum Actions Pending Repair or Replacement	8
3.5	Marking Defect Locations	8
3.6	Inspection Reports	8
3.7	Follow-Up Inspections	8
3.8	Appoint Watchman	9
3.9	Weld Repairs	9
3.10	Records	9
3.11	Environment	9
4	Responsibilities	10
4.1	Track Manager	10
4.2	Cast Crossing Inspector	10
4.3	Cast Crossing Watchman	10
5	Supporting information	10
6	References	11
6.1	References	11
6.2	Abbreviations	11
6.3	Definitions	11
6.4	Technical content manager	12
6.5	Document history	12
7	Index of Attachments	13
7.1	Attachment 1 Cast Crossing Inspection Form	14
7.2	Attachment 2 Cast crossing Monitoring Report Form	16
7.3	Attachment 3 Inspection Zones of a Cast Crossing	18
7.4	Attachment 4 Minimum Actions	19
7.5	Attachment 5 Further information on cast crossings and cast vees used in London Underground running lines	22
7.6	Attachment 6 Procedure for Liquid Penetrant Testing	24
7.7	Attachment 7 Procedure for Magnetic Particle Testing	26
8	Current Written Notices attached to this standard	27

1 Purpose

- 1.1 The purpose of this standard is to define the methods to be used when inspecting cast crossings and cast vees. It also specifies the permissible limits of defect and damage to be removed for specific rail steel types
- 1.2 This standard mandates the requirements for inspection and is in addition to the PM4 inspection and reflects the LU Track standards for the inspection frequency and minimum actions to take when significant defects are discovered.
- 1.3 The standard outlines the training and competence requirements for Inspectors and the Inspection and reporting procedures to be followed
- 1.4 The objective of this standard is to properly manage the risks associated with broken and/or defective components. This is achieved by visually examining the component, in order to establish whether there are any defects visible that may affect the safety of the line, and, taking into account known deterioration rates, to maintain crossings in a safe condition.

2 Scope

- 2.1 This standard applies to the inspection and/or repair of cast crossings and cast vees on the LU railway.

3 Requirements

3.1 Safety considerations

- 3.1.1 Inspectors shall guard themselves against personal injury and help prevent injury to others in the course of their duties.
- 3.1.2 Inspectors shall wear appropriate personal protective equipment when carrying out inspections.
- 3.1.3 Inspectors shall confirm that appropriate track safety arrangements are in place before undertaking inspections. The full inspection of a cast crossing or vee must only be undertaken in engineering hours or in an appropriate track possession when there are no trains and the current is discharged.
- 3.1.4 The inspector shall confirm that on the completion of work all tools, equipment and material waste is removed from the work site. He shall also confirm that, subject to any immediate actions required as set out in Attachment 4, the crossing is safe for service, and shall make a declaration to that effect.

3.2 Training and Competence

3.2.1 General

- 3.2.1.1 The inspection of cast crossings and cast vees is a skilled operation and shall be undertaken only by persons who have attended an appropriate training course and are in possession of a current and valid certificate of competence issued by a training centre approved by LU and have subsequently been licensed by LU to undertake inspections on LU Infrastructure.
- 3.2.1.2 In the event that a person has been trained at a training centre which does not already have LU approval, the training arrangements shall be reviewed (including their



coverage of any LU-specific aspects of S1175) and, if appropriate, LU approval shall be given to that training centre.

3.2.1.3 If LU approval in accordance with clause 3.2.1.2 is appropriate, persons trained at that centre and possessing Network Rail certificates may be issued with LU licences within the same time validity, subject to their being briefed fully on any LU-specific aspects of this standard.

3.2.1.4 If LU approval in accordance with clause 3.2.1.2 is for any reason not appropriate, persons trained at that centre, even if possessing Network Rail certificates, shall not be licensed to work on LU infrastructure until any necessary extra or alternative training is given.

3.2.2 Training

3.2.2.1 Personnel attending designated training courses must have reasonable knowledge and of cast crossings. Experience of maintaining or welding crossings is desirable.

3.2.2.2 The candidate must have basic literacy and numeric skills.

3.2.3 Issuing Certificate of Competence and On-Going Competence

3.2.3.1 Candidates successfully completing the course shall be issued with an intermediate certificate of training for the inspection of cast crossings and cast vees.

3.2.3.2 A competent person shall mentor candidates carrying out a minimum six inspections under supervision.

3.2.3.3 The mentor, whether agreeing or disagreeing with the trainee's findings, shall endorse the Inspection reports.

3.2.3.4 On the sixth Inspection an assessor as defined in the Railway and Other Guided Transport Systems (Safety) (ROGS) regulations shall assess the candidate carrying out the inspection.

3.2.3.5 The assessment documentation along with the decision report shall be sent with the six previous inspection reports to the training centre. If the trainee is deemed to be successful, a certificate of competency shall be issued.

3.2.3.6 The inspection reports and assessment decision report shall be attached to the trainee's written and practical training papers and retained at the training centre.

3.2.3.7 The training centre shall forward a copy of the candidate's portfolio to the LU Training and Competency Manager who shall issue the relevant LU Safety Critical Licensed Identification Card.

3.2.4 Maintaining Competence

3.2.4.1 Inspectors shall be subject to work place competency assessment at two yearly intervals.

3.2.5 Use of liquid penetrant testing (LPT)

3.2.5.1 All personnel using LPT shall hold a current certificate of competency for the procedure and follow the manufacturer's guidelines for its use. The inspector(s) shall also be aware of the safety and PPE requirements and have access to the relevant Control of Substances Hazardous to Health (COSHH) assessment documents.



3.3 Inspection

3.3.1 Frequency of Inspections

3.3.1.1 Every cast component shall be thoroughly inspected by a competent person at intervals no greater than:

- a) 6-monthly for cast manganese crossings and vees
- b) 3-monthly for bainitic centre-block crossings

3.3.2 Inspection Zones of a Cast Crossing

3.3.2.1 Being aware of the Inspection zones of a cast crossing or vee is a vital part of the inspection. The zone location of a defect is an important factor when deciding the minimum action as defects of the same size could have a different minimum action if found in another zone.

3.3.2.2 Zone Locations:

- a) Leg Ends
- b) Longitudinal Change of Section
- c) Head
- d) Foot
- e) Wall of Web Flange-way & Base of Flange-way
- f) Side Wall
- g) Check Flare
- h) Nose
- i) Wheel Contact Surfaces
- j) Tri-metallic Zone - (Stainless Steel Insert used for joining cast Austenitic, Manganese steel to adjacent rails)

See Attachment 3 – Inspection Zones of a Cast Crossing.

3.3.3 Full or Out-Of-Track Inspection

3.3.3.1 In the case of crossing “out-of-track” inspection for either repair or recycle, the fish-plates or base-plates shall be removed to allow full inspection.

3.3.4 Cast Crossing Inspectors

3.3.4.1 Cast Crossing Inspectors shall carry the relevant certificate of competence and Safety Critical Licence readily available for production upon request, whilst carrying out Inspections.

3.3.4.2 The following Items of equipment shall be made available for the inspector to use when inspecting cast components.

Equipment	Purpose
Personal Protective Equipment	Appropriate personal protective equipment must be worn whilst carrying out Inspections
LPT Equipment	LPT equipment to be used to detect or establish the presence of surface breaking defects in rails or weld repairs on the running surface.
Wire Brush	A wire brush must be used to remove light rust and stubborn material that could mask a defect, particularly if the component is wet.
Dry cloth or paper towels	To remove rust/dust/dirt from cracks after wire-brushing.
Soft Brush	A soft brush will allow small particles of dirt and dust to be brushed clear of visual defects before applying the dye penetrant.
Inspection Mirror	Used for viewing inaccessible areas and underside of crossing.
Torch	For additional lighting when examining shaded areas of the crossing or in poor lighting conditions.
Wax Crayon/Paint	Wax crayon/Paint for marking defects.
Magnet	To assist in the identification of steel type.
Report Forms & Pen	The report form to record information can be found in Attachment 1 of this standard.
LU Cat 1 standard S1175	For referencing minimum action requirements.

3.3.5 Methods of Inspection

3.3.5.1 The inspection of cast crossings is normally by detailed visual observation.

3.3.5.2 There are other non-destructive techniques that should be used if additional information is required on the extent of cracks.

Type of Cast Crossing (steel)	Type of Non-Destructive Technique		
	LPT	MPT	Ultrasonic
Austenitic (AMS)	✓	✗	✗
Bainitic	✓	✓	✓

(See Attachment 6 – Procedure for Liquid Penetrant Testing)

(See Attachment 7 – Procedure for Magnetic Particle Testing)

3.3.6 Cleaning and Drying the Crossing

3.3.6.1 Prior to inspection of the crossing, it must be clean with flange-ways and aprons clear of spillage e.g. ballast, chippings, oil and dust.

3.3.6.2 The presence of heavy oil or grease may require a chemical cleaner to be utilised. In damp weather the specific inspection zones shall be dried out to facilitate visual Liquid Penetrant Testing (LPT) inspection.

3.3.6.3 Drying shall be undertaken by wiping the rail surface with a dry cloth or paper towel and the surface cleaned using a wire brush. The surface shall then be sprayed with pre-cleaning (spray) fluid and wiped with lint free paper and allowed to evaporate before applying dye penetrants.



Note: Wire-brushing of components may cause cracks to be masked by rust/dust/dirt being brushed into them, particularly where the component is wet. A dry cloth or paper towel should be used to clean the area to enable any cracks to be correctly assessed.

3.3.7 Preliminary Visual Inspection

- 3.3.7.1 Take account of any chalk or paint marks that may indicate existing defects previously identified.

3.3.8 Methodology

- 3.3.8.1 The Inspector shall work systematically starting from one end of the casting component, to the opposite end.

3.3.9 Examination

- 3.3.9.1 The following areas of the crossing shall receive detailed examination during inspection.

- a) All wheel contact surfaces
- b) Leg ends, particularly in the upper fillet radii
- c) Longitudinal changes of section
- d) The base of the flange-way
- e) The aprons, particularly the areas adjacent to fish-plates
- f) The top of the box end of the vee
- g) The foot, particularly at changes of section at the flare ends and at fastening positions
- h) The flash butt weld position, particularly the foot tips and the upper fishing surfaces of these welds.

- 3.3.9.2 The following features are to be noted and reported. The first three are potentially the most serious as they can affect safety of the line:

- a) The breaking away of a section of the nose
- b) Horizontal cracking in the upper fillet radii
- c) Cracking at a fishbolt hole
- d) All other cracking
- e) Porosity - squats - wheelburns
- f) Breaking out / shelling / spalling
- g) Vertical deformation of the running surface
- h) General wear on the vee and wing rail running surfaces in the wheel transfer area
- i) Irregular appearance of the surfaces
- j) Presence of weld repairs
- k) Deformity of the crossing nose or wing rails
- l) Other defects or any damage.

3.3.10 Features to be taken into account during Inspections

- 3.3.10.1 Other features to take in account when inspecting the crossing is the condition of crossing support bearers, chairs / base-plates and condition of ballast and compaction. Ensure:

- a) All fasteners are in position and functioning where appropriate.
- b) Track gauge, nominal check rail gauge (protection distance of the nose), and setting of cover checkrails is correct.

3.4 Minimum Actions Pending Repair or Replacement

- 3.4.1 The minimum action to be taken on discovery of a defective cast crossing or cast vee will depend on the nature of the defect. Its length and position within the casting will determine the course of action to take.
- 3.4.2 Details of defects and minimum actions can be found in Attachment 4.
- 3.4.3 The minimum action to be taken on discovery of a defective cast centre crossing or cast vee produced in bainitic steel shall be as follows:

Leg Ends

Minimum Action as for Pearlitic Rail Steel.

Monobloc including change of section

Minimum Action as for Cast Austenitic Manganese Crossings

- 3.4.4 Remedial measures shall be taken as soon as possible to remove the defect or change the crossing, protecting safety of the line, so normal running can be resumed.
- 3.4.5 Where the Cast Crossing Inspector recommends a minimum action to the crossing e.g. welding, imposition of a speed restriction or removal of the crossing, the Cast Crossing Inspector shall liaise with the Track Manager responsible for implementing the minimum action.
- 3.4.6 When recommending weld repairs of crossings or vees, the manufacturer's operating and maintenance manuals relevant to the components shall be consulted especially when welding in close proximity of the Tri-metallic Zones on crossings with flash welded leg ends.

3.5 Marking Defect Locations

- 3.5.1 All known visible defects that require removal or repair shall be clearly and durably marked. The marking shall identify the location of the defect with sufficient precision to ensure that when the defect is removed, it is removed in its entirety.
- 3.5.2 Defects shall be marked with an indelible marker such that any deterioration of the defect can easily be observed during follow-up inspections. In particular, the ends of any crack shall be clearly marked and dated so that growth rates can be monitored accurately.

3.6 Inspection Reports

- 3.6.1 The Cast Crossing Inspector shall complete the defective crossing report found in Attachment 1 and, where necessary, shall complete the cast crossing monitoring report form found in Attachment 2 clearly marking the length and location of the defect and the frequency that it shall be inspected.
- 3.6.2 On discovery of a defect described in Attachment 4, a defect form shall be completed as required in standard S1158. The defect shall then be recorded on the Rail Fail Database, also in Ellipse or equivalent, and plans made for the crossing to be repaired.

3.7 Follow-Up Inspections

- 3.7.1 Where inspections by the certificated Cast Crossing Inspector have resulted in a defect being identified this may result in additional inspection being imposed on the crossing in accordance with the minimum action criteria found in Attachment 4.



- 3.7.2 Under such conditions a patrolman or competent trackman may be formally briefed by the Cast Crossing Inspector or Track Manager or nominated Deputy as to what additional follow-up inspections shall be carried out at the increased frequency. The briefing shall be recorded (on the cast crossing monitoring report form found in Attachment 2) and the patrolman/trackman shall sign the briefing note to ensure the conditions of the inspection are understood. On completion of the mandatory briefing the patrolman/competent trackman shall be acknowledged as the “Cast Crossing Watchman”.
- 3.7.3 The Cast Crossing Watchman shall inspect the extremities of the crack to ensure it has not propagated past the Inspector’s marks. Where the crack length has increased the Cast Crossing Watchman shall immediately advise the Cast Crossing Inspector / Track Manager. The Cast Crossing Inspector / Track Manager shall re-examine the crossing and, where appropriate, reclassify the defect code.
- 3.7.4 The Cast Crossing Watchman shall record the date of the inspection and the length of the crack, and sign the inspection sheet. Where a crack has grown beyond the previously marked extent, the new extent shall be clearly marked and dated so that the growth rate can be monitored accurately.

3.8 Appoint Watchman

- 3.8.1 Where the minimum action mandates “Appoint Watchman” a Cast Crossing Watchman, who has been briefed to inspect a defective crossing, shall undertake an inspection a minimum three times per day as follows:
- a) after morning peak traffic;
 - b) after evening peak traffic;
 - c) during engineering hours.

3.9 Weld Repairs

- 3.9.1 Weld repairs shall be undertaken on any casting where metal has broken out.
- 3.9.2 Weld repairs shall be undertaken as soon as possible to prevent propagation of the defect.
- 3.9.3 Weld repair limitations and procedures shall be as set out in T0436.

3.10 Records

- 3.10.1 Inspection records shall be retained and maintained for a minimum period of 5 years and shall be available for audit.

3.11 Environment

- 3.11.1 The inspection of cast crossings and cast vees process shall have minimal impact on the environment. The inspection process utilises hand tools and some chemicals.
- 3.11.2 The degreasing agents, liquid penetrant dyes and such like are normally supplied in aerosol containers. Storage and disposal shall be in accordance with the manufacturer’s recommendations and LU’s procedures for waste disposal.
- 3.11.3 Similarly all contaminated rags and tools used in the inspection process shall be disposed of in accordance with LU’s procedures for waste disposal.

4 Responsibilities

4.1 Track Manager

- 4.1.1 The Track Manager for each Line is responsible for the implementation of this standard and shall ensure that:
- a) all his Line's track teams have access to the standards and specifications.
 - b) all relevant sub-contracting companies have access to the standards and specifications.
 - c) LU personnel and any sub-contracting company(s) are compliant with the requirements of this standard.
 - d) all staff carrying out inspections are qualified in accordance with the requirements of section 3.2 of this standard.
 - e) all cast crossings and vees are inspected within the specified timescales.

4.2 Cast Crossing Inspector

- 4.2.1 The Cast Crossing Inspector is responsible for ensuring that:
- a) the area of the crossing to be inspected is thoroughly cleaned immediately prior to the inspection using a suitable degreasing agent.
 - b) a thorough inspection of the crossings and/or vees is carried out to establish the actions to be taken.
 - c) the extent(s) of any defects on the crossing are marked as required.
 - d) all the necessary details are recorded on the relevant inspection forms:
 - i) Cast Crossing Inspection Failure Form (Attachment 1)
 - ii) Cast Crossing Monitoring Report Form (Attachment 2)
 - e) where defects are identified the minimum actions are applied in accordance with Attachment 4.

4.3 Cast Crossing Watchman

- 4.3.1 The Cast Crossing Watchman is responsible for ensuring that:
- a) he receives a brief from the Cast Crossing Inspector or Track Manager on what additional "follow up" inspections are required and at what frequency.
 - b) he undertakes the inspections as directed, marks up the crossing as required, and records the information on Cast Crossing Monitoring Report Form (Attachment 1).

5 Supporting information

- 5.1. Cast manganese crossings and cast vees are manufactured from austenitic manganese steel (AMS). It is tougher than normal grade rail and can tolerate large cracks before total failure. Cracking, which appears minor on the surface, may however be associated with larger internal defects. These larger defects may result in premature failure unless stringent inspection, maintenance and repair procedures are adhered to.
- 5.2 Cast centre block and cast centre vee crossings are also produced in bainitic steel which does not have the fracture toughness of AMS so the early detection of cracks is of paramount importance.
- 5.3 Cast crossings manufactured in bainitic steel can be identified by utilising a magnet. bainitic steel will attract a magnet. Austenitic manganese steel will not attract a magnet.