Standard Category 1

S1158 A11 Track – Inspection and Maintenance

Contents

Please read the written notices attached to the back of this document

1 Purpose

The purpose of this standard is to define the requirements for the measured and manual inspections and maintenance of the track system.

2 Scope

2.1 This standard applies to the Permanent Way system in running lines, depots and sidings.

2.2 It covers, but is not limited to, the following components of track:

a) running rails

b) check rails

c) rail fastenings including rail pads

d) adjustment and expansion switches

e) switches and crossings

f) track support features including ballast, shingle, formation, sand blankets, geosynthetics, second-stage concrete, transition slabs and drainage systems

g) switch fittings such as soleplates, stretcher bars and brackets and ancillary equipment such as point levers and point heaters.

2.3 That part of the standard dealing with inspection covers the following activities:

a) routine inspections of the track;

b) inspection of the track following a period out of use or when regular inspections have been suspended;

c) inspection following work on or near the line, to assure that the completed works and maintenance tolerances in standard S1159 are achieved and that the track is safe for its permitted use;

d) inspection following exposure to conditions or events that could affect the safety of the line;

e) inspection of temporary works;

f) inspection of certain off-track features including structures and fencing, to the extent that this activity is the responsibility of the Track discipline (in some cases this is by reference to other relevant standards).

2.4 The standard does not cover the requirements associated with the performance and design of track, which are the subject of standard S1157.

2.5 The standard shall be read in conjunction with standards S1162, S1163 and S1164 in respect of conductor rails and associated components.

2.6 The standard does not cover the requirements associated with Rail Defect management, which are the subject of standard S1178.

3 Requirements

3.1 Track Categories

3.1.1 Each track section shall be allocated a track category A, B, C, D, E, F, or U to ensure that the requirements for those inspection and maintenance activities that are determined on the basis of track category can be ascertained for each location.

3.1.2 The method of classification of 'in use running lines' shall be a combination of tonnage and speed to give a track loading factor L, where:

a) $L = (TV^2)/1000$;

b) T is the annual tonnage in millions of gross tonnes;

c) V is permitted speed in miles per hour;

d) the category is determined from the loading factor:

I. category A, where $L>30$;

II. category B, where $15 \leq L \leq 30$;

III. category C, where $L<15$.

Note: For the purposes of this standard and consistency with the ORR, the term 'Running lines' is defined as all LU track outside Depot and Maintenance Siding limits and subject to Engineering hours. This includes Turnbacks or Reversing Sidings, Loop, and Lay-by or Lay-over Sidings that are located near the running lines when their prime purpose is to allow a train to be reversed (or temporarily stabled and prepared but not decoupled or maintained).

The term 'in use' means all track not secured as out of use, as per Category E below.

3.1.3 The classification of Depot and Maintenance Sidings and all track not deemed 'in use running lines' shall be as follows:

a) category C: in use Depot and Maintenance Sidings where at least one of the following applies

I. a derailment or track fault could adversely affect the safety of traffic on a running line or have a serious impact on the train service

II. current rail section is fed from the running lines

III. permitted Speed is greater than 16km/h

IV. used as a through running route by Engineer's trains or may be used by service trains as a diversionary route off the running line.

b) category D: in use Depot and Maintenance Sidings not classified as C or F with a maximum permitted speed of 16km/h

c) category E: track generally exempted from standard requirements that is not in use, or track with restricted use and access, e.g. Aldwych Branch and Epping to Ongar boundary

d) category F: fleet maintenance pit roads or rail within fixed Plant, e.g. train washes, wheel lathes

e) category U: track that is fully removed or decommissioned such that it cannot be used to run trains, has no signalling or power feeds, and poses no safety risk, e.g. residual embedded rails in depot buildings over which a train cannot run.

3.1.4 The classification of track as Category E shall be authorised by the Professional Head of Permanent Way Engineering, and a suitable inspection and maintenance plan put in place and approved. Where an inspection and maintenance plan has been approved by the Professional Head of Permanent Way Engineering, Track standard requirements not included in the authorised plan will not apply to the classified section of track.

3.1.5 For Category F track a suitable inspection and maintenance plan shall be approved by the Professional Head of Permanent Way Engineering. Where an inspection and maintenance plan has been approved by the Professional Head of Permanent Way Engineering, Track standard requirements not included in the authorised plan will not apply to the classified section of track.

3.1.6 A database shall be maintained, recording for each track section up-to-date traffic data and current track category.

3.2 Inspections – general

3.2.1 Track shall be subject to detailed monitoring and inspections to ensure the safety and quality of the track asset and to identify, record, and prioritise maintenance work to be carried out. Attachment 1 contains a schedule of routine inspections and in each case the maximum interval between them, together with certain other inspections which are to be carried out as required.

3.2.2 Monitoring and inspection of the track system is critical to safety. Inspections shall be carried out only by persons who are appropriately trained and licensed for the purpose. In particular, these persons shall be competent to declare that the track is safe for its permitted use.

3.2.3 Routine inspections shall be capable of measuring and assessing the condition of track components and parameters in order to compare results against defined requirements and good practice, so as to enable trends to be monitored and changes over time to be recorded and assessed. In particular, these components and parameters shall be subject to monitoring against, as a minimum, the thresholds defined in standards S1159 and S1164.

3.2.4 Where practicable, guidance shall be provided to inspection staff to assist them in identifying defects which may be difficult to detect.

3.2.5 Sufficient information, including a Walkout report, shall be provided to inspection staff regarding the location and nature of previously-reported defects to enable them to pay appropriate attention to those defects during the inspection.

3.2.6 Where safe and practicable the opportunity should be taken to observe the track under traffic where this may reveal behaviour that can be seen only with the track in service.

3.2.7 Inspections of the track system assets shall be carried out at such intervals that:

a) emerging defects should be identified and known defects monitored so that appropriate action is taken before safety standards are breached

b) developing trends should be identified

c) maintenance and renewals shall be planned in a timely manner.

3.2.8 The intervals between each of the mandated inspections shall be no greater than any maximum specified in this standard. The required interval for specific locations shall be determined using an appropriate risk assessment that takes account of basic factors about the track including location, use, configuration and more variable factors such as condition and failure rates (where trends must also be considered) of the track components, and other aspects of the overall inspection regime including the inter-dependence of different inspections.

3.2.9 The procedure described in clauses 3.3.3 and 3.3.4 for the assessment of intervals between patrolling and supplementary inspections, and the procedure referenced in clause 3.4.2 for the interval between junctionwork (PM4) inspections constitute risk assessments in the context of clause 3.2.8. The assessments shall be reviewed:

a) when there is any change of track configuration

b) when there is a change of use

c) when performance history changes (e.g. incidence of derailments or broken rails)

d) when there is a change in asset condition

e) annually.

3.2.10 If an inspection is being carried out at an interval less than the maximum mandated in this standard, any increase in this lesser interval, including reversion to the maximum permitted interval, shall be supported by an appropriate risk assessment.

3.2.11 When a condition is identified, which poses an unacceptable risk to safety or the reliability of the train service or is likely to deteriorate to an extent where it poses such a risk before the next scheduled inspection, corrective actions shall be taken to restore the asset to a safe and fully operational condition. Otherwise, either the asset shall be taken out of service, or the speed of traffic shall be appropriately restricted, or other action shall be taken to mitigate the risk. The details of the sub-standard condition and of any action taken shall be recorded on the track asset condition database.

3.2.12 As part of the introduction of new components or assemblies potential failure modes and defects shall be identified, and appropriate minimum actions shall be set out in this standard.

3.2.13 Some items within the scopes of individual track inspections are duplicated by other track or other disciplines' inspections. In this situation:

a) the full scope of the individual inspections shall be adhered to irrespective of duplication;

b) any fault identified as requiring action by an inspector shall be reported and followed up in the normal way. It shall not be assumed that another inspection covering the same feature will identify and deal with the fault.

3.2.14 Where inspection findings may be of interest to other disciplines, those disciplines shall be informed. For example, unexpected or rapid deterioration in track geometry or loss of ballast may indicate instability in earth structures: in addition to the corrective actions shown in S1159 the Civil Engineer shall be informed, and, where

the stability of the earth structure may be of concern, the durability of the track repair shall be monitored for signs of further deterioration which may indicate continuing earth movement.

3.2.15 The procedure for recording inspections, required by clause 3.7.1, shall provide a means of verifying that inspections are being carried out at the required intervals.

3.2.16 The inspection system shall provide assurance, by means of checking at an appropriate frequency, that inspections are being completed conscientiously and effectively.

3.2.17 The inspection reporting and recording system (see also clause 3.7) shall provide for a positive statement to be made (within the scope of the inspection) that the asset is safe for its permitted use until the next scheduled inspection, or, if it is not, the reason. In the event that the asset is not considered to be safe until the next scheduled inspection, appropriate action shall be decided upon and implemented to safeguard the asset.

3.2.18 The inspection and maintenance regime shall take account of recommendations arising from incident inquiries as appropriate.

3.2.19 The inspection regime shall provide for investigation of defects which may be precursors of more serious situations (e.g. broken stretcher bars, poorly-secured cover checks) and defects which are recurrent. Investigation shall be targeted at identifying and, as far as reasonably practicable, eliminating root causes.

3.2.20 When visual inspections are not carried out in daylight, lighting shall be provided to enable identification of features that are:

a) up to 30m in the distance (e.g. serious track geometry faults)

b) in the immediate vicinity (e.g. component condition)

c) detailed (e.g. cracks in rails and stretcher bars).

3.2.21 Where the lighting referred to in clause 3.2.20 is battery-powered the battery life shall be sufficient to provide the necessary level of illumination for the duration of the inspection.

3.2.22 In addition to the requirements in Section 3 of this standard, requirements relating to specific aspects of inspection, minimum actions, maintenance and reporting are set out in Section 11 ‘Attachments’.

3.2.23 Inspection disrupted by exceptional events – general

3.2.23.1 In conditions where effective inspection is not practicable, e.g. with snow cover or flooding, any suspension of normal inspection shall be for the minimum practicable period.

3.2.23.2 In the event that traffic has been suspended and normal visual inspection has not been practicable during the period of suspension, a visual inspection shall be carried out prior to resumption of traffic to confirm that the track is in a fit condition for the passage of trains.

3.2.24 Inspection disrupted by heavy snow cover

3.2.24.1 Where the line remains open to traffic but normal inspection is impracticable, the manager responsible shall take mitigating action in the form of either cab-riding or a temporary speed restriction. In making this decision account shall be taken of:

a) the current Walkout report for each area of suspension, noting particularly

I. any defects subject to a Temporary Approved Non-Compliance and the adequacy of current mitigation

II. whether Safety Standard defects have been rectified

III. whether Maintenance Limit defects are likely to be affected by the change in conditions

b) the ultrasonic testing history and the status of any rail defects in the area under suspension and if additional mitigation is required

c) the output from the previous track recording vehicle run over the area

d) the form of track construction.

3.2.24.2 The manager shall;

a) complete the relevant mitigation form to regularise the suspension of the inspection activity;

b) monitor the site conditions and ensure that competent inspection resource is available to resume inspections once conditions permit this to be done safely.

3.2.24.3 It is important that managers understand how the operation of Sleet trains may impact on the inspection regime in areas unaffected by snowfall or adverse conditions. In these circumstances managers should seek to work with Operations staff to maintain as far as reasonably practicable the normal inspection frequency.

3.2.24.4 In areas where the operation of Sleet trains imposes a reduction in the normal inspection frequency, the manager responsible shall take mitigating action in the form of either cab-riding (with the facility to halt the train and take corrective action such as reinstating keys, if required) or a temporary speed restriction. In making this decision account shall be taken of:

a) records of the number of BH keys routinely re-inserted by the patrolman in the area where access will be lost

b) whether the keys are reported as sequential or individual

c) based on the above and the time that will have elapsed between inspections, whether the number of keys displaced is likely to have reached an unacceptable level.

3.2.25 For all relevant inspections, any change to the information captured on the inspection assessment forms shall be approved by the Professional Head of Permanent Way Engineering or relevant technical delegated authority.

3.2.26 Where an inspection is not completed within the required timescale, an assessment of the risk and regularisation of the inspection shall be undertaken in accordance with procedure PR0128. A Mitigation form shall be completed to record the decision in line with the approved timescales following the missed inspection.

3.2.27 Inspection routes

3.2.27.1 Track inspection shall be by means of inspection routes, which shall have clearly defined boundaries.

3.2.27.2 Inspection routes should be configured in such a way as to maximise the effectiveness and efficiency of patrolling, taking account of different intervals required for various parts of the line, and of any supplementary inspection which may be required at specific sites.

3.2.27.3 Inspection Route Diagrams and Route descriptions shall be provided to Patrollers and PM3 and PM5 Track Inspection staff. The diagrams shall be marked with the Road LCS codes and Point numbers, Point location codes and boundary markers to aid fault identification and reporting.

3.2.27.4 Inspection Route Diagrams shall be subject to annual review.

3.2.27.5 Up to date Patrol Route Location lists (Maximo Route Stops) shall be maintained to enable Patrol Walkout Reports to be generated.

3.2.27.6 The presence of boundary markers shall be noted on the Inspection Route Diagrams. Boundary markers shall be inspected during Patrolling to ensure that they are:

a) present

b) securely fixed

c) fully legible.

3.3 Basic Visual Inspections

3.3.1 Scope

3.3.1.1 Basic visual inspection shall comprise the core activity of patrolling (PM1 and PM2) and, where required, supplementary inspection which may focus on particular features or locations. Details of the requirements for both core patrolling and supplementary inspections are given in the following clauses.

3.3.2 Core patrolling – general requirements

3.3.2.1 Patrolling shall be carried out either:

a) by walking in the four-foot of the track where safe to do so, or

b) in Engineering Hours only, using an LU-approved mechanised trolley if an assessment has identified the track as suitable for this method of patrolling. The use of trolleys for this purpose shall be subject to the following limitations:

I. the speed during patrolling shall be limited to 10mph

II. they may be used for up to a maximum of 75% of patrols on any section of line.

3.3.2.2 Only the track walked over, or run over by the trolley, shall be regarded as being patrolled. However, observation shall be made of adjacent tracks and of off-track features to the extent practicable.

3.3.2.3 Persons carrying out patrolling are not normally required to take measurements as part of the inspection.

3.3.2.4 Components and features of the track shall be examined by patrolmen to locate conditions which are unsafe, potentially unsafe or likely to cause delay to trains. Principal conditions to be looked for and guidance on the relevant minimum action required of patrolmen are set out in Attachment 2. However, the list of conditions in

Attachment 2 is not exhaustive and any condition which appears upon visual inspection to pose a risk to safety or the train service shall be subject to appropriate action. Following each patrol the patrolman shall refer to the Walkout report to confirm whether or not a defect identified during the patrol has already been reported and recorded in the defect management system.

3.3.2.5 Patrol Walkout Reports shall contain details of Registered Conditions on the Condition Registers (Register of Inherent Geometry, Non-Compliant Flangeway Register and Residual Switch Opening Register etc.), as required by the registers. The conditions in the aforementioned Registers should not be classified as SS, ML or MT but must be monitored, as required by the registers, during Patrolling and other Inspections.

Note**:**	Where necessary until reports can be amended (to use a registered condition code) registered conditions may be classified as MT so that they appear on the reports.

3.3.3 Core patrolling – maximum interval between patrols – Cat A, B and C track

3.3.3.1 Regardless of the interval derived from clauses 3.3.3.2 and 3.3.3.3, the interval shall be 24 hours if the need for supplementary inspection, as described in clause 3.3.5, has not been assessed and recorded.

3.3.3.2 The maximum patrolling interval for any section of Cat A, B or C lines shall be assessed with reference to the track configuration, as follows:

a) The maximum patrolling interval for bullhead track shall be 72 hours, or 96 hours if the interval includes both Saturday and Sunday.

b) The maximum patrolling interval for flat bottom shall be 1 weeks if determined by a risk assessment program, subject to the methodology approved in PR0108. Where there is no such risk assessment carried out, the maximum patrolling interval shall be 72 hours.

3.3.4 Core patrolling – maximum interval between patrols – Cat D track

3.3.4.1 If either the assessment described in clause 3.3.4.2(a) or the assessment of the need for any supplementary inspection as described in clause 3.3.5 has not been made, the interval shall not exceed 72 hours, or 96 hours if the interval includes both Saturday and Sunday.

3.3.4.2 The maximum core patrolling interval for Cat D track may be set at one week, subject to:

a) an assessment being carried out of the degree of possible track degradation between patrols, and of the implications of such degradation for safety and service reliability

b) train speed not exceeding 15mph

c) Depot Managers being informed of instances where weekly patrols are implemented.

3.3.5 Supplementary inspection – general requirements

3.3.5.1 The outcome of the assessment, described below, of the need for any supplementary inspection shall be recorded, including any decision that no such

activity is required. In the absence of such record the patrol interval shall default to 24 hours (see clause 3.3.3.1).

3.3.5.2 Where patrol routes or specific locations require inspection at an interval less than that determined from clause 3.3.3.2 (Cat A, B and C track) or clause 3.3.4.2 (Cat D track), owing to isolated changes in track configuration or degraded asset condition, supplementary inspection shall be carried out at those locations. This activity shall comprise inspections focused on the relevant particular features of those locations and minor repairs as appropriate. The criteria to be taken into account for determining the need for and frequency of this supplementary activity include but are not limited to:

a) “fixed” features, e.g. junctionwork which has a PM4 inspection interval of 4, 8 or 12 weeks, variations in track configuration, longitudinal-timbered bridges;

b) “transient” features, e.g. known Safety Standard exceedances, the need for repeated and frequent maintenance interventions (e.g. reinstatement of loose rail fastenings), abnormal rate of deterioration (e.g. to track geometry, arising from unstable earth structures), history of broken rails, trespass, vandalism, adverse weather (see also clause 3.3.6 in respect of hot weather).

3.3.5.3 Where an aspect of track configuration is sufficiently localised (e.g. a short length of bull-head checked track within otherwise mainly flat-bottom track), the required lower patrol interval may be satisfied by focused supplementary inspection.

3.3.5.4 The record of the assessment of the need for any supplementary inspection shall be retained for two years, after which it shall be archived.

3.3.6 Supplementary inspection – hot weather inspections

3.3.6.1 Inspections in hot weather are classified as supplementary inspections and shall be carried out as follows:

a) short-rail track: additional safety patrolling shall be carried out if the rail temperature reaches 35°C by 11.00 hrs and is still rising, or if it reaches 37°C at any time. If it is impracticable to carry out patrolling on foot (e.g. owing to lack of access during traffic hours), cab-riding is permitted subject to its effectiveness and practicability; if cab-riding is considered ineffective or impracticable a speed restriction of 25 mph shall be imposed;

b) welded track: the track shall be managed in accordance with critical rail temperatures, as described in standard S1177.

3.4 Inspections involving measurement

3.4.1 Track quality – plain line (PM3)

3.4.1.1 Inspection of plain line in running lines, depot track and sidings to ensure that overall track maintenance, cleanliness and tidiness standards are being maintained. These inspections shall be carried out by a person with responsibility for the safety of the line and who responds to reports of the basic visual track inspections.

3.4.1.2 The inspections shall be carried out with the purpose of:

a) identifying conditions which are non-compliant with the requirements of standards S1159 and S1164, or are likely to become so

b) determining the scope of remedial works required

c) establishing priorities for general maintenance programmes and determine proposals for renewal works.

3.4.1.3 Measurements of parameters such as track gauge and twist shall be made at intervals along the track to suit the track condition. Alternatively, where current reports of vehicle-based track geometry data are available these may be used.

3.4.1.4 The inspections shall ensure that deteriorating track conditions are identified before they become sub-standard, and that any sub-standard conditions found are promptly reported and correctly rectified.

3.4.1.5 Principal conditions to be looked for and the relevant minimum action required of persons carrying out track quality (PM3) inspections are set out in Attachment 2. However, the list of conditions in Attachment 2 is not exhaustive and any condition which appears upon measurement or visual inspection to pose a risk to safety or service performance shall be subject to appropriate action.

3.4.1.6 The intervals between track quality (PM3) inspections are given in Attachment 1.

3.4.1.7 When carrying out the inspection the current Walkout report shall be available. As part of the inspection all defects identified in the Walkout report shall be confirmed as either rectified, or if present that they are correctly described.

3.4.2 Junctionwork (PM4)

3.4.2.1 The PM4 inspection of junctionwork shall comprise the core activity of full inspection and, where required, supplementary inspection which may focus on particular features.

3.4.2.2 The core inspections of junctionwork shall be at intervals determined by an approved risk assessment, using either the risk assessment form F0149 ‘Assessment of base interval between Junctionwork (PM4) inspections’ or an equivalent providing no less information. The assessment shall be reviewed in accordance with clause 3.2.9.

3.4.2.3 Supplementary inspections shall be undertaken where the condition of the junctionwork necessitates this. They may be full or partial, but as a minimum shall address the features where condition is deficient.

3.4.2.4 Switches shall be operated as necessary during inspections.

3.4.2.5 For Controlled Switches there shall be an approved management plan which shall include requirements for inspection (which may exceed those set out in this standard). Up to date plans can be found in PR0123.

3.4.2.6 There shall be provision on the PM4 report form for a declaration that the next inspection can await the assessed “core” interval, or whether a supplementary inspection is required.

3.4.2.7 When carrying out the inspection the current walk-out report shall be available. As part of the inspection all defects identified in the walk-out report shall be confirmed as either rectified, or if present that they are correctly described. The inspection shall extend a sufficient distance beyond the junctionwork, (defined as extending between the switch tips and the last through bearer behind the crossing), to allow for the detection of defects which in combination with any defects within the junctionwork limits would increase safety risk.

Note:	As stated in S1159, it is important to recognise that where different defects exist together in combination their combined effect may create a greater risk demanding a more onerous response. Therefore, it is possible that defects outside the junctionwork may have the effect of increasing safety risk when considered in combination with defects within the junctionwork.

3.4.2.8 Junctionwork Walkout Reports shall contain details of Registered Conditions on the Condition Registers (Register of Inherent Geometry, Non-Compliant Flangeway Register and Residual Switch Opening Register etc.), as required by the registers. The conditions in the aforementioned Registers should not be classified as SS, ML or MT but must be monitored, as required by the registers, during Patrolling and other Inspections.

Note:	Where necessary until reports can be amended (to use a registered condition code) registered conditions may be classified as MT so that they appear on the reports.

3.4.2.9 Residual switch opening, gauge and flangeway shall all be recorded independently of each other. The residual switch opening between the closed switch and stock rail shall be measured and included in the gauge measurement at a set of points. This is to provide an accurate measure of the gauge during operation.

3.4.3 Inspection of switch and stock rails and of cast crossings and cast vees

3.4.3.1 Inspection of switch and stock rails for wear and damage shall be carried out with approved gauges in accordance with standard S1176.

3.4.3.2 In addition to the PM4 inspections of junctionwork (clause 3.4.2) detailed inspections of cast crossings and cast vees shall be carried out to detect cracks and other defects. The methods of inspection and the actions to be taken in the event of defects shall be in accordance with standard S1175.

3.4.4 Requirements specific to rail joints

3.4.4.1 Bolted joints, all types

All bolted rail joints shall be visually inspected at assembly and in the course of scheduled track safety and quality inspections to confirm:

a) that they are adequately supported and restrained;

b) that they and their components conform to the thresholds defined in standard S1159;

c) their mechanical integrity;

d) that any necessary bonding is in place and secure.

3.4.4.2 Insulated joints

In addition to the requirements in clause 3.4.4.1, insulated joints shall be inspected to confirm that:

a) the insulating parts, where visible, are not defective

b) rail head deformation at the rail ends and/or metallic particles embedded in the end-post are not at risk of bridging the end-post

c) in the case of 4-hole 56E1 Tenconi joints coloured orange, there is no cracking of the fishplates as observed using the apertures in the lower edge of the encapsulation.

3.4.4.3 Temporary rail joints

3.4.4.3.1 Temporary rail joints shall have a speed restriction applied in accordance with table 1.

3.4.4.3.2 Temporary rail joints that are formed of back hole drilled and bolted fishplates and supported by clamps shall be inspected during the T002/3 handback, after 72 hours and then every 7 days. The inspection shall be recorded on form F2472. In addition to the clamp inspection, the arrangement shall be visually checked during routine patrol inspections.

3.4.4.3.3 Temporary rail joints that are secured only by rail clamps shall be inspected in accordance with the frequencies set out in table 2 and recorded on form F2472. All rail clamps shall be installed in accordance with the requirements set out in R0772.

3.4.4.3.4 Following inspection, subject to the joint remaining secure and in good condition, the inspection arrangements stated in this standard shall be maintained until the temporary joint is removed. Where the condition of the joint changes such that adjustment or other remedial work is required, daily on-site inspections shall be made until the temporary joint is removed.

Table 1: Permitted speeds at temporary rail joints

Joint gaps and steps		Sawn rail ends, fishplates, back holes drilled, CBX, and bolted, clamped at inner holes		Sawn rail ends, fishplates or clamp plates secured by clamps only	
	Speed (mph)	Limiting dimensions (mm)	Maximum passing tonnage prior to welding or removal[a]	Limiting dimensions (mm)	Maximum passing tonnage prior to welding or removal[a]
Maximum rail gap	10	15	N/A	>50-75[a]	0.5 MGT[a]
	20	10[b]	6 MGT[b]	>10-50[a]	0.5 MGT[a]
	50	6[I]	6 MGT[I]	10	1 MGT[d]
	60	6[I(g)]	6 MGT[I(g)]	10[h]	1 MGT[d][h]
Maximum rail step (vertical)	10	N/A	N/A	2	0.5 MGT
	20	1	6 MGT	1	1 MGT[d]
	50	0[I(f)]	6 MGT[f]	0[I(f)]	1 MGT[d][f]
	60	0[I(g)]	6 MGT	0[I(h)]	1 MGT[d]

Table 1 Notes:

(a) Gaps greater than 26mm are not to be welded after being in traffic.

(b) Gaps up to 26mm permitted if welded within 1 MGT.

(c) Gaps up to 10mm permitted if welded within 2 MGT.

(d) Confirm using APR that joint components used are not subject to shorter time limits.

(e) Profile grind to achieve matched rail ends.

(f) 1mm step is permissible but must be welded within 1 MGT.

(g) Clamp bolts to be retained by a positive locking system, or arranged so that the bolts are not loaded in bending.

(h) Joint to be secured by 4 clamp bolts retained by a positive locking system, or arranged so that the bolts are not loaded in bending.

(i) Clamps on a back-hole drilled and clamped joint form part of the assembly and are therefore subject to the inspection requirements for that assembly, (i.e. 72 hours/Patrol).

(j) Subject to joint remaining secure. Gaps >26mm to be inspected at 24 hour intervals until removed.

(k) Fishbolt holes drilled for the installation of back-hole drilled and clamped joints shall be cold-bolt expanded following welding of the rail ends in accordance with S1157 Section 3.8.2.6. (Note: the effect of any cold-bolt expansion is NOT lost when welding is carried out on a previously back-hole drilled and clamped joint, due to the distance of the holes from the Heat Affected Zone of the weld).

(l) Track Tonnage is available via the following link: Track Tonnages.

Table 2: Timeline and inspection requirements for use of clamps with temporary rail joints

Time	
0	Installation and T002/3 handback inspection
24 hrs	1st inspection
48 hrs	2nd inspection. If clamps are secure, inspect 48-hourly (24-hourly with Robel “Des10” at 60mph) until removal or 28th day.
7th day	Remove clamps if time extension not approved.
14th day	Remove clamps if time extension not approved. Clamps for composite joints must be removed.
21st day	Remove clamps if time extension not approved.
28th day	Remove clamps if time extension not approved. If still in use impose 20mph speed restriction and institute 24-hourly inspection.

Table 2 Notes:

1. Clamp types shall be in accordance with R0772. G-Clamps are not permitted to be used to form temporary rail joints.

2. All inspections in this table must be recorded on form F2472.

3. At every inspection it shall be verified that:

   a) all bolts are tight and secure

   b) fishplates are correctly located to the rails and the clamps remain not less than 30 mm from the ends of the fishplates

   c) the two adjacent sleepers at each side remain well packed

   d) the correct speed restriction is being applied

4. Lesmac clamps for concreted track must be removed after 48 hours when used for temporary joints.

5. In addition to these inspections, clamps shall also be visually checked during routine Patrol inspections in accordance with G1548 or G1648.

3.4.4.4 Rail clamps used in mitigation for rail defects and welds

3.4.4.4.1 Clamps installed as mitigation for rail defects set out in S1178 or for aluminothermic welds set out in T0432 shall have a speed restriction applied in accordance with the requirements set out in S1178 or T0432. The clamps shall be inspected in accordance with the frequencies set out in table 3.

Table 3: Timeline and the inspection requirements where temporary clamps are used for rail defects and aluminothermic welds (including failed welds or missed weld inspections)

Time	
0	Installation and T002/3 Handback inspection (note 4)
24hours	1st inspection
48 hours	2nd inspection
Every 7 days (note 3)	Inspect every 7 days since first installation.

Table 3 Notes

1. Clamp types shall be in accordance with R0772.

2. All inspections in this table must be recorded on form F2472.

3. At every inspection it shall be verified that:

   a) all bolts are tight and secure

   b) fishplates are correctly located to the rails and the clamps remain not less than 30 mm from the ends of the fishplates

   c) the two adjacent sleepers at each side remain well packed

d) the correct speed restriction is being applied

4. Information for clamped welds shall also be captured on the appropriate welding forms (weld completion form, weld non-conformance form or weld inspection form as appropriate).

5. The clamps may only remain installed for the allowable repair timescale stipulated in S1178 or T0432 for the defect or mitigation. Any extension to this timescale would need to follow the TANC process and agreed by the competent authority set out in S1178 or T0432.

6. In addition to these inspections, clamps shall also be visually checked during routine Patrol inspections in accordance with G1548 or G1648.

3.4.4.5 Requirements for all temporary rail clamps and temporary rail joints

3.4.4.5.1 Every temporary rail clamp shall be given a unique identification number, excluding G clamps. A record shall be kept of every use of the clamp. The record shall contain as a minimum the clamp type, the plate type, the location, the total period (number of days) the clamp was in service, the reason for the clamp and the subsequent inspection work order details. The department that has possession of the clamp shall be responsible for keeping the register which may be electronic.

3.4.4.5.2 A live register shall be kept by each line (maintenance) for all clamp installations currently installed on the network. Capital shall also hold a live register of clamp installations and provide details to the maintenance teams.

3.4.4.5.3 All temporary rail clamps and plates shall be subject to an inspection and maintenance regime to ensure that components put into service are not defective, worn beyond tolerance or excessively fatigued.

3.4.4.5.4 Where track supports in tube tunnel track are installed at 500mm centres, it is not possible to fit temporary clamped joints or emergency fishplates without omitting the Pandrol clips on one or both of the baseplates each side. In such locations the following requirements shall be met:

d) Clips will not be removed unnecessarily if the temporary fishplate will fit without doing so

e) The only clips or insulators missing, defective or not secure for 5m each side of the temporary fishplate will be those removed adjacent to the temporary fishplate to accommodate its fitting

f) The maximum number of clips or insulators missing, defective or not secure per 100m of track shall comply with S1159 clause 6.4.3

g) Where combined insulators and pads need to be removed to fit the temporary fishplate a suitable temporary pad is to be inserted to ensure rail support.

3.4.4.6 Welded joints

3.4.4.6.1 Newly installed welded joints shall be examined immediately after completion of the weld and then inspected within 28 days after installation, in accordance with the criteria and tolerances set out in technical specification T0432.

3.4.4.6.2 Faults associated with welded joints discovered during routine track inspection (e.g. Patrol, PM3 or PM4) shall be actioned in accordance with the maintenance tolerances set out in standard S1159.

3.4.5 Inspection of Level Crossings and Road Rail Access Points (RRAPs)

3.4.5.1 Where the rail is fully embedded (e.g. in a poured elastomeric compound), only ultrasonic inspection shall be used.

3.4.5.2 Where the level crossing or RRAP surface comprises panels or other permeable infill materials, inspection shall be through the removal of sufficient panels or infill material to allow the condition of the rail under a road wheel path to be assessed. Frequency of inspection shall be in line with the following:

a) Where the surface is likely to be subject to salt contamination the rail and fastenings shall be inspected on an annual basis. Maintenance interventions shall be undertaken where the condition necessities this

b) Where the surface is not likely to be subject to salt contamination the rail and fastenings shall be inspected at 3 yearly intervals. If significant corrosion is present the inspection frequency shall be increased to annual

c) Alternatively a site specific inspection regime may be determined using a risk evaluation tool approved by the Professional Head of Permanent Way Engineering or technical delegated authority.

Note: Examples of significant corrosion includes rail gall > 1mm, web section loss > 1mm, rail foot damage/indentation > 1mm.

3.4.5.3 Where the level of corrosion has caused section loss, the rail shall be replaced in accordance with standard S1157.

3.4.6 Inspection of Lubricators

3.4.6.1 New types of lubricators for use on the LU network shall be approved for use through the Approved Product Register (APR).

3.4.6.2 Inspections shall be programmed to take place every 28 days, unless an assessment is undertaken by the track manager that requires a more regular frequency.

3.4.6.3 Findings from lubrication inspections, and any remedial works required, shall be reported on form F0165 ‘Rail Lubricator Log Sheet’.

3.5 Track geometry recording

3.5.1 Method

3.5.1.1 The following track categories shall be subject to routine track geometry recording by an approved track recording vehicle such as TRV, or by ATMS:

a) Category A and B

b) Category C track where resources, service pattern, access availability and train stabling arrangements makes it reasonably practical.

3.5.1.2 Category A, B and C track, where the use of TRV or ATMS is not expected to record or cannot routinely record, shall have track geometry recorded at a risk based frequency approved by the Professional Head of Permanent Way Engineering or relevant delegated technical authority for track recording:

a) by manually-propelled recording trolley (“Amber trolley” or equivalent), or failing that

b) track gauge and 2m twist shall be measured and recorded e.g. during PM3 inspections or as a supplement to PM4 inspections.

3.5.1.3 The requirement for recording in 3.5.1.2 may be omitted or an alternative frequency specified in cases such as track normally used at less than 16km/h, approaches to train arrestors, or infrequently-used short sections of track between crossovers, with the approval of the Professional Head of Permanent Way Engineering or relevant delegated technical authority for track recording.

3.5.1.4 Registers listing details of the proposed recording methods for category A, B and C track shall be maintained and shall be submitted to the Professional Head of Permanent Way Engineering for review by the end of March annually.

3.5.1.5 Track geometry recording shall accord as far as reasonably practical with EN 13848. Any new systems introduced shall have symmetrical zero phase shift spatial recording filters.

3.5.2 Parameters to be recorded

3.5.2.1 The following track geometry features (parameters) shall be measured on each track recording vehicle run:

a) top (left and right): top of each running rail shall be measured over a base length of 25m (when recording above 20km/h**)

b) alignment: alignment of the running rails shall be measured over a base length of 25m (when recording above 20km/h**)

c) twist: twist shall be measured over base lengths of 2m and 10m (whenever possible, and in all cases above 8km/h**)

d) cant (whenever possible, and in all cases above 8km/h*)

e) dynamic cross-level (when recording above 20km/h**)

f) wheel unload (whenever possible, and in all cases above 8km/h* for lines with Wheel Unloading limits in S1159)

g) curvature

h) corrugation: rail head corrugation shall be measured on each running rail for the pitch nominated (if available)

i) gauge: gauge between the running edges of the two running rails shall be measured at a point 14mm below the rail crown.

*Any new track recording systems shall as far as practicable record Twist, Cant, Wheel Unload (if required) and Gauge down to zero km/h.

**Any new track recording systems shall as far as practicable record top, alignment and dynamic cross-level down to 5 km/h with symmetrical Zero phase shift spatial filters.

3.5.3 Track recording vehicle calibration and modifications

3.5.3.1 The track recording equipment shall be calibrated regularly against an approved procedure in order to ensure accuracy and repeatability of measurement, and positional accuracy. Calibrations shall be recorded for future independent audit purposes.

3.5.3.2 Modifications and repairs to the track recording measuring equipment shall not adversely affect the consistency of information produced including the ability to monitor trends or the comparability with former results, unless specifically authorised by the competent authority.

3.5.3.3 Modifications to the track recording measuring equipment and subsequent calibration, verification and validation of changes shall be controlled using an approved procedure.

3.5.3.4 A log shall be maintained of all suspected faults, repairs, calibration and maintenance activities relating to the measuring system.

3.5.3.5 Calibration certificates shall be issued twice per year (typically in spring and autumn) along with a log of significant changes to data recording or reporting.

3.5.3.6 Suspected system faults or calibration drift shall be notified to the competent person, investigated and appropriate diagnostic checks and calibration techniques used. If necessary the calibration certificate shall be revoked and calibration repeated.

3.5.3.7 Where errors are transient or impacting only part of the measuring system it may continue to be used. This use shall occur only where serious track geometry faults can be better addressed by continuing to operate. Any concerns regarding data integrity shall be highlighted to data users.

3.5.3.8 The following actions shall be taken to ensure high serviceability of the track recording measuring equipment:

a) A preventative maintenance regime shall apply to the servicing of the measuring system

b) A preventative maintenance regime shall apply to the servicing of all the vehicles of the track recording train (whether or not they are carrying the recording equipment)

c) An essential spare parts list of mechanical items, recording apparatus and computer hardware items shall be compiled. The items shall be stored appropriately and replenished as used.

3.5.4 Track geometry recording frequency and programming

3.5.4.1 The frequency of track geometry recording shall be such that:

a) developing trends are identified

b) maintenance planning is facilitated

c) safety standards are not breached.

3.5.4.2 Where available, sufficient ATMS data to give route coverage shall be:

a) no less often than twice weekly and

b) at intervals planned not to exceed four days.

When this cannot be attained the interval shall not exceed four weeks.

3.5.4.3 On any sections of line where ATMS runs, provided that the ATMS interval does not exceed four weeks, then the interval for recording by TRV shall not exceed 32 weeks.

3.5.4.4 Sections of line not covered by ATMS, or where ATMS recording intervals exceed four weeks, shall be recorded using TRV at the following maximum recording intervals below (unless otherwise approved by the Professional Head of Permanent Way Engineering or relevant delegated technical authority for track recording):

a) Category A and B track used for timetabled passenger moves, except as shown in (b) and (c): 8 weeks

b) Chesham branch, Mill Hill East branch, Watford N to E Junctions: 16 weeks

c) Category A and B multi-path platform areas and approaches: 16 weeks

d) Category C track: 32 weeks where reasonably practical

e) Category D tracks is not require to be routinely recorded but must be reported if recorded.

3.5.4.5 A compliant programme for track recording by TRV shall be produced and approved at least 12 months ahead.

3.5.4.6 A maximum planning tolerance of one week may be applied to the scheduled run dates of TRV.

3.5.4.7 If a recording run by TRV is missed and cannot be re-scheduled within three weeks, appropriate mitigation shall be implemented: this may include the use of ATMS data.

Note:	The extent of mitigation shall depend on the extent of gap between runs. For a gap of less than double the normal inspection interval plus 3 weeks the risk is normally mitigated by reviewing existing data and manually inspecting areas of concern. For longer durations, either an alternate geometry measurement inspection by other means is needed, or a justification for each track section as to why for the current interval the risk is mitigated by existing routine visual checks and scheduled fault repairs.

3.5.4.8 If the availability of the TRV is reduced such that the approved recording frequencies cannot be achieved, track shall be monitored using valid ATMS data where this is available. Where no valid track recording measurements are available the track geometry shall be manually inspected at a frequency no less than the approved track recording frequency.

3.5.4.9 Track Recording Diagrams showing the track recording pattern shall be created and managed as controlled documents. Changes to the Diagrams shall be approved by a competent person.

3.6 Other inspections

3.6.1 Off track (PM5 and PM6)

3.6.1.1 Off-track inspections, (PM5 and PM6), shall check the following:

a) PM5 - condition of operational boundary fences (to identify signs of trespass etc.)

b) PM6 - vegetation, drains, manholes, ditches, embankments and cutting slopes on day-maintained lines and specifically-defined items and sites on night-maintained lines. Inspections shall ensure the safety and quality of the off-track assets.

Sub-standard conditions to be looked for and details reported on form F0132 'Off track and fencing inspections'. The relevant minimum actions are set out in Attachment 3.

3.6.1.2 The intervals between off-track inspections are given in Attachment 1.

3.6.2 Vegetation (PM6)

Further to clause 3.6.1.1, particular requirements regarding inspection of lineside vegetation profiles are set out in S1165.

3.6.3 Cleanliness of the track environment

Requirements regarding inspection to confirm the standard of cleanliness of the track environment are set out in standard S1166.

3.6.4 Acceptance of track work

3.6.4.1 Following any work which has the potential to affect the track, the track shall be inspected to confirm its compliance with standards S1159 and S1164.

3.6.4.2 The scope of "track work" includes minor activities (e.g. reinstatement of rail keys or clips by a patrolman) as well as track renewal-type activities. Inspection shall take place on an as-required basis and as a minimum the following shall be reported and recorded:

a) location, date and nature of work (in the case of minor repairs during basic visual inspections this requirement may be met by appropriate comment in the inspection report)

b) that the completed work has either:

I. met the requirements of standard S1159 or S1164 as appropriate and is accepted or

II. not met the requirements of standard S1159 or S1164 and requires rectification and further inspection before acceptance.

3.6.4.3 Where works have, or are likely to, alter the vertical rail position (e.g. lifting and packing or correcting a Top or Twist fault) 2m and 10m Twist values must be calculated and compared to limits in S1159.

Note:	Consideration should be given to using a track geometry trolley, rather than calculating twist from static readings, to detect twist faults where works have, or are likely to, alter the vertical rail position.

3.6.4.4 Following the completion of works, the information captured during the inspection and acceptance of the works back into service shall be recorded on the relevant handback form (**F1952** for MPD and R&E works, **F2500** for BCV/SSL Maintenance, **F3300** for JNP Maintenance).

3.6.5 Inspection of Longitudinal Timber Bridges

3.6.5.1 Inspections shall be carried out as stated in PR0114 and include:

a) Track only inspections to check the condition of track componentry and geometry

b) Joint Track/Civil inspections to check the condition of the structure and drainage.

3.6.5.2 Principal conditions to be looked for and the relevant minimum actions required are set out in Attachment 2 and 5.

3.6.6 Inspections carried out jointly with patroller

3.6.6.1 Inspections shall be carried out jointly with each patroller in order to:

a) assess the patroller's competence by checking the quality of the inspection carried out by the patroller

b) encourage good practice

c) listen to and address specific concerns.

3.6.6.2 The patroller shall be accompanied on the inspections by the Inspection Supervisor or, on a maximum of one in two inspections, a PM3 Inspector.

3.6.6.3 Except as varied by clause 3.6.6.4, each patrol route shall be the subject of a joint inspection to a programmed two-monthly cycle and each regular patroller shall participate in a joint inspection at least once every six months.

3.6.6.4 Subject to demonstration of assured compliance with requirements for PM3 inspections, Track Skills Licensing, asset condition monitoring and fault reporting, the requirements given in clause 3.6.6.3 may be varied as follows:

a) There is no requirement for each patrol route to be jointly inspected: inspections may be carried out on any convenient route.

b) Inspections shall be carried out jointly with each regular patroller (see Note below) at least once every six months.

c) In order to fulfil the purposes of the joint inspections, the Inspection Supervisor shall chair a meeting with regular patrollers at least 4-weekly to review inspection findings and actions related to particular patrol routes as well as general patrolling issues.

Note:	Patrollers who carry out infrequent PM1/2 inspections (less than 5 shifts per year) are not required to take part in programmed joint Inspections unless the Inspection Supervisor judges that there is a need.

3.6.6.5 Findings of joint inspections shall be reported on form F0145 'Joint Inspection with Patrolman Report' for BCV/SSL and F5767 'Joint Inspection with T001 Licensed Person' for JNP, or an equivalent providing no less information.

3.6.6.6 Following each joint inspection reference shall be made to the Walkout report to confirm whether or not the defects identified during the inspection have already been reported and recorded in the defect management system.

3.7 Inspection reports and records – routine inspections

3.7.1 General

3.7.1.1 An inspection reporting and recording regime shall be implemented, fulfilling as a minimum the following requirements:

a) It shall be recorded that the inspection took place. The record shall contain details of:

I. type of inspection

II. date when inspection was carried out

III. geographical extent of inspection (by line and kilometreage).

b) If any mandatory inspection is omitted, either in full or in part, the fact shall be recorded together with details of any mitigation applied

c) Defects found shall be recorded in sufficient detail by nature and location for any necessary maintenance activity to be planned and for trends to be identified

d) Repetitive failures shall be identified, e.g. clips or keys which frequently fall out, and reported as repetitive defects

e) If no defects are found, the fact shall be recorded

f) Any immediate remedial action taken during the inspection shall be recorded

g) There shall be provision for the inspection staff to state whether they were able to undertake the inspection fully, taking account of (for example) weather and time available.

3.7.1.2 The findings of inspections shall be reviewed by an appropriate accountable manager and recorded on a track asset condition database that shall:

a) be monitored to identify developing trends

b) be used to target, plan and prioritise maintenance and renewal activities and record their completion.

3.7.2 Basic visual inspections

3.7.2.1 Reports of basic visual track inspections shall be reviewed by the inspector's manager to determine and prioritise (or to agree any prioritisation already given) the actions needed to address the faults identified. The manager shall sign the report within three days of the inspection being carried out.

3.7.2.2 Reports of basic visual inspections shall be retained for a minimum of two years.

3.7.3 Track geometry recording reports

3.7.3.1 The following reports with faults determined in accordance with standard S1159 shall be produced and data distributed as part of TRV track recording:

a) <u>At end of each recording run</u>

I. Speed Restriction Threshold Fault Report (to be distributed as soon as practicable if any Speed Restriction breaches are identified)

II. Safety Standard Discrete Fault Report, including wide and tight gauge (to be distributed after processing, typically to be within two days but in all cases within five days of recording run)

III. Maintenance Limit Individual Exceedance Report (to be distributed after processing, typically to be within two days but in all cases within five days of recording run)

IV. Maintenance Target Individual Exceedance Report (to be distributed after processing, typically to be within two days but in all cases within five days of recording run).

b) <u>On completion of recording of line</u>

I. Online Geometry Data (Excel data viewer or DataMap) with chart printing capability (to be available after processing typically within two days but in all cases within five days of recording run)

II. Data processed for on-line viewing (to be available within 5 working days)

III. Standard Deviation Colour Bar Chart (to be distributed within 10 working days)

IV. Line Standard Deviation Quality Band Trend Chart (to be distributed within 10 working days)

V. Line Quality Index Trend Chart (to be distributed within 10 working days).

c) LU-wide track recording period report

I. Summary of recording achievement

II. LU line by line comparison Standard Deviation Quality Band Chart (to be distributed within 10 working days of end of cycle)

III. LU line by line comparison Quality Index Chart (to be distributed within 10 working days of end of cycle)

IV. Calibration certificates issued in period.

3.7.3.2 ATMS reports on Speed Restriction Threshold Faults and Safety Standard Discrete Faults shall be produced and issued no less than twice a week. Maintenance Limit and Maintenance target fault reports shall be produced and issued no less than every four weeks. Track quality data (Standard deviations) shall be viewable in DataMap or, if available, in published reports.

3.7.3.3 No data (except duplicate data from the same line recording cycle, Spurious Track Geometry as detailed in clause 3.7.3.6 and Inherent Track Geometry as detailed in Clause 3.7.3.7) shall be excluded from the reports.

3.7.3.4 The TRV track geometry reports shall be retained (in electronic form where possible) by the track recording team for a minimum of 10 years.

3.7.3.5 Managing Reported Track Geometry Faults

3.7.3.5.1 When a Safety Standard geometry fault is identified a work order for rectification must be raised. Inspection of Safety Standard Exceedance (ISSE) shall also be raised.

Note: The ISSE may be a two stage response:

Stage 1: Initial site based visual inspection by a competent person within 24 hours of condition being identified, looking for component failure and/or any signs of track bed movement (See F0126 'Special Inspection of Safety Standard Exceedance Site (ISSE)' for example of form to complete).

Stage 2: Detailed survey identifying the rectification works to be performed shall be completed within the rectification timeframe specified in S1159. (See F0126 'Special Inspection of Safety Standard Exceedance Site (ISSE)' for example of form to complete).

A further inspection and form is not required to be completed upon further reports of a known fault where there is an open corrective work order and the condition is stable and can be monitored by ATMS.

3.7.3.5.2 The work order for rectification date shall not be extended if the inspection is delayed. Where the fault is not rectified and is identified on subsequent recording (even at a lower level) the initial fault date shall be used to determine the mandatory

action date. The relevant mitigation form shall be used if an inspection is delayed and a TANC raised and approved if the fault rectification timescale cannot be achieved.

3.7.3.5.3 Where corrective works have been undertaken and a repeat fault peak from the same parameter (e.g. 2 metre Twist) occurs within 10 metres either side of the original defect within 12 months, a further more detailed inspection to identify a root-cause fix shall be undertaken unless the faults can be demonstrated from a review of the data to be distinct and unrelated (e.g. related to separate rail joints).

3.7.3.5.4 Where a discrete Safety Standard geometry fault or a Bad or Unacceptable Standard Deviation cell cannot be rectified by normal maintenance or will continue to reoccur due to underlying asset condition, a site specific concern with suitable mitigation must be added to the Track Risk Register. Based on the outcome of the Risk Review if appropriate a Renewal of Way submission for Track Renewal or Heavy Overhaul shall be submitted.

3.7.3.6 Managing Track Geometry Spurious Data

3.7.3.6.1 Track Geometry Spurious data is invalid data caused by the measurement system incorrectly generating an invalid output (i.e. in error). The Track Recording system and data processing engineers shall as far as possible avoid spurious Safety Standard faults being reported.

The maintainer shall act on all Safety Standard faults reported to them and shall action the fault as genuine, and arrange rectification and inspection on that basis. However, if a concern is raised and confirmation is received by a competent track recording engineer declaring the fault spurious prior to the inspection or rectification becoming due, then action is not required.

Where a site inspection fails to find the fault or the site readings suggest the recording system may have generated a spurious fault, the fault shall stay open until a review by a competent engineer either identifies the fault or a competent track recording engineer confirms the fault is spurious. A TANC may be used to extend the repair interval in the event that the fault cannot be found, and provided that the initial review identifies that the site condition appears to be within the competency of the inspector to be safe for trains to run.

Note:	The competent track recording engineer shall seek guidance or defer the matter to the Technical Delegated Authority for Track Recording if the nature of the condition falls outside established guidance and training.

3.7.3.6.2 Where a fault is identified at a lower magnitude statically compared to the dynamic magnitude via TRV or ATMS etc. then the dynamic magnitude shall be used for fault classification and minimum action timescale, unless the dynamic reading is declared invalid following the methodology set out in 3.7.3.6.1 above.

Note:	Faults that are suspected to be spurious may actually be genuine– careful evaluation is required so that genuine faults are not ignored. Many examples of poor fastenings causing real dynamic faults have occurred. ATMS limitations in Junction Work can in some cases cause misreading of switches and crossing noses, causing spurious faults. The TRV system, even in Junction Work, will not generate a false Top or Twist fault, (with cant based twist calculation methodology), of Safety Standard magnitude unless there is an instrumentation failure.

3.7.3.7 Inherent Track Geometry

3.7.3.7.1 Inherent Track Geometry is a valid reading from the recording system where the nature of track alignment/construction causes an inherent fault due to its design/construction geometry (e.g. Alignment through divergent routes in P&C). It is not normally practicable to correct Inherent Track Geometry. A central Register of Inherent Track Geometry conditions, with a risk based registration process, shall be used to allow the conditions (that are not practicable to correct) to be recorded and regularised with revised intervention limits, and further mitigations where required. The Register shall be subject to review at a minimum annual frequency.

Note**:**	The Register of Inherent Track Geometry condition is intended to take the place of all revised track geometry limit concessions. These concessions shall be withdrawn as their provisions are transferred to the Register.

3.7.3.7.2 The Register of Inherent Track Geometry will specify revised track intervention limits so that if the condition deteriorates a fault will still be reported and where appropriate deterioration rectified. The following types of conditions/faults can be registered:

a) Stable pre-existing geometry faults,

b) Conditions/faults caused by designed geometry,

c) Conditions/faults caused by componentry dynamic response,

d) Conditions/faults associated with the interface between new (or newly maintained) track and existing track.

3.7.3.7.3 The methodology for registration and approval on the Register of Inherent Track Geometry shall be approved by the Professional Head of Permanent Way Engineering.

Note**:**	Inherent Geometry can in certain circumstances cause a particular increased risk of component fault or rail defects. As such careful monitoring and mitigation may be needed based on the nature of the Inherent Geometry and wider site condition/configuration.

3.8 Maintenance

3.8.1 General

3.8.1.1 Track shall be maintained:

a) in a condition which ensures that the safety standards in standard S1159 are not breached;

b) within the maintenance tolerances given in standard S1159;

c) in a condition which achieves the performance requirements;

d) in a manner which provides economic whole-life costs.

3.8.1.2 Conditions identified in the course of inspections which present a risk of reducing the safety of the track or degrading its performance shall be rectified as soon as practicable and in a timescale consistent with safety risk and cost effectiveness. Minimum actions to be carried out when defective conditions are identified are shown in Section 11, S1159, and S1178.

3.8.1.3 Certain items attached to the track may be vulnerable to damage during track maintenance work. For example, track bonds shall be suitably protected during loading and unloading of materials and storing rails in the four-foot. Where it is necessary to temporarily remove track bonds, this shall be done only by licensed persons. Damage to bonds or other equipment attached to the track shall be immediately reported to the Fault Report Centre.

3.8.1.4 Paint-marking of tripping hazards such as ends of check rails shall be maintained.

3.8.2 Rail joints

3.8.2.1 Conditions identified in the course of inspections which present a risk of reducing the safety or integrity of rail joints shall be rectified as soon as possible to reduce cumulative damage, in accordance with standard S1159 and S1178.

3.8.2.2 Maintenance activities shall not compromise the integrity or performance of rail joints.

3.8.2.3 Tight and insulated rail joints shall not be lubricated. Insulated joints shall not be shimmed.

3.8.2.4 Where short rails occur at the mouth of tube tunnels, the first 60m of rail joints in the tube tunnel shall be regulated and greased as in open sections.

3.8.2.5 If it is necessary to remove the fishbolts or fishplates during maintenance work on tight rail joints, or insulated joints in CWR or LWR, longitudinal movement of rail ends shall be prevented by the use of an approved rail tensioning device.

3.8.2.6 When fishplates are replaced the inner fishbolt nuts shall be tightened, followed by the outer nuts, all to the torque specified in standard S1159. The torqueing of these nuts shall be checked again within 7 days to ensure loosening has not occurred.

3.8.2.7 Maintenance of insulated joints, other than tightening of bolts, lifting & packing, removal of burring and lipping, and cleaning, shall require the presence of a competent signalling representative, who shall ensure that its position is not moved and who shall test the electrical integrity of the joint on completion of the work.

3.8.2.8 Where rail end batter exceeds the tolerance given in standard S1159 the rail shall be changed or the rail end cropped.

3.8.2.9 Dipped joints shall be assessed to determine appropriate corrective action, e.g. re-packing or rail-end straightening. If the rail head level cannot be restored to the requirements of standard S1159, the rails shall be replaced.

3.8.2.10 Rail joint straightening shall not be undertaken:

a) on tight rail joints

b) on insulated joints

c) on rails containing austenitic manganese steels

d) within 1m of a rail defect.

3.8.2.11 The rail ends shall be ultrasonically tested prior to, and within 14 days after, expansion joint or weld straightening.

3.8.2.12 Fishbolts and sleeper fittings at the rail joint sleepers shall be tightened prior to rail joint straightening being undertaken.

3.8.2.13 All reasonable measures shall be taken to remove voids from under and around the four sleepers either side of the rail joint after rail straightening and before trains are permitted to pass over the site.

3.8.2.14 If a weld breaks during the straightening process, a sample of the broken weld shall be removed and sent for a metallurgical assessment.

3.8.2.15 In both concreted and ballasted track the support of the joint sleepers shall be inspected and the chairs or other supports packed as necessary. Packing shall be carried out between chair and sleeper in concreted track (while retaining adequate fixity to the sleeper) and sleeper and ballast in ballasted track.

3.8.2.16 Joint packing and shimming shall be carried out to meet the requirements of S1159. Where bolted joints have been installed to connect running rails of differing heights, the requirements stated in clauses 3.8.2.17 to 3.8.2.19 below shall also apply.

> Note: At locations where bolted joints have been installed to connect running rails of differing heights it is important to consolidate or adjust the rail supports either side of the joints to provide uniform support. This is especially critical for the rail supports under the most-worn rail which will have been lifted relative to the other rail to provide a continuous running table at the head of the rails. The applied lifting can create voids, which must be removed to avoid the risk of geometric faults, excessive loading and rapid deterioration of the track structure.

3.8.2.17 For plain line ballasted track, the ballast shall be packed as described in 3.8.2.19 below. Any type of chair, baseplate or under-sleeper packing shall only be used as a temporary measure where packing of the ballast is ineffective due to the general ballast condition. For ballasted junctionwork, rails of different depths on long timbers shall be adjusted using hardwood packing.

3.8.2.18 For non-ballasted track, chairs or baseplates on timber sleepers shall be packed using hardwood packing. Where baseplates are directly fixed to a concrete trackbed the correct type of (non-timber) baseplate packing shall be used; timber packings shall not be used except for emergency works, and arrangements shall be made to replace them with the correct type of baseplate packing within 72 hours. Alternatively, where adjustable rail supports are installed, they shall be adjusted to correct the rail level.

3.8.2.19 The rail support closest to the joint shall be packed or adjusted to bring the rail to within 1mm of the rail level at the joint. Following this, the rail supports further from the joint shall be packed or adjusted to ensure a maximum rail vertical difference of 2mm between adjacent supports.

For example, if the difference in height of the rail between the joint and the closest support is 6mm then the rail at 3 rail supports will need to be packed or adjusted to the following levels:

a) 1st sleeper/rail support (closest to joint): 5mm
b) 2nd sleeper/rail support: 3mm
c) 3rd sleeper/rail support: 1mm
d) 4th sleeper/rail support: 0mm

3.8.3 Sleepers and bearers

3.8.3.1 Work on trainstop sleepers shall be undertaken in conjunction with a competent signalling person.

3.8.3.2 When replacing defective sleepers, sound serviceable sleepers of the same material may be used where that does not diminish the track's overall remaining service life, or the service life intended to result from the works. In the case of wood sleepers, “same material” means hardwood for hardwood and softwood for softwood.

3.8.3.3 The assessment of timber sleepers or bearers for replacement or renewal shall take into account the following:

a) splits - length and depth

b) rot

c) indentations

d) multiple screw holes

e) loss of chair or baseplate screw grip

f) derailment damage

g) broken screwspikes.

3.8.3.4 Fastenings in wood sleepers and bearers shall be kept tight in order to prevent wear of the screw holes, indentation, gauge widening and relative movement between the chair or baseplate and the sleeper or bearer.

3.8.3.5 All screwspike holes made in sleepers and bearers shall be counter bored to prevent high stresses on the timber when driving in the screw, which lead to splitting of the timber and loss of thread fixation.

3.8.3.6 Redundant screw holes in wood sleepers and bearers in Open sections shall be plugged. The plugs and holes shall be treated with preservative.

3.8.3.7 When pulling through wood sleepers or bearers:

a) there shall preferably be not less than 150mm from the outermost edge of the chair or baseplate to the end of the sleeper or bearer, but this may be reduced to 75mm for sleepers and 50mm for bearers; provision shall be made to prevent end splitting and the cut ends of softwood items shall be treated with an approved preservative

b) new screw holes shall not be closer than 75mm to existing holes

c) existing indentation shall be suitably packed

d) agreement shall be obtained from the relevant department if Signals or Power equipment is attached to the sleeper or bearer.

Note:	Where the minimum edge to screw hole distances specified in the above cannot be achieved, any concession against these requirement should consider the use of screws that have a tendency to not split timber (e.g. Excalibur bolts).

3.8.3.8 The assessment of concrete sleepers or bearers for replacement or renewal shall take into account the following:

a) derailment damage

b) cracking

c) loose housings

d) exposed reinforcement or prestressing wire (indicating underside erosion).

3.8.4 Ballast

3.8.4.1 The following requirements shall be met in respect of ballast:

a) With the exception of ballast shoulders, ballast shall be no higher than the top of the bearers and sleepers

b) The vertical faces of bearers and sleepers shall not be visible

c) There shall be no voids under bearers or sleepers, and the distance of 250mm either side of the ends of the chairs or baseplates shall be packed tightly

d) Ballast shall be kept clear of rails, operational equipment and switch mechanisms and shall not obscure track datum plates or markers

e) Approved methods of consolidation shall be used

f) Wet beds shall be treated by an approved method as soon as reasonably practicable

g) Precautions to preserve track stability shall be exercised when removing ballast for maintenance purposes.

3.8.5 Stoneblowing

3.8.5.1 Stoneblowing shall not be used:

a) where ballast is unconsolidated

b) where ballast is deficient in level and quantity

c) for lifts greater than 25mm or lifts between 20mm to 25mm over 5 or more sleepers in 25.

3.8.5.2 See T0407 for the specification for stoneblower aggregate.

3.8.6 Formation and drainage

3.8.6.1 Drainage systems shall be maintained at intervals appropriate to the site. Sumps and catchpits shall be emptied as necessary and pipework and channels kept free-flowing. Minimum actions for certain conditions are shown in Attachment 2 and Attachment 3 and shall be followed.

3.8.6.2 Where inspections identify track defects which may indicate formation problems, arrangements shall be made for a competent person to investigate the site, determine the adequacy of the formation, diagnose the cause of any formation problems and recommend remedial treatment. Track defects commonly associated with the need for formation treatment include:

a) localised or general settlement with poor vertical alignment of track

b) deformation of ballast profile

c) sub-grade contamination of ballast

d) wet spots and pumping.

3.8.6.3 The treatment shall include all necessary measures to improve the stability of the formation as a base for the track support structure. Depending on the site characteristics, appropriate measures shall include:

a) works to improve the site drainage

b) reconstruction of the crossfall

c) installation of a geotextile or geogrid, in order to control sub-grade erosion, improve sub-grade stiffness, or both

d) installation of a sand blanket

e) removal of soft sub-grade and replacement with selected good quality fill

f) rolling in hardcore or good quality granular fill over the sub-grade

g) lime stabilisation of clay sub-grade in conformity with BS 1924-2

h) cementation processes such as the injection of cement grout or cement and clay mixtures into the sub-grade.

3.8.7 Longitudinal timbers

3.8.7.1 Conditions to be assessed during the inspection and maintenance of longitudinal bridge timbers and associated features and fastenings are shown in Attachment 5, together with the minimum action to be taken if the conditions are not satisfied.

3.8.7.2 When longitudinal timbers are to be removed, a person with responsibility for the bridge structure shall carry out an inspection of the exposed components. That person shall ensure that any necessary maintenance is carried out prior to the refitting of the timbers.

3.8.8 Re-use of materials

Assets for re-use in the track system shall comply with T0430 for minimum condition unless special conditions prevail, and consideration shall be given to whole-life costs.

3.8.9 Advance precautions

Management procedures for the track system shall ensure adverse weather precautions are implemented in advance of the hot and cold weather periods and that train services are not disrupted nor the safety of people compromised due to adverse weather.

3.8.10 Hot weather period

3.8.10.1 During the hot weather period, rail temperatures shall be measured every two hours between 1100 hours and 1500 hours at a number of locations throughout the LU system and reported to the Duty Operations Manager (Engineering).

3.8.10.2 Rail temperatures shall be compared with pre-defined thresholds, and measures taken in accordance with standard S1177 to protect traffic if these thresholds are exceeded.

3.8.11 Cold weather period

3.8.11.1 Snow and ice build up shall be controlled so that as far as reasonably practicable it does not present a hazard or disrupt the operation of trains.

3.8.11.2 Clearance of snow and ice and the application of de-icing fluid shall be required at the following:

a) Points

b) Running rails

c) Walkways

d) Cable stiles

e) Conductor rails in depots and sidings

f) Rails and road surfaces at Level Crossings and Road and Rail Access Points

g) Flangeway gaps: hard packed ice causes train lifting.

3.8.11.3 A Winter Weather Plan shall be prepared for each line and depot, and detail at least the following:

a) arrangements for sufficient trained staff to undertake planned duties at listed sites

b) arrangements for staff facilities and the supply and storage of required tools, PPE and de-icing fluid

c) local protection arrangements, responsibilities, and working instructions at each site

d) for manual de-icing of conductor rails in depots and sidings, definition of lengths and locations of track to be de-iced for each site are required.

3.8.11.4 Where point heaters are not installed or not working snow and ice shall be cleared from the slide chair and around the mechanism, and the points tested to confirm operation. Where point heaters are installed and working, no manual cleaning is required. Heaters in working order shall be turned on in advance of cold weather.

3.8.11.5 A schedule for the level of day or night cover needed shall be maintained and worked to.

3.8.11.6 Snow clearance and de-icing of conductor rails (in depots only) shall be undertaken only with traction current discharged.

3.8.11.7 Salt is highly corrosive and must not be used to prevent or control snow and ice build up. De-icing fluid in accordance with T0423 should be used where required.

3.8.11.8 Staff shall comply at all times with legislation, LU directives, instructions and notices relating to the handling, storage, application and disposal of chemicals, environmental protection and control of pollution.

3.8.11.9 Precautions shall be taken to prevent the entry of chemicals into local water sources, and fluid shall be disposed of only in locations designated for chemical disposal.

3.8.12 Requirements specific to junctionwork

3.8.12.1 Junctionwork shall be kept clear of debris, litter or other extraneous material.

3.8.12.2 Maintenance activities that may affect switch operating mechanisms, track circuits or insulated joints shall comply with signalling requirements.

3.8.12.3 If either the switch or the stock rail requires replacement, both components shall be replaced at the same time as a matching pair.

3.8.12.4 Procedures shall be maintained for the repair welding of crossings, including the limits on wear or damage that may be weld-repaired.

3.8.12.5 Switches (see definition in clause 7) shall be identified and listed in a Register, which shall record, as a minimum, the following information concerning the switches:

a) Unique identifier

b) Line, usual running direction

c) Location and LCS level 4

d) Rail Section

e) Switch type

f) Handing of approach curve, where switch is used in facing moves

g) Minimum radius of approach curve within 20m of the switch tips

h) Grade of switch rails

i) Controlled switch status

j) Controlled switch category (for controlled switches)

k) Handling of controlled move (for controlled switches)

l) Derailment risk rating (for controlled switches)

3.8.12.6 The Register of Controlled Switches shall be made available to LU Train Services and Professional Head of Permanent Way Engineering and shall be maintained up to date. The details of any switches subsequently removed from the Register shall be retained.

3.8.12.7 For controlled switches there shall be an approved management plan which shall include requirements for inspection (which may exceed those set out in this standard). In the event that the handing of the switch is reconfigured to be opposite to that of the approach curve, measures shall be taken to prohibit reversion of the switch handing to be the same as that of the approach curve.

3.8.12.8 Controlled Switches shall be maintained and monitored in accordance with PR0123. Where practicable, the factors which cause the switch to be a Controlled Switch shall be removed.

3.8.13 Lighting

3.8.13.1 The lighting at worksites shall provide a sufficient level of illumination to ensure the safety of all railway personnel engaged in the work and a satisfactory quality of work.

3.8.13.2 The provision of approved effective lighting shall be considered when assessing trackwork to prevent uncontrolled or misdirected lighting causing a nuisance to neighbours, a hazard to road and rail traffic in the vicinity or a hazard to persons working about the track.

3.9 Lineside storage of spares and other material

Note: This section deals with the lineside storage of materials used for, or arising from, the renewal and maintenance of the track and of off-track assets such as fencing. The requirement to remove scrap materials from site need not be applied to arising's from vegetation management: standard S1165 (Landscaping and Vegetation) allows for disposal of vegetation waste on site as long as environmental, nuisance to neighbours, operational and safety constraints are taken into account. For such material a storage licence is not required but the other requirements in this section shall be applied in a manner appropriate to the material.

3.9.1 General

3.9.1.1 Items to be stored shall be classified as strategic spares, maintenance items, project items or scrap.

3.9.1.2 The quantity and location of strategic spares shall be determined in order to enable rapid response to track failures.

3.9.1.3 All storage locations shall be subject to site-specific risk assessment, storage plans and storage methods.

3.9.1.4 Storage of items in unlicensed locations shall be avoided as far as reasonably practicable. Where storage is unavoidable the items shall be placed so as not to adversely affect the safe and efficient operation of the railway. Moveable items shall be secured to a permanent fixture. Arrangements shall be made for removal of items, including scrap arising from work, when no longer required.

3.9.1.5 All permanent storage containers should be labelled clearly with permanently fixed plates.

3.9.2 Approval of storage locations

3.9.2.1 A schedule of storage locations shall be submitted for allocation of space in accordance with standard S1472. The schedule shall be reviewed and updated annually and shall contain the following information:

a) position and boundary of storage area, including a map if necessary

b) identity of the asset the spare is required for, e.g.; point number (strategic spares only)

c) description of the items that may be kept in the store

d) quantity to be stored at the location

e) identity of the manager accountable for the storage arrangements.

3.9.2.2 All storage locations shall be subject to and display a Storage Licence in accordance with LU Rule Book Leaflet No LF 14. The Licence will be subject to three-monthly reviews which will consider at least the same criteria as the original application.

3.9.2.3 Storage space for scrap items may also be allocated in approved locations where strategic spares and maintenance items are kept; this shall be indicated in the schedule for those locations.

3.9.2.4 Granting of a Storage Licence for the storage below ground of hazardous substances and materials that do not comply with standard S1085 Fire Safety

Performance of Materials shall be subject to evidence of prior approval of a concession against that standard.

3.9.3 Location of items on or near the track

3.9.3.1 Items shall not:

a) be kept in designated places of safety adjacent to the track if they impede persons from taking refuge from the passage of trains or rail vehicles

b) be kept in the cess if they unduly obstruct or endanger persons from walking safely along the track

c) be stored in cess areas that have been designated as a limited clearance

d) protrude into walkways or recognised access routes

e) obstruct or introduce tripping hazards in refuges or in tunnel cross passages

f) obstruct train sighting distances for persons walking or working on the track

g) block access to lineside equipment or cause an obstruction to any asset that may need maintenance

h) be stored such that they could be struck by trains or road vehicles

i) adversely affect detrainments

j) be stored against any cable run.

3.9.3.2 Care shall be taken that the lines of sight to existing signs, signals or lighting facilities are not obstructed, and that compounds and containers do not adversely affect other railway equipment, e.g. cables, post runs, signalling or communications apparatus.

3.9.3.3 Lengths of rail left on the track within the sleeper length shall be firmly secured by an authorised method so as to prevent movement caused by vibration or unauthorised persons. Bullhead rail shall be secured on its side. Rails shall be placed so that they do not make contact with any installed rail, chair, baseplate or rail fastening, and do not foul any track or signalling mechanism.

Rails stored outside of the four foot shall be positioned so that they are clear from the end of sleepers. The position shall also take into account site conditions, to ensure the rails will not subsequently move by vibration or by weakness in the underlying support. The positioning of all stored rails shall be checked by a T002 or T003 clearance handback before the start of traffic.

3.9.3.4 Items stored in the four foot shall be placed as far as reasonably practicable on only one side of the negative conductor rail and not change sides between adjacent stations. However, account shall be taken of check rails changing sides at sub-200m radius reverse curves and of the need for staff using Short Circuiting Devices to be able to stand on that side of the negative conductor rail nearer to the positive conductor rail, without being impeded by stored items.

3.9.3.5 Safety pits shall be used for storage only as a last resort, when no other suitable location is available. Storage in safety pits shall comply with the following requirements:

a) Rail stored over safety pits in deep level tube stations shall be laid on the side of the negative conductor rail further from the platform edge. The spacing and size

of the bearers supporting the rail shall not unduly restrict the opening of the safety pit nearer to the platform edge

b) Other items stored in a safety pit should not obstruct the side along the platform edge and shall not be stored in the first or last third of the station ground. They shall not protrude above the top of the pit

c) The duration of storage in safety pits shall be minimised.

3.9.3.6 Ballast, ash, sand, spoil and other loose material lying on or near the track shall be kept clear of point gear, train stops and other apparatus and away from rails and insulators, so as to avoid electrical leakage and danger of electrocution under damp conditions.

3.9.4 Security of stored items

3.9.4.1 Stacking of items shall be done safely and neatly with no items protruding outside the natural boundary formed by the stack. In particular, cutting edges of tools and protruding reinforcing bars shall be covered to minimise risk of injury.

3.9.4.2 Storage of items, including their securing, shall take account of the following risks:

a) on elevated ground: that an item may fall and endanger persons or infrastructure below

b) on uneven or weak ground: that ground movement could undermine the stability of the store

c) instability of the stack: that excessive height could lead to collapse or toppling of items stored

d) adverse climatic conditions, or train vibrations or turbulence or drafts in tunnels: that items may move and come into contact with trains or sensitive parts of the infrastructure

e) against a structure: that the structure may be unable to bear the weight.

3.9.4.3 In locations at risk of vandalism, items that could be placed on the track shall be kept in a locked compound and/or securely bundled together to prevent movement.

3.9.4.4 Rolled and sheet material, packaging and delivery bags, and rails less than 4m long shall not be stored near the line except in a locked compound. However, emergency 3.3m rails may be stored outside a compound if they are firmly secured.

3.9.4.5 Locked containers shall either be sufficiently heavy to prevent accidental or deliberate unauthorised movement by manual means, or be secured to a permanent fixture.

3.9.4.6 Compounds and containers shall be located at least 2m from any adjacent track and at least 300mm from any defined walkway. Opening of doors and lids shall not reduce these clearances.

3.9.4.7 If wheeled items such as track trolleys or iron men cannot be stored in a locked compound and are being stored near the track they shall be secured with chains and padlocks to a suitable fixed object clear of the track so as to be clear of trains or other rail vehicles. If the wheeled item can be dismantled each piece shall be secured as above.

3.9.4.8 Items which are stored in tunnels and cross-passages will be subject to air turbulence from the 'piston-effect' of trains passing through the tunnels, particularly in tube tunnels. This can cause significant air velocities and pressures, (e.g. air pressure of 0.7kN/m^2 was measured on a hoarding in Holland Park Station). The effect of such pressures on stored items can cause them to move and obstruct the track, with the attendant risk of coming into contact with trains. Items such as sheet materials, and objects which although heavy have a large, impervious surface area (e.g. storage bins), are particularly susceptible.

When materials or equipment are to be stored at lineside, the effect of air velocity and pressure shall be considered and suitable restraint provided where required. Materials or equipment stored in cross-passages between running tunnels shall be provided with restraints designed to withstand the air pressure and suction loads derived from Clause 3.1.8.6 of S1055 (Civil Engineering – Deep Tube Tunnels and Shafts) and its accompanying note, and Table 1 of S1067 (Tunnel and public area cooling and ventilation).

Note:	Where it is intended that restraint is to be provided by friction forces between materials or equipment and the surface on which they are installed, a partial load factor of 0.85 shall be applied to those loads relied upon to generate friction. Restraint for containers and bins shall be designed to cope with the case when they are empty.

3.9.5 Ongoing management of sites being used for materials storage

3.9.5.1 Regular inspections shall be carried out and actions taken to maintain the site in good order, including the correct display of a current Storage Licence and the removal of any accumulated rubbish or unauthorised material.

3.9.5.2 Arrangements shall be made for the removal of all materials and equipment when no longer required. This removal shall be carried out before the work is complete.

3.9.6 Emergency storage

3.9.6.1 In the event of an emergency arising that results in materials or equipment being left by the track, the site person in charge shall ensure their security by any necessary means. Items shall be moved to a licensed storage facility, or removed entirely, as soon as practicable.

3.10 Single line working

3.10.1 Where single line working is to be employed the following shall apply:

a) approved controlled procedures, including prior notification and planning instructions, shall be implemented

b) the section of track to be traversed shall be subject to prior assessment and the implementation of any mitigation measures identified

c) warning signs shall be positioned at all cross track walkways for the duration of the single line working

d) unless authorised by the Professional Head of Permanent Way Engineering the speed restriction in the direction of travel not controlled by signals shall be a maximum of 20mph, except over junctionwork where the maximum speed restriction shall be 10mph

e) any existing lesser speed restriction than in (d), above, shall be observed, with signs provided for both directions of running.

3.10.2 Further to clause 3.10.1(b), the following track features shall be dealt with as below prior to and during the period of single-line working. At the end of the period the track shall be restored to its normal condition.

a) Switches without facing-point locks shall be secured.

b) Adjustment switches shall be secured (except in emergency situations lasting no more than three days).

c) Unless authorised by the Professional Head of Permanent Way Engineering slipper runs shall be installed on both sides of closure rails in junctionwork (except in emergency situations lasting no more than three days).

d) Alternate keys in bullhead track shall be reversed if single-line working is expected to be in force for more than eight days.

e) Lubricators shall be adjusted, or hand-greasing applied, to cater for the reverse running.

f) The following items normally in trailing mode shall be checked for their suitability for facing movements:
   I. conductor rail ramps;
   II. check rail flares;
   III. rail joints (steps in running surface).

3.10.3 In the case of emergency single-line working where it is not possible to implement fully the requirements of clauses 3.10.1 and 3.10.2:

a) the maximum speed restriction in the direction of travel not controlled by signals shall be 10mph except where a lesser speed restriction prevails;

b) however, where the emergency single line working extends into the second traffic day the full requirements of clauses 3.10.1 and 3.10.2 shall be implemented.

3.11 Application of temporary speed restrictions

3.11.1 The value and extent of speed restrictions due to asset condition or temporary works shall be based upon:

a) risk assessments of the conditions and combinations thereof

b) the risk mitigation measures employed over the duration of the works or condition;

and these details shall be published in advance (except in the case of an emergency).

3.11.2 The speed restriction zones shall be marked by signs in conformity with Attachment 6. Where track is signalled for bi-directional traffic, or where single-line working is in operation, signs shall be erected on both sides of the affected area.

3.11.3 In Tube sections, signs marking temporary speed restrictions shall where practicable be duplicated, i.e. on the wall and in the four-foot.

3.11.4 Where Train Operating Companies run trains over LU lines, any differential restriction shall be shown on a separate sign with appropriate lettering to distinguish between operators.

3.11.5 Signs shall be removed and securely stored immediately following the lifting of the restriction.

3.11.6 The details of speed restrictions (unless emergency) shall be submitted for publication in the Traffic Circular or, if there is insufficient time, an Engineering Notice and then in the Traffic Circular. The published details shall include the start and end dates of the restriction.

4 Responsibilities

4.1 The Professional Head of Permanent Way Engineering is responsible for the technical content of this standard.

4.2 TfL and TfL Suppliers shall be responsible for compliance with the requirements of this standard.

5 Supporting information

5.1 Background

5.1.1 The activity of basic visual inspection, (also known as track patrolling), has been designed to intercept critical defects and to provide early warning of impending defects in the track and adjacent assets.

5.1.2 Failure to detect defects in the track and adjacent assets has a direct effect on the overall safety of the railway and can lead to incidents such as derailments, collisions or tunnel fires which have the potential to cause loss of service, damage to assets and injury or loss of life to staff and members of the public.

5.1.3 Measures in the form of supplementary inspection should be designed to ensure that parts of patrol routes or sections of the line considered to be particularly at risk may be subject to additional activities over and above the minimum patrolling frequency.

5.1.4 Where track has been installed either as a renewal or new-build it may be necessary to inspect the track to confirm that it is compliant with the design and standards. Persons required to perform such inspections should:

a) have been assessed as competent with knowledge, familiarity and experience of the track, its component parts, maintenance standards and practices and new trackwork construction

b) be capable of exercising sound engineering judgement in the assessment of matters which may affect the acceptability or otherwise of partially completed or completed work.

5.2 Safety considerations

5.2.1 The potential consequences of track not complying with this standard include:

a) failure of a track component, leading to derailment, collision, injury or death to members of the public, customers or staff, or loss of service

b) risk of injury to staff when installing, maintaining or removing track components

c) fire risk

d) instability or misalignment in the track structure

e) degradation of track support components

f) damage to traction system and signalling equipment

g) loss of ballast profile

h) contamination of ballast

i) failure of the formation

j) localised or general settlement

k) drainage problems leading to the possibility of flooding and disruption of the service

l) environmental damage through erosion and degradation of components;

m) tripping hazards

n) risk of injury to staff during the operation of hand-operated switch levers.

5.2.2 General

5.2.2.1 The use of inappropriate materials may cause excessive wear, damage or premature failure of components. These conditions may lead to incorrect track geometry and impaired track performance, with the risk of disruption of the train service, collision or derailment.

5.2.2.2 The consequences of material failures may include:

a) injury or death of members of the public and personnel if derailments occur

b) erosion of the design safety factors which might result in rolling stock exceeding kinematic profile and colliding with structures, trackside infrastructure or other trains with consequent risk of injury

c) injury to customers resulting from falls occasioned by an uneven ride

d) injury to those handling rail when the rail does not react to handling in a normal fashion or when the handling equipment used is inappropriate because the rail is incorrectly identified e.g. lifting equipment being overloaded.

5.2.3 Lighting

The use of artificial lighting may be necessary to ensure that all practicable steps are taken to reduce the risk of incidents during track engineering work. This will not be realised unless:

a) the lighting used is sufficiently powerful to provide illumination to the standard required

b) the lighting used is of the correct material and performance specification for the environment in which it is to be used

c) the lighting equipment is arranged or installed so that cables and other components do not represent hazards

d) the arrangement of light prevents optical illusions or ‘blind spots’ caused by glare or shadow

e) the light source is electrically safe and properly earthed

f) glass and other light components which may shatter, are properly contained and guarded if such an event should occur.

5.2.4 Rail

5.2.4.1 Failure of a rail under traffic may be catastrophic in terms of loss of life, injury, and damage to assets. It is essential to maintain high standards of inspection and maintenance to ensure the integrity of the rail, associated components and fastenings.

5.2.4.2 Defects in running rails and fishplates may be caused during design or in manufacture, as well as by incorrect installation, alignment and maintenance. Under the operation of trains, such defects will develop further and new ones may be created. Their detection and removal is an essential part of the safe operation of the LU railway.

5.2.4.3 The rail inspection regime defined in Section 3 of this standard has been designed to provide early warning of defects in the running rails. Failure to detect defects in the running rails, or failure to act appropriately upon detection of a defect, can lead to the loss of a part or complete section of the running rail and increased risk of derailment with associated potential loss of life or injury to members of the public and staff.

5.2.4.4 Failure to ensure that rail used on the railway conforms to a pre-determined material specification may result in the rail failing to perform as designed. Safe operation of the railway may be affected by any or all of the following:

a) material hardness imperfections which lead to failure of the rail in normal use

b) material grade imperfections which lead to uneven or exceptional wear

c) material profile imperfections contributing to ride, handling and installation difficulties

d) misidentification of rail type leading to its use in the incorrect location or the use of incorrect welding techniques.

5.2.4.5 Failure to repair running rails in accordance with this standard may lead to cracks developing in the rail and an eventual rail breakage. This situation may lead to loss of service and in extreme cases derailment, causing damage to property and injury to persons.

5.2.4.6 Running rail profile management is an integral part of track maintenance for controlling safety risk by removing or retarding the development of rail head defects.

5.2.5 Rail joints

5.2.5.1 Any rail joint is an intrinsic weakness and the number of rail joints within the track system shall be minimised. Failure to adequately maintain rail joints may lead to:

a) poor rail alignment and track gauge resulting in excessive wear and increased risk of derailment and damage to track components and rolling stock

b) rail ends pulling apart causing rail end batter, damage to fishplate and rail and possible rail buckling

c) rough riding and wheel unloading

d) failure of insulated joints.

5.2.5.2 Incorrect cutting and drilling of rails may cause unacceptable rail, fishplate and fishbolt stresses resulting in star cracking in rails and failure of fishplates and bolts. This may increase the potential for derailment with the risk of injury to customers and staff, damage to assets and disruption to traffic.

5.2.5.3 Failure of the signalling system may also occur where bolt holes are incorrectly positioned at insulated joints further increasing the risk of disruption to traffic.

5.2.5.4 Cracks initiating from fishbolt holes are a prime source of running rail failure. Cold expansion of fishbolt holes if properly applied will create an annulus of compressed steel around the bolt holes thus increasing the fatigue life of the steel and substantially reducing the initiation and propagation of cracks with a consequent reduction in the potential for derailment and delays to traffic caused by broken rails.

5.2.6 Handling of materials

5.2.6.1 Insecure loads may result in components falling from wagons during transit causing damage to components and track assets.

5.2.6.2 Incorrect loading may result in the load fouling tunnels, structures and trackside equipment. This may lead to damage to signalling equipment potentially causing the risk of collision of trains and injury to passengers, derailment, loss of service and damage to assets.

5.2.6.3 Use of incorrect handling techniques or the failure to take appropriate precautions when handling rail may result in damage to the rail, the track, or the track infrastructure. The consequences of such damage may include:

a) failure of running rails which might result in derailment if the rail is overstressed by overbending, during loading or unloading or by dropping

b) failure of sleepers as a result of damage received during rail unloading

c) shorting of conductor rails through damage to insulators during rail handling

d) loss of gauge or buckling of rails as a result of damage to chairs, keys, resilient fastenings and rail anchors by rail being handled

e) loss of signals or traction current with attendant hazard to traffic or handling personnel as a result of rails damaging cables.

5.2.7 Adjustment and expansion switches

The safety related risks that may arise from inadequate maintenance of adjustment and expansion switches include the following:

a) loss of correct gauge or alignment

b) vehicle derailment or collision resulting in injury or loss of life to personnel, customers or members of the public, and causing disruption to services and damage to rolling stock and infrastructure.

5.2.8 Rail lubricators

Failure to adequately maintain rail lubricators may compromise track safety in the following ways:

a) over-lubrication may lead to lubricant migrating to the crown of the rail thus reducing train braking efficiency and causing wheels to spin

b) lack of lubrication may lead to rapid rail and wheel wear and subsequent component failure

c) lack of lubrication may increase the friction between the wheel and the running and check rails thus increasing the tendency for a wheel to mount the rails and cause a derailment

d) if not correctly maintained rail lubricators may become loose and cause a derailment

e) lack of lubrication may cause the wheel to screech along the rail creating a potential noise hazard to LU personnel and travelling customers

f) lack of lubrication at check rail locations can cause a thinning of the wheel flange which may result in a potential derailment hazard

g) over-lubrication may cause lubricant spatter and create a fire hazard.

5.2.9 Advance precautions

Where precautionary measures are not in place before the onset of cold weather, the impacts on safety can include:

a) injury to staff working on the railway, particularly when visibility is impaired by falling snow or sleet

b) injury to staff slipping or tripping as they go about the track

c) electrical hazards resulting from the interruption of traction current

d) hazards from the unsafe handling of substances used in cleaning, greasing and de-icing operations.

5.2.10 Adverse weather and other external effects

5.2.10.1 The integrity of the track system and in particular the track support system is at risk from the forces of nature and other outside influences such as:

a) bridge strikes

b) flooding

c) scour.

5.2.10.2 In spite of the fact that these occurrences are difficult to foresee they should be anticipated and contingency plans made to minimise their effect on train services and people.

6 Person accountable for this document

Name	Job title
Andrew Brice	Professional Head of Permanent Way Engineering, TfL

7 Definitions

Term	Definition	Source
Adjustment switch	A modified stock and switch rail provided between long welded rail track and jointed track, or between two sections of long welded rail track, or between continuous welded rail and long welded rail or jointed track, to allow for longitudinal rail movements so as to relieve temperature variation induced rail stresses.	Glossary
ALARP	Under UK legislation, TfL is required to do whatever is reasonably practicable to reduce the health and safety risks to its employees and others affected by its operations; in other words, risks must be reduced to a level which is as low as reasonably practicable (ALARP). The term reasonably practicable means that safety measures should be undertaken unless the cost, in terms of money, time and trouble, is grossly disproportionate to the safety benefit, which is expressed in terms of the value of the risk averted by the safety measure.	Glossary
ATMS	Automated Track Monitoring System – an unattended track measurement system mounted on in-service passenger trains that measures, processes and transmits track geometry data to those responsible for the day-to-day maintenance of track.	Glossary
Ballast	Material used to spread loads from the underside of the sleeper to the formation and holding the track in the desired location.	Glossary
Bearer	Beam providing vertical support and gauge restraint to the rails in junctionwork.	Glossary
Broken rail	A running rail which is fractured through its full cross-section or has a piece broken out of it which renders it unserviceable.	Glossary
Check rail	A rail installed adjacent to and at a constant distance from a running rail in the four foot, which restricts lateral movement of the wheel.	Glossary
Cold expansion of fishbolt holes	A process by which a bolt hole is expanded to produce a permanent increase in diameter thus creating a compressed annulus of steel around the bolt hole which resists cracking.	Glossary
Controlled Switch	A Controlled Switch site is where: a) the location is on the running lines or where a derailment could represent a safety risk to	Glossary

Term	Definition	Source
	the running lines, and b) the switches are used for facing moves of passenger trains or non-passenger vehicles under any operating circumstances, and. c) the 20m of track immediately in front of the switches has a radius of curvature of 400m or less and has the same direction of curvature as the turnout. Note: “any operating circumstances” shall be interpreted as including all physically possible moves, whether or not signalled and whether or not in traffic hours, other than those which are expressly prohibited.	
Crossing	A means of passing flanges of wheels through or over the path of the running rail.	Glossary
Expansion switch	A rail component designed to allow longitudinal rail movement in association with continuous welded rail sites or long underbridge subject to expansion and contraction.	Glossary
Material	The generic term for all items used in the construction of the track infrastructure not otherwise described.	Glossary
Patrolling Needs Assessment	Risk assessments which provide a systematic review of each patrol route, taking account of location, configuration, maintenance arrangements, condition and trends in the condition of track components, failure history and service duty to determine the overall patrolling need. This need can be met either by patrolling or by a combination of patrolling and Supplementary Inspections.	Glossary
Piston effect	The effect is generated by a train moving through a tunnel. Since the train is confined by the tunnel walls, a pressure gradient is generated along the train and air is pushed ahead of the train and sucked from behind, thus generating an air flow. The main factors which influence the magnitude of the piston effect are the blockage ratio, (defined as the ratio of the train cross-sectional area to the tunnel cross-sectional area) and the train speed, length and nose shape.	Glossary
Rail lubricator	A device activated by a passing wheel for spreading a lubricant along the running edge of a rail in order to reduce rail and wheel wear on curves in the track.	Glossary

Term	Definition	Source
Supplementary inspections	Patrolling normally carried out over designated parts of a patrol route only, in addition to and in support of minimum patrolling frequency or in response to adverse weather conditions.	Glossary
Track system	All permanent way assets which support and guide trains and are within 2m of any running rail.	Glossary

8 Abbreviations

Abbreviation	Meaning
ALARP	As low as reasonably practicable
APR	Approved Product Register
ATMS	Automated Track Monitoring System
BH	Bull Head
BS	British Standard
CWR	Continuous Welded Rail
EN	Euro Norme (European standard)
FB	Flat Bottom
ISSE	Inspection of Safety Standard Exceedance
LCS	Location Coding System
LU	London Underground
LWR	Long Welded Rail.
MGT	Million Gross Tonnes
ML	Maintenance Limit
MT	Maintenance Target
NR	Network Rail
ORR	Office of Rail and Road
RRAP	Road Rail Access Point
SS	Safety Standard
TANC	Temporary Approved Non-Compliance
TRV	Track Recording Vehicle
TSR	Temporary Speed Restriction

9 References

References in the text are made to latest editions unless specific editions are cited.

LU company documents

Document no.	Title or URL
F0126	Special Inspection of Safety Standard Exceedance Site (ISSE)
F0132	Off track and fencing inspections

Document no.	Title or URL
F0145	Joint Inspection with Patrolman Report (BCV/SSL)
F0149	Assessment of base interval between Junctionwork (PM4) inspections
F0165	Rail Lubricator Log Sheet
F1952	Track Worthiness Certificate – MPD and R&E
F2472	Temporary Clamp Inspection Form
F2500	Fit for Traffic Inspection Checklist (BCV/SSL)
F3300	Track operations AP JNP; Track handback checklist
F5767	Joint Inspection with T001 Licensed Person (JNP)
PR0108	Management of track patrolling
PR0114	Longitudinal timber bridges
PR0123	Management of Controlled Switches
PR0128	Track - Management of Temporary Approved Non-Compliance (TANC) and mitigation of missed/overdue inspections
R0772	Temporary Rail Clamps
S1004	Signage for operational purposes
S1085	Fire safety performance of materials – Stations and Tunnel Infrastructure
S1157	Track – Performance, Design and Configuration
S1159	Track – Dimensions and Tolerances
S1162	Conductor Rail – Performance, Design and Configuration
S1163	Conductor Rail – Inspection and Maintenance
S1164	Conductor Rail – Dimensions and Tolerances
S1472	Allocation Of Space On Operational Property
S1175	Track – Inspection of cast crossings and cast vees
S1176	Inspection and repair to reduce the risk of derailment at switches
S1177	Track - Managing temperature-dependent risk
S1178	Rail Defect Management
T0407	Track ballast and stoneblower aggregate
T0430	Re-use of track materials

British Standards

Document no.	Title or URL
BS 1924-2	Hydraulically bound and stabilized materials for civil engineering purposes. Part 2: Sample preparation and testing of materials during and after treatment
EN 13848	Railway applications – Track – Track geometry quality

Note: European standards (EN) are prefixed “BS” when used in the UK.

10 Document history

Issue no.	Date	Changes	Author
1-158 A1	October 2007	Standard 2-01302-220 re formatted and re-numbered to 1-158, no technical changes have been made to the content other than changing references to other Standards where their numbers have changed. Authorised for use. Previous authorisation is valid	
1-158 A2	March 2008	Changes agreed at the Director Led Review Meetings - TLL Standards Review - Track Authorised for use.	Quentin Phillips
1-158 A3	October 2009	Incorporation of text from 1-160A1 and 1-161A1. Clause 3.9 revised to incorporate FIR 17011895. Incorporation of Written Notice LU-WN-00721, Addition of Attachment 15 Amended following agreed PSC S1-01175 comments Other minor changes. Authorised for use.	Quentin Phillips
1-158 A4	February 2010	As a result of LUSATS action, clauses 3.1.8 to 3.1.10 added and clause 3.7.1 amended Authorised for use	Quentin Phillips
1-158 A5	July 2010	Standard updated to reflect proposals made by PSC S1-01329. Reformatted to new template.	Quentin Phillips
S1158 A6	October 2011	Standard updated to reflect proposals made by DRACCT refs 00437 and 00629. Renumbered to S1158.	Quentin Phillips
A7	May 2012	Standard updated to reflect introduction of Automated Track Monitoring System (ATMS) as per DRACCT No. 01089. Also incorporation of two Written Notices (01100 and 01111).	Quentin Phillips
A8	December 2013	Standard updated to incorporate Written Notices 01135, 01138, 01152, 01179, 01195, 01203 and 01217. Other minor changes. Per DRACCT No. 01923.	Quentin Phillips
A9	September	Standard updated to incorporate Written Notices 01283, 01287, 01288,	Quentin

	2016	01292 and 01310. Revised rail defect actions for B-scan inspection technology. Other minor changes. Per DRACCT No. 04431.	Phillips
A10	August 2019	Standard updated to remove Rail Defect Management requirements which will be captured in new standard S1178. Written notices 01467, 01469, 01482, 01495, 01512, 01529, 01534, 01539, 01545, 01555, 01571, 01572 were incorporated. Further approved changes have also been included. Replacement of all example forms with links and other minor changes. Also, requirements in LU standard S2402 A1 'Snow and ice clearance from track, walkways and cable stiles' has been incorporated into this standard. S2402 has therefore been superseded by this version of S1158. Change id CR-10633.	Nicholas Winfield / Mike Barlow
A11	August 2023	Arrangements for temporary rail clamps and temporary rail joints (clauses 3.4.4.3 to 3.4.4.5) updated following a review by Engineering. Welded joint clause (3.4.4.6) updated following review by Delegated Authority for Welding Administrative correction to 3.6.6.3 and 3.6.6.4 which was referencing incorrect clause numbers. Change No. CR-18038.	D. Higgins / S. Smith / C. Taylor / P. Willats

11 Attachments

11.1 Attachment 1 – Schedule of inspections

Type of inspection	Description	Maximum interval
Basic visual		
Patrolling (“PM1”, “PM2”)	Inspection by patrolmen of track from within the four-foot, and of lineside features, to detect and report sub-standard conditions; taking immediate action where necessary to carry out minor repairs and adjustments. PM1 inspections are day patrols during traffic hours. PM2 inspections are night patrols during engineering hours or possessions.	See clauses 3.3.3 and 3.3.4.
Supplementary inspection	Extra visual inspections focused on particular features (usually location-specific) which, owing to their configuration or condition, require an inspection interval shorter than the patrolling interval applicable to the remainder of the patrol route. These inspections include taking immediate action where necessary to carry out minor repairs and adjustments.	See clause 3.3.5.
Hot weather inspection	Additional inspection during hot weather to identify sub-standard conditions or unsafe situations due to a rise in temperature, taking immediate action where necessary to carry out minor repairs.	As required. See clause 3.3.6.
Manual assessment		
Track quality inspection – plain line (“PM3”)	Inspection of plain line in running lines, depot track and sidings to ensure that overall track maintenance, cleanliness and tidiness standards are being maintained.	One month, but the interval may be increased to a maximum of 12 weeks subject to annual review, using a risk assessment method approved by LU.
Inspection with Patroller	Inspection with patroller to: a) assess the patroller’s competence by checking the quality of the inspection carried out by the patroller; b) to encourage good practice; c) listen to and address specific concerns.	See clause 3.6.5
Junctionwork (“PM4”)	Inspection to confirm a junctionwork layout’s fitness for traffic and to identify, catalogue and prioritise maintenance work to be carried out.	See clause 3.4.2.
Cast crossings and cast vees	Inspection to check for cracking and other defects, using visual and other non-destructive techniques.	Manganese – six months; Bainitic – three months.
[CWR and] LWR inspection	Inspection to check for rail movement of welded rail sites.	See S1177.
Short rail inspection	Inspection to check expansion gaps in rail joints of short rails.	See S1177.
Inspection of SS exceedance (ISSE)	Inspection initiated by reports from cab or track geometry inspections and involving a closer examination to identify what work is required to rectify sub-standard conditions.	Determined from results of track recording vehicle inspections and the results of deterioration rates of faults measured by ATMS.

Type of inspection	Description	Maximum interval
Manual track geometry inspection	Manual inspection to measure, monitor and subsequently maintain the condition of LU track and guide staff in the use of data so generated. For use where a track recording vehicle does not record or when it is unavailable.	To be compatible with track recording frequency.
Ultrasonic inspection of running rails	Inspection of running rails by ultrasonic means, the recording of data, and the interpretation of the data to detect sub-standard conditions and take subsequent action.	Determined by risk assessment program. See S1178.
Lead rail gauging	Inspection to confirm the vertical position of the lead rails.	Six months
Inspection of Level Crossings and Road Rail Access Points	Inspection to check for corrosion, cracking and other defects, in running rails using ultrasonic or detailed inspections.	Annually where subject to salt contamination. 3 yearly where not subject to salt contamination. Frequency may be increased depending on the level of corrosion present.
Automated		
Track recording vehicle inspection	Inspection by a track recording vehicle (TRV or ATMS) to measure and monitor, by track recording technology, the condition of the track against specified standards.	See clause 3.5.4.
Other		
Inspection from the front cab	Inspection from the front cab of a normal service train to observe the track and identify specific sites where rough riding has been reported.	One month over all running lines.
Off-track inspection of fences, drains, manholes, ditches, embankments and cutting slopes	Inspection of subsidiary features to the track related to trespass, drainage and the stability of earthworks.	Fencing – one month ("PM5"); Vegetation, slopes, track drains and ditches – three months ("PM6").
Dynamic clearance inspection in accordance with S1156	Inspection to detect and measure any infringements of the clearance between the rolling stock kinematic limit and structures to assure compliance with S1156.	See S1156.
Inspection following complaints from the public or train drivers	Inspection of specific locations either by an examination of existing records or by manual methods (on track) to determine the source of the complaint, detailed measurement and reporting of results and any remedial action required.	As required.
Acceptance of trackwork	a) Inspection carried out during and on completion of works to determine compliance with engineering standards, specifications and drawings including subsequent actions resulting from these inspections. b) Inspection by track inspection staff of minor repairs carried out during the track inspection.	As required, manually and using ATMS-derived data where appropriate.
Longitudinal timber bridges	General and detailed inspections of the condition of longitudinal timer bridges as outlined in PR0114. This includes Track only, and joint Track/Civil inspections.	See PR0114 for inspection schedule.

11.2 Attachment 2 – Track Safety (Patrolling) and Track Quality inspections – sub-standard conditions to be looked for in track components or features, and the relevant minimum actions

The list of components or features in the following table is not exhaustive. Any condition which appears upon visual inspection or measurement to pose a risk to safety or to the train service shall be subject to appropriate action.

The minimum action to be taken in each case, and the urgency of response, shall depend on the nature and level of risk. The action shall normally be one of the following:

If a serious risk is found which cannot be immediately rectified by inspection staff:

a) during Traffic Hours, stop or slow trains and advise and seek assistance from the Line Service Centre or the Line Controller or both. If necessary, seek discharge of traction current until the condition has been rectified or otherwise mitigated;
b) during Engineering Hours, advise and seek assistance from the Track Access Controller and the Fault Reporting Centre. If necessary, seek delay to restoration of traction current until the condition has been rectified or otherwise mitigated;

If a defective condition can be immediately made safe by inspection staff:

c) carry out an adjustment or repair and report the action taken and any further action required;

If a defective condition cannot be immediately rectified by inspection staff but does not pose serious immediate risk:

d) note location and type of condition causing concern, and report for further investigation or action.

Notes:

1. This table includes certain conditions related to conductor rail and associated items.
2. Certain conditions listed in the table involve the taking of measurements or the use of gauges. The Patrolman's inspection, however, is normally limited to visual inspection.
3. Certain conditions listed in the table relate to junctionwork. Where the assessment of these conditions involves the use of gauges or the taking of measurements, this falls within the scope of PM4 inspections.

Component or feature	Conditions to be looked for
Track gauge	tight or wide
	irregular
Top	one rail dips or both rails dip
	one rail has heaved or both rails have heaved
Line	misalignment
Cross levels	incorrect cant on curve
	canted on straight
	twist (2m or 10m)
Running rails in plain line and junctionwork	cracks or breaks, wheel burns, corrugation, batter or other defects
	grease or leaves on rail head
	'snowing' (metal particles)

Component or feature	Conditions to be looked for
	unusual wear patterns (e.g. bright, rough surface)
	continuous or intermittent sidecut
	rail approaching limit of head wear, sidecut or baseplate gall
	incorrect application of adhesion improver
	water drips on rail head
	rails corrugated or battered
	flame cut rails or fishbolt holes
Expansion and adjustment switches	rail tip not on slide chair or baseplate and preventing movement of switch
	effectiveness limited because not adjusted
	missing or loose blocks and bolts
	incorrectly greased
	wear of moveable rails
Check rails	incorrect flangeway
	misaligned
	dry
	anchor bolt or clamp loose or missing
	cracked or broken rail
	cracked or broken fishplates
	height difference
	Missing or defective fishbolts, the failure of which could allow a fishplate or part of a fishplate to move and obstruct the flangeway. This includes joints within 1 metre of any flange entry or exit.
Loose rails left on track	fouling of chairs, running rails or conductor rails, or not secured
Rail joints in plain line, junctionwork and check rails	missing, broken or loose bolts, or cracked or broken fishplates
	cracked or broken welds
	fishplates touching chairs in running direction
	incorrect bolt type
	broken or loose signal bonds
	rail joint misalignment, including rail gap (noting especially if the inward step is facing direction of running)
	pumping sleepers adjacent to rail joint
	dipped or battered rail ends
	Missing or defective fishbolts, the failure of which could allow a fishplate or part of a fishplate to move and obstruct the flangeway. This includes joints within 1 metre of any flange entry or exit
	joint contaminated with dust, dirt, grease, oil, lubricant or other
Insulated rail joints (additional to rail joints above)	spreading or deterioration of end-posts (‘T’ pieces), or distortion of nylon channel
	insulation broken down
	rail end gap greater than 7mm
	burred rail ends
	longitudinal joint movement making fishplate/sleeper fastening contact possible
Rail keys or clips	fallen out, broken, or wooden keys not nailed at trainstop positions
	installed in the wrong direction
	FB clips missing, damaged or corroded
	clip insulator missing
	mixed keys
Chairs and baseplates	cracks or breaks, signs of looseness, e.g. lateral or vertical movement under load caused by loose or broken fastenings

Component or feature	Conditions to be looked for
	out of position
	broken or missing
Sleeper fastenings	loose or missing
	missing rail pad under flat bottom rail
Sleepers	excessive movement
	evidence of voids
	cracking or rotting
Ballast, concrete or ash support, under plain line track and junctionwork; shingle	signs of subsidence, sleepers working badly under load, excessive (visible) line or top irregularity, signs of slurry or inadequate profile
	signs of flooding
	incorrect profile (ballast and shingle)
	insufficient quantity (ballast and shingle)
Switches, crossings and fittings	cracks, breaks or excessive wear to the crossing nose, cover check, stock, splice, point, wing or closure rails, switch tip or slide chairs or baseplates
	flangeway clearances of switch, check rails and crossings outside tolerance
	grooved slide chairs
	displaced splice rail
	litter or ballast which may prevent switch operation
	stretcher bars loose, damaged or missing
	pin and circlips connecting the extension piece to the indication arm of the strecher bar are loose or missing
	Missing or defective fishbolts, the failure of which could allow a fishplate or part of a fishplate to move and obstruct the flangeway. This includes joints within 1 metre of any flange entry or exit
Bolts, blocks and switch anchors in junctionwork	broken/missing bolts or blocks, or loose bolts (noting especially any bolt that is fouling equipment for operating points)
Locked wheel ramps	parts missing or incorrectly fitted; arrange removal
Slipper runs	missing
	loose or damaged
	signs of shoes striking
Lead rails	assess extent of rail wear
	measure relative heights
Lubricators	damage to unit, hoses or reservoir
	incorrect (especially excessive) grease application
	not correctly fixed to the track
Track on bridges (unballasted) additional to there track features	timbers unsound
	fastenings, chairs, packings loose
	rail joints not clear of bridge.
	see also Attachment 5
Conductor rail	loose or broken bonds or connections
	cracks or breaks on bonding
	cracks or breaks at welds, in fishplates, loose fishplates or rail out of insulators, excessive wear, signs of misalignment or burn marks
	welds touching insulators, ears twisted
Conductor rail ramps	cracks or breaks (if current is off and a ramp end is being struck by shoes, remove or reposition insulators to lower ramp as a temporary measure)
	grooving at ends, excessive wear, misalignment or burn marks
	mis-striking of ramps
Conductor rail negative	longitudinal movement risking fouling of point mechanism

Component or feature	Conditions to be looked for
splays	uneven wear
	wear at conductor rail splice
Negative splay filler pieces	shrinkage causing gaps
	excessive/uneven wear
	worn/missing
Conductor rail insulators	missing, cracked or broken insulators (if insulators have been struck, search for other damage to conductor rail components)
	missing coachscrews or clips
	damaged/missing packing
	signs of arcing
Conductor rail anchors	loose, broken or missing
Conductor rail anchor blocks	split, worn or out of place
Conductor rail safety blocks	cracked, loose, out of place
	touching conductor rail
Conductor rail protection planking	damaged, missing or misplaced
Track components and ancillary equipment	damage or signs of striking by hanging train equipment (examine for full extent of damage and report as soon as possible so that trains can be examined)
Train arrestors	signs of damage or movement from striking
	debris which may affect operation
	low, poorly maintained sand profile (sand drags)
	incorrectly positioned, damaged or missing parts
	check height of buffer beam
Fences visible from four-foot	gaps or other damage through which access could be gained
Paper traps	damaged, missing, or excess litter
Monument blocks and pointers	excessive pointer movement
	damaged, loose or missing
Drains	signs of flooding or blockage
Manhole covers	missing, broken or damaged
	not in place
Trainstops	broken or damaged
	obstructed by litter, ballast or other material
	excessive grease
Signalling and electrical equipment	bonds incorrectly positioned, disconnected or damaged
	cable runs not properly supported, or posts out of line
Speed signs (permanent and temporary restrictions	malfunctioning, missing or displaced
Limited clearance boards	damaged, missing or dirty
Wooden walkways	damaged/decay
	accumulation of rubbish
	kickboards missing
	obstructed
Cable stiles	damaged
Tunnel escape routes/exits and walkways	obstructed

Component or feature	Conditions to be looked for
Flammable materials in tube and sub-surface sections	accumulation of paper, dry leaves or other flammable materials on or adjacent to track or cable runs; used fuel, grease or gas containers, residue of fuel or grease, rags, fluff, oddments of timber or plant material; incorrect storage of flammable materials.
Trackside permanent and temporary storage areas	unlocked
	not labelled to define the responsible manager, key holder's telephone number and permissible material and quantities stored
	licence to store not displayed
Track environment	foul water seepage; spilt chemicals; excessive litter; pests and vermin
Obstructions or foreign material on track	any part fallen from service train, any material fallen from ballast train or material thrown onto the track (examine for any damage caused to track and remove object to a place of safety off the track)
	slipped material from cutting
	accumulations of paper, dry leaves or other flammable materials on or adjacent to track and cable runs; foreign matter on track near trainstops, stock rails and switches or check rail gaps
	tools or other equipment on the track (remove to an approved area if possible)
Major works in progress on open and sub-surface sections	incorrect storage of materials, tools or equipment
Major works in progress on tube sections	any insecurity of shuttering, form work, jack and brace units, block and wedges or other temporary track support, unsafe storage of track renewal material on or about the track, structures which infringe clearances to trains
Emergency equipment, e.g. rail clamps	wrong type
	loose components or incorrectly fitted
Work in progress outside but near railway boundary	any situation likely to affect the safety of the track, structures or boundary fencing
Trespassers	unauthorised persons found on railway property (politely request to leave premises. If refused, summon help and/or call police.)
Underbridges and viaducts	undue movement or deflection
	loss of ballast
	cracks in parapets
	loose cable runs or coping stones
	blocked drainage channels to abutments
	debris on bridge floors or girder ends
	grass or other growth on brickwork or masonry
Overbridges, girders over track	condition of cable runs, advertisement hoardings, missile screens and similar
Pipe bridges	escape of liquid from pipes, or gas leakage
Cable bridges and signal gantries	loose/damaged cables and brackets
Culverts	headwalls cracked
Girdering over track (apart from bridges)	undue deflection; heavy seepage or fallen material; gauge fouling
Covered ways, i.e. metal or reinforced concrete structure in tunnel form	undue deflection; loose masonry or heavy seepage; gauge fouling
Retaining walls	unusual cracks/bulging; any tendency for wall to move towards track; loose cable runs
Tunnels (masonry)	heavy seepage

Component or feature	Conditions to be looked for
	loose bricks or loose cable runs
	undue loss of ballast which might indicate failure of invert or collapse of old sewers
	any indications of gauge fouling, i.e. trains striking walls
Tunnels (cast iron, bolted concrete segments, flexible iron or in-situ concrete)	heavy seepage
	cracked or bulging segments
	any indications of gauge fouling, i.e. trains striking walls or noise reduction screens
	loose/damaged noise reduction screens
Advertisement hoardings (free standing or fixed to structures)	loose fixings, movement or gauge fouling
Buildings and structures	accumulations of paper, dry leaves or other flammable materials
	graffiti
	other vandalism or damage
Embankments and cuttings	evidence of instability by loss of track 'top' or cable run leaning; signs of slippage; material blocking cess drains
General cleanliness and tidiness	excess litter and rubbish
	burning material
	materials not stacked neatly
	presence of Storage Licence
Boundary markers	Missing
	Loose
	Obscured
	Not fully legible
Level Crossings and Road Rail Access Points.	Rail head corrosion
	Corrosion of web
	Rail foot corrosion
	Corrosion of fastenings
	Obstruction of flange ways
	Application of salt
	Deterioration of road surface or panelling
	Deterioration of sub-surface track components

11.3 Attachment 3 – Off-track inspections of fences, drains, manholes, ditches, vegetation, embankments, cutting slopes and cesses

Feature	Conditions to be looked for	Note
Fences	gaps or other means by which unauthorised entry may be made, with particular attention being given to areas of trespass and vandalism or signs of trespass	See Note D
	insecurity of fence requiring local repairs	See Note D
	rubbish, vegetation or other material on or next to fences	See Note B
	fences requiring partial or complete renewal	See Note B
	special sites where up-grading of the fence is considered necessary	See Note B
Drains, manholes and ditches	over silting of manhole sumps	See Note B
	manhole covers damaged or not in place	See Note B
	blocked or damaged drains or ditches	See Note B
	lack of flow or standing water	See Note B
	any evidence that water is not entering drains	See Note B
Vegetation	encroaching on neighbouring properties	See Note B
	encroaching on structures	See Note B
	encroaching on ditches and drains	See Note B
	obscuring signals	See Note C
	encroaching on structure gauge	See Note B
	constitutes a fire danger	See Note C
	burning material	See Note A
	fouling cable runs or encroaching on track	See Note B
	grass needs cutting	See Note B
	trees in danger of falling over or on track	See Note C
	leaf fall	See Note B
Embankments, cutting slopes and cesses	rubbish in cess	See Note B
	burning material	See Note A
	cracks and other signs of movement or loss of stability of slopes	See Note C
	spillage into the cess from cuttings	See Note C
	toe wall stability deteriorating	See Note C
	ground heave	See Note C
	faulty drainage in retaining walls and stress causing deterioration of the structure	See Note B
	damage to embankments by foxes, rabbits or similar	See Note B

Notes: Describing minimum action to be taken:

A Stop or slow trains if a serious sub-standard condition is found during traffic hours. Advise and seek assistance from the Line Service Centre or the Line Controller or both. If necessary, seek discharge of traction current until the condition has been rectified

B Note location and type of sub-standard condition and report for further investigation or action

C If an unsafe condition is observed action as for Note A, otherwise action as for Note B

D If an unsafe condition is observed carry out repair or adjustment if possible, otherwise action as for Note B

11.4 Attachment 4 – Rail support and fastening maintenance

Observation	Effect	Action	Remarks
Missing or broken keys or clips.	Loss of gauge.	Replace or renew key or clip.	
Horizontal movement of chair or baseplate under traffic.	Gauge widening Derailment potential.	Move chair or baseplate to provide sound wood. Plug old holes. Drill new holes. Fill holes with resin and re-gauge. Check track gauge.	Possibility of using coils to 'tighten up' existing screwspike holes. Alternative is to fill holes with resin compound.
Missing or broken chairs or baseplates.	Loss of rail support.	Replace or renew chair or baseplate.	
Missing running rail pads or insulators.	Gauge widening. Worn sleepers.	Replace with the correct pad, running rail insulator or clip.	Always use a left hand and a right hand clip to secure each rail end at rail joints.
Worn running rail insulators.	Loss of toe load. Gauge widening. Potential for short circuits.	Replace with correct running rail insulator.	
Worn running rail pads.	Loss of toe load.	Replace pads.	
Running rail insulator 'pushed' against the outer housing on curves.	Wide gauge.	Replace running rail insulators. Review alignment.	
Loose Pandrol housings.	Wide gauge.	Renew sleeper.	Install tie-bars in short term pending re-sleepering.
Rail gall at chairs or baseplates.	Loss of rail depth. Potential rail failure.	Monitor until maximum gall is reached and then replace rail.	
Concrete sleeper housings loose and able to move about. Split concrete sleeper.	Loss of gauge.	Replace sleeper.	
Poor fastenings permitting movement of chairs or baseplates on sleepers under traffic.	Wide gauge.	Plug holes. Fit helical maintenance coils. Fill holes with epoxy resin.	
Screwspikes on high rail leaning to outside of curve.	Indentation of sleeper. Elongated screwspike hole. Crushed ferrules. Wide gauge.	Reposition chair or baseplate in sound wood and re-gauge. Fill holes with epoxy resin and re-gauge.	
Split sleepers.	Derailment	Replace sleeper.	

Observation	Effect	Action	Remarks
Centre split to heartwood. Severe decay. Broken.	potential. Gauge widening.		
Old screwspike holes. Elongated screwspike holes.	Wide gauge.	Fit helical maintenance coils. Fill holes with epoxy resin. Re-gauge.	
Indentation. Rotted or broken packings.	Loss of cant. Increased dynamic twist.	Fit approved hardwood packings. Replace packings.	
Split ends.	Possible gauge widening.	Clamp and fit gang nail plates prior to installation.	
Voiding.	Increased dynamic twist. Loss of track stability. Potential track buckle.	Pack.	
Timber indentation underneath caused by abrasion on bearers.	Possible weakening of longitudinal timber.	Measure indentation.	

11.5 Attachment 5 – Minimum actions for longitudinal timbers

Where the action shown is to replace the timber, reference shall be made to LU standard S1051 for design loading criteria.

Maintenance item	Condition	Minimum action to be taken
Longitudinal bridge timbers and transoms	Split, rotted, or otherwise defective	Replace timber
	Condition of the timber is considered detrimental to the distribution of the load to the superstructure or detrimental to the security of the fastenings	Replace timber
	Defective transom considered not to be an effective part of the timber frame	Replace transom
	Loose fitting tenon joints	Wedge, or replace timber as necessary
Through bolts	Wear, corrosion, unable to tighten or other defects	Replace bolt
	Security and tightness of nuts	Fully tighten as necessary, replace defective items fully tighten
Tie rods	Wear, corrosion, unable to tighten or other defects	Replace tie rod
	Security and tightness of tie rod nuts	Fully tighten as necessary, replace defective items
Timber packings	Worn, split, breaking up and unable to fulfil their function	Replace packing
Vertical and parallel wedges	Loose, split, cannot be tightened	Replace by components of the original size and shape, refer to design drawings
Timber retaining brackets	Cracking along weld, excessive wear, corrosion, does not retain timber efficiently	Replace or repair
Packing retainers	Cracking along the weld, corrosion or excessive wear	Replace or repair
Positive insulator stools	Split or rotted timber blocks, does not provide adequate support for the conductor rail	Replace defective items
	Bolts and nuts worn, corroded, unable to tighten	Replace defective items
	Security and tightness of nuts and bolts	Fully tighten as necessary
	Conductor rail gauge	Gauge
Step-off stools	Split, rotten or otherwise defective timber components	Replace
	Holding down straps do not provide positive fixing of the step-off stool to the bridge structure	Replace as necessary
	Coachscrews worn, corroded, defective or unable to be tightened	Replace
	Non-slip tread surface damaged or worn	Replace
Steel saddle	Corrosion or defective welds causing lack of security of fixing to timber bearer	Repair or replace with compatible items

Maintenance item	Condition	Minimum action to be taken
Timber struts	Split or rotten	Replace strut. Struts shall be cut with square ends and secured in the steel saddle using timber wedges
Longitudinal bridge timbers extending onto ballasted track	Maintenance of ballast	On underbridges where longitudinal timbers extend onto the ballasted track the ballast shall be maintained
Timber walkway	Planking distorted, twisted, split, rotted or otherwise defective	Replace timbers. Treat with preservative coating
	Security of coachscrews	Tighten or replace as necessary. The holes shall be countersunk to accommodate coachscrew heads
	Redundant coachscrew holes	Prior to refitting the timber walkway planking, redundant coachscrew holes in transoms and longitudinal timbers shall be plugged using plugs of similar material to the transoms or longitudinal timbers
	Surface level of planking	The finished surface level of the planking at joints shall be flush and shall be adzed if necessary
Interface between ballasted track and longitudinal bridge timber	Track alignment	Track alignment at the interface between ballast supported track and track supported on longitudinal bridge timbers shall be maintained within the positional and geometric tolerances
		If chair or baseplate positions are adjusted then redundant screwspike holes shall be plugged using timber plugs of similar material to the longitudinal bridge timbers
		Care shall be taken to ensure design alignment is achieved, and cant is matched between the ballasted track and longitudinal timbered portion of track
Chairs and baseplates	Use of correct chairs and baseplates at specific locations	Special high base chairs shall be used at certain locations to provide cant. These are designated with suffix 'T' or 'S'. When replacing such chairs it is essential that a chair of an identical designation is fitted in order that the applied cant is maintained. 'Small base' chairs, designated with a prefix 'L' or 'M' shall be used where an insufficient width of timber exists for an 'S1' chair
		For FB track, high base baseplates do not exist. 'Small base' baseplates, designated with a prefix 'L' or 'M' shall be used where an insufficient width of timber exists for a 'Pan 6' or 'Pan 7' baseplate
		Where high base chairs are not required it is essential that 'S1', 'L' and 'M' chairs and baseplates fitted on longitudinal timbers are alternated. The relative positions of the screwspike holes are different, enabling the position of such holes to be varied with respect to the place of the timber grain. Adoption of only one type of chair or baseplate may lead to splitting along the grain and a consequential severe loss of fastening provided by the screwspikes

Maintenance item	Condition	Minimum action to be taken
Chair indent	Excessive indentation that adversely affects the longitudinal profile or cross level of the timber	Use approved hardwood chair packings as necessary
Condition of existing chair packing	Rotted, excessive cracking, not an effective support for the chair	Replace packings with the minimum number required

11.6 Attachment 6 – Marking of temporary speed restrictions

11.6.1 Introduction

11.6.1.1 The type and placing of temporary speed restriction signage depends on whether LU or Network Rail (NR) is responsible for the signalling system.

11.6.1.2 On LU-signalled lines no signage is required where the passenger service is provided entirely by automatic train operation (ATO) and assurance has been given that the restriction will be implemented within the ATO system.

11.6.1.3 All signage shall be located in accordance with the clearance requirements in standard S1156 (and applicable NR clearance standards on the Wimbledon branch).

11.6.2 LU-signalled lines

11.6.2.1 The commencement of a temporary speed restriction shall be marked by a sleeper-mounted sign (type 7-01412-210 in standard S1004) located in the four-foot displaying the permissible speed.

11.6.2.2 A dual-aspect amber flashing warning lamp shall be positioned in the four-foot approximately 50m in rear of the commencement sign to alert the train operator to the restriction. The flashing lamp and commencement sign shall be located to give train operators an adequate view to allow sufficient braking distance. (Note: The lamp is not an advance warning sign as understood on NR lines.)

11.6.2.3 The termination of a temporary speed restriction shall be marked by a sleeper-mounted sign (type 7-01412-220 in standard S1004) located in the four-foot at a distance beyond the speed-restricted area equal to the length of the longest train which normally uses that section.

11.6.2.4 A dual-aspect amber flashing warning lamp shall be positioned in the four-foot closely in rear of the termination sign to alert the train operator to the end of the restriction, but not so closely that sighting of the termination sign is obscured.

11.6.2.5 Signs and lamps shall be placed on the side of the negative conductor rail judged to give train operators the best view of them.

11.6.2.6 On bi-directional lines, and during single-line working, signs and lamps shall be erected on both approaches to the affected area.

11.6.2.7 Signs used in an emergency may be the same as those for a planned restriction.

11.6.3 Network Rail-signalled lines

11.6.3.1 Wimbledon branch

11.6.3.1.1 Signs to NR standard shall be erected, including advance warning signs also to NR standard. The distance between the advance warning sign and the commencement sign shall be calculated in accordance with NR standards.

11.6.3.1.2 During single-line working, signs shall be erected on both approaches to the affected area.

11.6.3.2 Richmond branch and Bakerloo line beyond Queens Park

11.6.3.2.1 NR will erect their standard signs on these sections.

12 Current written notices attached to this document

Written Notice No	Issue date	Written Notice Title
LU-WN-01723	19/12/2023	Inspection requirements of temporary rail clamps where traffic is ceased (CR-18533)
LU-WN-01727	01/03/2024	Table 1 Notes to include Note (k)

F0770 A3 Written Notice

1	Written Notice Reference No.	**WN-01723**
2	Person Accountable	Andrew Brice
	Directorate	TfL Engineering Asset Strategy
	Date Issued	19/12/2023
3	**Details of the document**	
	Title:	Track – Inspection and Maintenance
	Reference No.	S1158
	Issue No.	A11
	Clause/Paragraph No.	3.4.4.3.4 table 2 and 3.4.4.4 table 3
4	**Details of Clarification or Correction**	
	Title of Written Notice	Inspection requirements of temporary rail clamps where traffic is ceased (CR-18533)
	Following a recent period of industrial action, a query has been raised regarding the requirement to inspect temporary rail clamps where traffic is not operating. The clause as it currently exists requires inspections to be undertaken based on calendar days and does not provide consideration for known periods where traffic may not operate, for example during a period of industrial action or possessions. The purpose of the inspection of temporary rail clamps is to determine if traffic has impacted upon the security of the clamping arrangement and where no traffic has passed over the clamping arrangement it is highly likely that the integrity of the clamping arrangement will not have been compromised. This written notice amends Table 2 'Timeline and inspection requirements for use of clamps with temporary rail joints and Table 3 'Timeline and the inspection requirements where temporary clamps are used for rail defects and aluminothermic welds (including failed welds or missed weld inspections' to include the note as below. In exceptional circumstances, by approval of Professional Head of Permanent Way or suitably delegated Permanent Way engineer the inspection of temporary rail clamps may revert to traffic rather than calendar days. This shall be documented accordingly on all relevant documentation or records.	

F0770 A3 Written Notice

1	Written Notice Reference No.	**WN-01727**
2	Person Accountable	Andrew Brice
	Directorate	Engineering
	Date Issued	01/03/2024
3	**Details of the document**	
	Title:	Track - Inspection and Maintenance
	Reference No.	S1158
	Issue No.	A11
	Clause/Paragraph No.	Table 1
4	**Details of Clarification or Correction**	
	Title of Written Notice	Table 1 Notes to include Note (k)

This written notice amends S1158 **Table 1 Notes** to include **Note (k)** as follows:

k) Fishbolt holes drilled for the installation of back-hole drilled and clamped joints shall be cold-bolt expanded following welding of the rail ends in accordance with S1157 Section 3.8.2.6.

Note: The effect of any previous cold-expansion is considered to be lost when welding is carried out.