



# Southern Region Track Risk Based Management



BETTER TOGETHER  
**SOUTHERN**

## Who am I?

- Brought up in Northern Ireland and moved to London in 2000 to study Civil Engineering at City University
- Chartered Engineer with the IET
- Joined the Rail Industry in 2002 as a Year in Industry student with AMEC Rail – working with the PWE at Tottenham and then the maintenance team on the District & Jubilee Lines
- After graduating, I was a project manager on maintenance of train care depots in Wessex and Southern before working on the construction of Singlewell Maintenance depot on HS1 near Gravesend
- Worked as a Project Engineer on the Woolwich Arsenal DLR extension
- Joined Network Rail in 2008 working my way through the organisation:
  - ATME Dartford
  - TME Watford
  - TME Orpington
  - Route Asset Manager [Track] Sussex then Wessex
- Appointed Regional Head of Engineering [Track] for Southern in October 2020





# Introduction to Southern Region



BETTER TOGETHER  
**SOUTHERN**

# Network Rail Operating Model – National Overview



|                          | Eastern | North West & Central | Scotland's Railway | Southern | Wales & Western |
|--------------------------|---------|----------------------|--------------------|----------|-----------------|
| Route Services           |         |                      |                    |          |                 |
| System Operator (SO)     |         |                      |                    |          |                 |
| Technical Authority (TA) |         |                      |                    |          |                 |
| CFO/ HR/ Comms           |         |                      |                    |          |                 |

## Network Rail Operating Model – Southern Region Overview





# Southern Region Track Risk Based Management



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# Background

# Safety Alert

A serious incident has taken place



## Workforce fatality

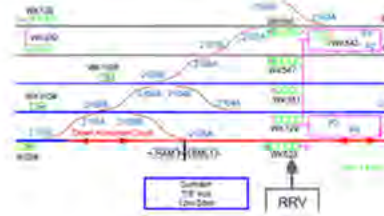
Scope: Network Rail line managers, safety professionals and accredited contractors

Ref: NRX21-01

Date: 12/02/2021

Location: Surbiton station, BML1 Wessex route

Contact: Allan Spence, Director of Regulator Liaison



## Overview

On Tuesday 9<sup>th</sup> February at 11.38 a.m., a track patroller was struck by 1L29, a Waterloo to Salisbury South Western Railway train, sustaining fatal injuries.

The patroller was one of a team of four inspecting the switches and crossings immediately west of Surbiton station. All of the lines were open to traffic and the system of work used unassisted lookout warnings.

The three other members of staff were acting as site lookout, distant lookout and patroller's assistant. All of the team were experienced at undertaking this activity, familiar with the location and had worked together previously. The inspection was a cyclical task done each week.

The line speed is 80mph. 1L29 was a through-train, travelling on the Down Fast line. Part of the asset to be inspected included a crossover between the Up and Down Fast lines at the location the patroller was struck.

The accident is being investigated by the Rail Accident Investigation Branch, the Office of Rail and Road and in a formal industry investigation.

While we don't yet know what led to this tragic accident, there are some immediate points for everyone undertaking, supervising and managing track patrols which inspect switches and crossings to consider:

- How do you check patrol diagrams\* are clear, understood and always followed? How does everyone know what version to use?
- Does the Safe Work Pack (SWP) work with the track patrol diagram, if your SWP is wrong, what stops you challenging any errors?
- Consider how each track patrol team safely covers the entire crossover where trains may arrive from different directions?
- Never step out of the confines of the agreed safe system of work.
- What arrangements could you use to avoid unassisted lookout working?

\*Company standard NR/L2/TRK/001/mod02

The tragic events of 9<sup>th</sup> February prompted us all to think about how we go about our business...

- Why do we send staff out onto the asset whilst trains are running?
- What is the **ACTUAL** need for all the inspections and maintenance activity we carry out in red zone?
- We need to make our activities more risk based
- We need to change

Track worker safety principle:

- To minimise (eliminate?) exposure of track inspection staff to lines open to traffic

Engineering (train accident risk) principles: what does the Track Section Manager need?

- To be confident and assured that the track is safe to run trains
- Serious defects are detected and controlled to minimise safety and performance risk
- To know where track assets are deteriorating, in what way and how quickly
- To be able to prioritise and plan repairs and refurbishment / renewal proposals



# The Plan



# What are we doing?

In response to Surbiton, introducing a focussed risk based approach to track management to support to Track Worker Safety Programme and to eliminate Unassisted Lookout Warning working

## Phased approach to Track Risk Based Management (green = complete; amber = in progress; red = yet to commenced)

Phase 1  
Risk assessment on  
S&C crossovers

Phase 2  
A - BVI on S&C  
B – Loss of BVI (all)

### Phase 3

A - SVI

B – Hot Weather  
Duties

C – 053/054 & Gauge

Phase 4  
Maintenance  
activities carried out  
in Red Zone

Phase 5  
Long Bearer  
inspection

Phase 6  
BVI in PL (not PLPR)

Phase 7  
Manual Track  
Geometry inspection  
Manual Rail Testing

Phase 8  
TME inspections

Additional activity underway to boost phases:  
Drone inspections, Class 153 S&C inspections, PLPR on S&C, Amber Deviations, IM workshop



# Phase 1

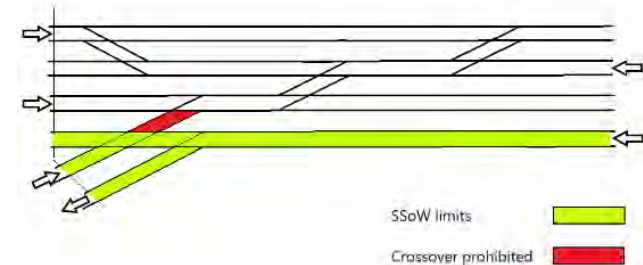
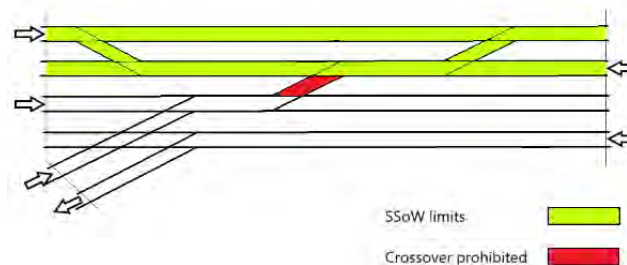
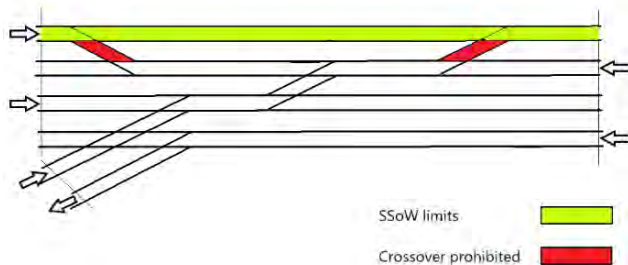


## Phase 1

Verification exercise to mitigate the risk of a patroller working outside the limits of their SSoW at crossovers in S&C and to confirm that the patrolling diagram is clear.



| Crossover PSR   | Traffic daily                                              | Traffic every 2 to 7 days | Traffic less than weekly |
|-----------------|------------------------------------------------------------|---------------------------|--------------------------|
| 20 mph or below | Use track cat for speed and tonnage on the crossover route | 26-weekly                 | 52-weekly                |
| 21-40 mph       |                                                            | 13-weekly                 | 26-weekly                |
| 41 mph or above |                                                            | 4-weekly                  | 13-weekly                |





# Phase 2



## Phase 2A

- Introduction of a Regional risk assessment for S&C BVI where it is being moved to being carried out only in green zone protection.
- This requires condition and failure history of a layout to be recorded.
- The output is a rating (from good to very poor) which will then indicate intervals for BVI to be carried out

Table 1 - Risk Assessment for Junction – Within patrol limit of the S&C (Junctions can be grouped if they are of similar construction & operational context – however if the risk assessment becomes too challenging separate junctions out)

|                                                          |                                                                                                                                                         |                      |                  |                          |
|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------|--------------------------|
| Junction Name(s)                                         |                                                                                                                                                         |                      |                  |                          |
| Point Numbers                                            |                                                                                                                                                         |                      |                  |                          |
| Risk assess classification (final output from table 2)   |                                                                                                                                                         |                      |                  |                          |
| Linked patrol diagram(s)                                 |                                                                                                                                                         |                      |                  |                          |
| Defect type                                              | Frequency of defect occurrence – approximate from Ellipse or TEFs<br>Only one “Y” per defect taking worst case scenario if assessing multiple junctions |                      |                  |                          |
| Class A items                                            | Category 1 = ≤4week                                                                                                                                     | Category 2 = >4w ≤3m | Category 3 = >3m | Estimate of Qty per year |
| Loose / missing fish bolts                               | N                                                                                                                                                       | Y                    | N                | 50                       |
| Cracked / broken plates                                  |                                                                                                                                                         |                      |                  |                          |
| Broken or damaged rail                                   |                                                                                                                                                         |                      |                  |                          |
| Ineffective sleepers at joints                           |                                                                                                                                                         |                      |                  |                          |
| Flangeway blockage in switches, crossings or check rails |                                                                                                                                                         |                      |                  |                          |
| Damaged switches                                         |                                                                                                                                                         |                      |                  |                          |
| Cracked crossings                                        |                                                                                                                                                         |                      |                  |                          |
| Broken or damaged modular bearer components              |                                                                                                                                                         |                      |                  |                          |
| Stretcher bar defects                                    |                                                                                                                                                         |                      |                  |                          |

| Class B items                                                                                                                                                   | Evidence from patroller on scale of work undertaken per junction every patrol                                              |                                |                                        | Estimate of volume |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------|--------------------|
|                                                                                                                                                                 | Category 1 = Lots                                                                                                          | Category 2 = Quite a few       | Category 3 = Not many                  |                    |
| Missing or ineffective fastenings                                                                                                                               |                                                                                                                            |                                |                                        |                    |
| Class C items                                                                                                                                                   | Evidence from track geometry outputs (the last full track recording output or output from MPV/manual in terminal stations) |                                |                                        | Estimate of volume |
| <i>Note – if there is limited information available in terminal stations, BVI and SVI feedback on track quality condition is sufficient for this assessment</i> | Category 1 = 4 or more per point end                                                                                       | Category 2 = 2-3 per point end | Category 3 = less than 2 per point end |                    |
| Total number of twist and gauge faults                                                                                                                          |                                                                                                                            |                                |                                        |                    |
| Dip angles >20mrad                                                                                                                                              |                                                                                                                            |                                |                                        |                    |
| Is there Cat I or Cat A cyclic top in the layout                                                                                                                |                                                                                                                            |                                |                                        |                    |

| Output from Risk assessment           | No of items in Category 1 | No of items in Category 2 | No of items in Category 3 |
|---------------------------------------|---------------------------|---------------------------|---------------------------|
| Output No of “Y” from risk assessment | /13                       | /13                       | /13                       |

Table 2 – Classification of condition based on risk assessment

| Range of category from assessment | Condition classification for Junction |
|-----------------------------------|---------------------------------------|
| ≥12 in Category 3                 | Good                                  |
| ≥9 in Category 3                  | Satisfactory                          |
| Any other combination             | Poor                                  |
| ≥6 in Category 1                  | Very Poor                             |

## Phase 2A – Outcome

Table 1 – Minimum Frequency of Basic Visual inspections

| Activity                                            | Qualifier                                                                                            | Track Category   |                  |                  |                  |                  |                  |                  |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|                                                     |                                                                                                      | 1A               | 1                | 2                | 3                | 4                | 5                | 6                |
| Basic visual inspection of plain line jointed track |                                                                                                      | N/A              | Twice per week   | Twice per week   | Once per week    | Once per week    | Once per 2 weeks | Once per 2 weeks |
| Basic visual inspection of plain line CWR           | Flat bottom rail on concrete or steel sleepers <sup>1</sup> with pandrol, SHC or vossloh fastenings. | Once per 2 weeks | Once per 2 weeks | Once per 2 weeks | Once per 4 weeks | Once per 4 weeks | Once per 8 weeks | Once per 8 weeks |
| Basic visual inspection of plain line CWR           | All other types of construction <sup>2</sup> .                                                       | Once per week    | Once per week    | Once per week    | Once per 2 weeks | Once per 2 weeks | Once per 4 weeks | Once per 4 weeks |
| Basic visual inspection of strengthened S&C         | Fully welded shallow depth switches on concrete bearers                                              | Once per 2 weeks | Once per 2 weeks | Once per 2 weeks | Once per 2 weeks | Once per 2 weeks | Once per 4 weeks | Once per 4 weeks |
| Basic visual inspection of strengthened S&C         | All other types                                                                                      | Once per week    | Once per week    | Once per week    | Or 1             | -                | -                | -                |
| Basic visual inspection of non-strengthened S&C     |                                                                                                      | N/A              | Twice per week   | Twice per week   | Or 1             | -                | -                | -                |
| PLPR Inspection System for plain line CWR           | As detailed in NR/L3/TRK/1015/Mod02                                                                  | Once per 4 weeks | Once per 4 weeks | Once per 4 weeks | Or 4             | -                | -                | -                |

**Note:**

1. Can include a short length of wood sleepers (up to 60 metres) within the length.
2. Frequency can be extended with RAM[T] approval by applying Appendix A requirements.



Table 3 - Revised Inspection frequencies based on options available

| Hierarchy      | Level 1                                          | Level 2                                                      | Level 3                                              |
|----------------|--------------------------------------------------|--------------------------------------------------------------|------------------------------------------------------|
| Classification | Daylight inspection                              | Night-time inspection with full lighting similar to daylight | Night-time inspection with hand lighting             |
| Good           | 2 x TRK001 interval – no additional requirements | 2 x TRK001 interval – no additional requirements             | 2 x TRK001 interval – additional requirements 1 to 4 |
| Satisfactory   | 2 x TRK001 interval – no additional requirements | 2 x TRK001 interval – additional requirement 1               | 2 x TRK001 interval – additional requirements 1 to 4 |
| Poor           | TRK001 interval – no additional requirements     | TRK001 interval – additional requirement 1 to 2              | TRK001 interval – additional requirements 1 to 2     |
| Very Poor      | TRK001 interval – no additional requirements     | TRK001 interval – additional requirement 1 to 4              | TRK001 interval – additional requirements 1 to 4     |

*\*note – more levels will be added in due course*

Supplementary requirements for night-time inspection in Poor or Very Poor layouts are described below. The TME, IME and HoA[T] may include further activity based on the condition and risk of the asset:

1. The TME is to implement a regular regime to identify areas of deterioration or areas of concern that require a tactile inspection – **EITHER** through regular trace review on S&C **OR** observation of the asset underload from a position of safety
2. Assess newly reported Dip Angles  $\geq 20$  mrad and undertake a tactile inspection on any joint or crossing associated with the dip angle within 8 weeks. Repeat Dip Angles  $\geq 20$  mrad are to be assessed for deterioration and a tactile inspection undertaken according to risk.
3. Super Red management – In line with current requirements and restated as a prompt, any super reds reported in poor or very poor layouts must have an up to date and robust action plan in place – documented on TEF3018
4. Crossing management – the TME is to consider reducing the interval of detailed crossing inspections at a frequency commensurate with incident history, asset condition and deliverability requirements. The revised regime is to be agreed with the IME and HoA[T]



## Phase 2B

- Introduction of a Regional risk assessment for any loss of BVI.
- This scenario applies to situations where loss of line-blockages/protection arrangements result in a high knock-on consequence of recovery in line with TRK/001/mod02 Table 3.
- The output is a rating (from good to very poor) which will then indicate extension intervals for BVI to be carried out

| PART A: Details of patrol                                                                                                    |        |        |           |                       |                                     |                                    |         |
|------------------------------------------------------------------------------------------------------------------------------|--------|--------|-----------|-----------------------|-------------------------------------|------------------------------------|---------|
| TME                                                                                                                          | SM[T]  |        | Patrol ID | Ruling Track Category | STANDARD <sup>1</sup> BVI frequency | MAXIMUM <sup>2</sup> BVI frequency |         |
| Location                                                                                                                     | ELR(s) | TID(s) | From      | (m/yds)               | To                                  | (m/yds)                            |         |
|                                                                                                                              |        |        |           |                       |                                     |                                    |         |
|                                                                                                                              |        |        |           |                       |                                     |                                    |         |
|                                                                                                                              |        |        |           |                       |                                     |                                    |         |
|                                                                                                                              |        |        |           |                       |                                     |                                    |         |
| PLPR data availability (for sites not yet officially 'Live')                                                                 |        |        |           |                       | Within the last;                    |                                    |         |
|                                                                                                                              |        |        |           |                       | 0 - 28 days <sup>3</sup>            | 29 - 56 days                       |         |
| PLPR data for 100% of patrol mileage available                                                                               |        |        |           |                       |                                     |                                    |         |
|                                                                                                                              |        |        |           |                       |                                     |                                    |         |
| PART B: Lighting arrangements of BVI                                                                                         |        |        |           |                       |                                     | Yes                                | No      |
| Daylight                                                                                                                     |        |        |           |                       |                                     |                                    |         |
| Night-time inspection with full lighting similar to daylight                                                                 |        |        |           |                       |                                     |                                    |         |
| Night-time inspection with hand lighting                                                                                     |        |        |           |                       |                                     |                                    |         |
|                                                                                                                              |        |        |           |                       |                                     |                                    |         |
| PART C: Permanent high risk features                                                                                         |        |        |           |                       |                                     | Present                            |         |
|                                                                                                                              |        |        |           |                       |                                     | Yes                                | No      |
| Jointed Track                                                                                                                |        |        |           |                       |                                     |                                    |         |
| Pan 8s                                                                                                                       |        |        |           |                       |                                     |                                    |         |
| Longitudinal timbers                                                                                                         |        |        |           |                       |                                     |                                    |         |
| Within 200m on the approach side of a major structure, station or embankment                                                 |        |        |           |                       |                                     |                                    |         |
|                                                                                                                              |        |        |           |                       |                                     |                                    |         |
| PART D: Temporary defective features                                                                                         |        |        |           |                       |                                     | Quantity                           |         |
|                                                                                                                              |        |        |           |                       |                                     | 0                                  | 01 - 02 |
| Number of M0 or M1 WAIFs raised on the previous three BVIs (including items that may not have been reported through Ellipse) |        |        |           |                       |                                     |                                    |         |
| Number of M0 or M1 items still open                                                                                          |        |        |           |                       |                                     |                                    |         |
| Temporary rail clamping arrangements                                                                                         |        |        |           |                       |                                     |                                    |         |
| Tie bars for gauge management (multiple of 3s)                                                                               |        |        |           |                       |                                     |                                    |         |
| Items subject to enhanced visual inspection during standard BVI or as part of TV mitigations                                 |        |        |           |                       |                                     |                                    |         |

| PART E: Supplementary inspections                                                                                                                                                                                                                                   |  |                      |  | Undertaken within the last;                      |              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------|--|--------------------------------------------------|--------------|
|                                                                                                                                                                                                                                                                     |  |                      |  | 0 - 28 days                                      | 29 - 56 days |
| Lastest TRV or MPV run(s)                                                                                                                                                                                                                                           |  |                      |  |                                                  |              |
| Lastest SVI(s)                                                                                                                                                                                                                                                      |  |                      |  |                                                  |              |
| Lastest SM or TME cab ride                                                                                                                                                                                                                                          |  |                      |  |                                                  |              |
|                                                                                                                                                                                                                                                                     |  |                      |  |                                                  |              |
| PART F: Scoring                                                                                                                                                                                                                                                     |  |                      |  | Maximum Extension                                |              |
| All 'green'                                                                                                                                                                                                                                                         |  |                      |  | The lesser of; standard BVI frequency or 14 days |              |
| All 'green' or 'amber'                                                                                                                                                                                                                                              |  |                      |  | The lesser of; standard BVI frequency or 7 days  |              |
| Any 'red'                                                                                                                                                                                                                                                           |  |                      |  | As in NR/L2/TRK/001/mod02, Table 3               |              |
|                                                                                                                                                                                                                                                                     |  |                      |  |                                                  |              |
| PART F: Approval                                                                                                                                                                                                                                                    |  |                      |  |                                                  |              |
| Any extension must not be used to pre-emptively not carry out a patrol, nor applied consecutively on the same patrol.                                                                                                                                               |  |                      |  |                                                  |              |
| List any other areas of concern that may affect the safety of the line prior to the risk assessed patrol timescale and declare interval that is being proposed (e.g. presence of shallow rib crossings, defective modular bearers, S&C with elevated housings etc.) |  |                      |  |                                                  |              |
|                                                                                                                                                                                                                                                                     |  |                      |  |                                                  |              |
| Proposed by:                                                                                                                                                                                                                                                        |  | Proposed start date: |  | Proposed end date:                               |              |
| SM[T]                                                                                                                                                                                                                                                               |  | SM[T] signature      |  | Date                                             |              |
| TME                                                                                                                                                                                                                                                                 |  | TME signature        |  | Date                                             |              |

Note 1: As per NR/L2/TRK/001/mod02, Table 2

Note 2: Through the application of a signed TEF3091 ('PL Appendix A') or TVs for S&C BVI risk assessment:

TR61946 & TR61995 - Kent

TR61943 & TR61947 - Sussex

TR61945 & TR61948 - Wessex

Note 3: If this option is selected, Sections B - E are not required to be completed and scoring is considered all 'green'.



# Phase 3



## Phase 3a

- Introduction of a Regional risk assessment for SVI where it is being moved to being carried out only in green zone protection.
- This requires condition and failure history of a layout to be recorded using RBM failure modes.
- The output is a rating (from good to very poor) which will then indicate intervals for SVI to be carried out.
- Southern Region have also introduced the option of conducting SVI in Darkness which is not positively covered in TRK/001.
- The risk assessment process proposed determines the condition of the asset that sets the inspection interval with supplementary Level 1 assurance activity that is to be undertaken if the inspection is to be completed in darkness

**Table 1 - Inspection Overview - details**

| TME      | SM[T]  | Inspection ID | Ruling Track Category | Inspection type (PL only or inc S&C) | Nominal frequency as per TRK/001  |
|----------|--------|---------------|-----------------------|--------------------------------------|-----------------------------------|
|          |        |               |                       |                                      |                                   |
| Location | ELR(s) | TID(s)        | From (mm.ch)          | To (mm.ch)                           | Inspection in day light or nights |
|          |        |               |                       |                                      |                                   |

**Table 2 - Inspection asset scope**

| Track Construction                                                                                                              | Does this inspection include the following assets (Yes / No) | Number of assets in inspection length |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|---------------------------------------|
| Plain Line jointed (units: track miles)                                                                                         |                                                              |                                       |
| Plain Line CWR – Flat bottom rail on concrete or steel sleepers 1 with pandrol, SHC or vossloh fastenings. (units: track miles) |                                                              |                                       |
| Plain Line CWR – all other types (units: track miles)                                                                           |                                                              |                                       |
| S&C – shallow depth on concrete (units: #point ends)                                                                            |                                                              |                                       |
| S&C – all other types (units: #point ends)                                                                                      |                                                              |                                       |
| Long timber bridges (units: #timbers)                                                                                           |                                                              |                                       |
| Direct fastened track (units: track miles)                                                                                      |                                                              |                                       |

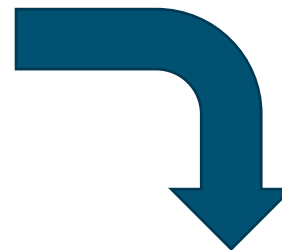
**Table 3b – Inspections that include any S&C Risk Assessment**

*Note - It is important to understand the condition of the asset when undertaking the risk assessment. Consideration must be given to areas where multiple defects are reported that may increase the risk*

| Asset Group           | Asset detail                                                                                                                            | Failure Scope (i.e what the description of the failure) | Presence of defects/assets that have action SM6 reported in last 12 months or work-bank items that are a risk in the next 6 months (Yes / No / NA) | If Yes, Estimate of volume per year | If Yes, is there sufficient risk that requires supplementary inspections? If so, what is proposed? |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------|
| Rails / Joints        | Rail – IBI – glued                                                                                                                      | Lipping, broken/cracked plates, failed insulation.      |                                                                                                                                                    |                                     |                                                                                                    |
| Rails / Joints        | Rail – IBI – site made                                                                                                                  | Lipping, broken/cracked plates, failed insulation.      |                                                                                                                                                    |                                     |                                                                                                    |
| Rails / Joints        | Rail – general conditions and rail defects not detected by UTU and manual rail testing (e.g. RCF, lipping, corrosion, gall, arc damage) | RDMS history (1, 2, A, B or Hs)                         |                                                                                                                                                    |                                     |                                                                                                    |
| Rails / Joints        | Rail – temporary rail clamps                                                                                                            | Loose bolts, incorrectly fitted clamps,                 |                                                                                                                                                    |                                     |                                                                                                    |
| Rails / Joints        | Check Rails – missing, worn or ineffective                                                                                              | Locations of excess wear or ineffective fastenings      |                                                                                                                                                    |                                     |                                                                                                    |
| Sleepers / Components | Fastenings/baseplates – legacy/obsolete – condition                                                                                     | Ineffective to hold top, gauge or line                  |                                                                                                                                                    |                                     |                                                                                                    |

## Phase 3a – Outcome

| Table 2 – Minimum Frequency of Section Manager and Track Maintenance Engineer Inspections                                                                                     |                                                                                                      |                |           |           |           |                        |                        |                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|----------------|-----------|-----------|-----------|------------------------|------------------------|------------------------|
| Activity                                                                                                                                                                      | Qualifier                                                                                            | Track Category |           |           |           |                        |                        |                        |
|                                                                                                                                                                               |                                                                                                      | 1A             | 1         | 2         | 3         | 4                      | 5                      | 6                      |
| Section Manager inspection of plain line jointed track                                                                                                                        |                                                                                                      | N/A            | 8 weekly  | 8 weekly  | 13 weekly | 13 weekly              | 13 weekly              | 13 weekly              |
| Section Manager inspection of plain line CWR                                                                                                                                  | Flat bottom rail on concrete or steel sleepers <sup>1</sup> with pandrol, SHC or vossloh fastenings. | 16 weekly      | 16 weekly | 16 weekly | 16 weekly | 26 weekly (see note 2) | 26 weekly (see note 2) | 26 weekly (see note 2) |
| Section Manager inspection of plain line CWR                                                                                                                                  | All other types of construction.                                                                     | 16 weekly      | 16 weekly | 16 weekly | 16 weekly | 16 weekly              | 16 weekly              | 16 weekly              |
| Section Manager inspection of strengthened S&C                                                                                                                                | Fully welded shallow depth switches, cast crossings on concrete bearers                              | 13 weekly      | 13 weekly | 13 weekly | 13 weekly | 26 weekly              | 26 weekly              | 26 weekly              |
| Section Manager inspection of S&C                                                                                                                                             | S&C not included in the above                                                                        | 8 weekly       | 8 weekly  | 8 weekly  | 13 weekly | 13 weekly              | 13 weekly              | 13 weekly              |
| Track Maintenance Engineer inspection                                                                                                                                         |                                                                                                      | 2 yearly       | 2 yearly  | 2 yearly  | 2 yearly  | 2 yearly               | 2 yearly               | 2 yearly               |
| Section Manager cab riding                                                                                                                                                    | 8 weekly where cant deficiency exceeds 150mm                                                         | 8 weekly       | 8 weekly  | 13 weekly | 26 weekly | 26 weekly              | 26 weekly              | 26 weekly              |
| Track Maintenance Engineer cab riding                                                                                                                                         | 13 weekly where cant deficiency exceeds 150 mm                                                       | 13 weekly      | 13 weekly | 26 weekly | Annually  | Annually               | Annually               | Annually               |
| <b>Note:</b><br>1. Can include a short length of wood sleepers (up to 60 metres) within the length.<br>2. Minimum inspection frequency for longitudinal timbers is 16 weekly. |                                                                                                      |                |           |           |           |                        |                        |                        |



| Table 5 – Classification of condition based on risk assessment                                                                                                           |                                             |                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|------------------------------------------|
| Range of category from assessment - PL                                                                                                                                   | Range of category from assessment – S&C     | Condition classification for Junction    |
| ≥18 in NO Faults                                                                                                                                                         | ≥24 in NO Faults                            | Good                                     |
| ≥15 in NO Faults                                                                                                                                                         | ≥20 in NO Faults                            | Satisfactory                             |
| Any other combination                                                                                                                                                    | Any other combination                       | Poor                                     |
| ≥12 in Faults                                                                                                                                                            | ≥14 in Faults                               | Very Poor                                |
| –                                                                                                                                                                        |                                             |                                          |
| Asset Condition Hierarchy                                                                                                                                                | Option 1 – Inspect in day light             | Option 2 – Inspect at night <sup>1</sup> |
| Good                                                                                                                                                                     | TRK/001 interval x 4 – (up to max 52 weeks) | TRK/001 interval x 3 <sup>2</sup>        |
| Satisfactory                                                                                                                                                             | TRK/001 interval x 2                        | TRK/001 interval x 1.5 <sup>2</sup>      |
| Poor                                                                                                                                                                     | TRK/001 interval                            | TRK/001 interval <sup>2</sup>            |
| Very Poor                                                                                                                                                                | TRK/001 interval                            | Agreement required with HoA[T]           |
| *In compliance to TRK/1019 and inspection of all TIDs at the required frequency                                                                                          |                                             |                                          |
| **Intervals are limited to TRK/001/mod02 cl6.2 that states SM[T] shall observe their asset no less than 52 weeks                                                         |                                             |                                          |
| Note 1 - There is potential to introduce Option 2 where fixed or site lighting is of sufficient levels to be similar to daylight inspections                             |                                             |                                          |
| Note 2 - Level 1 assurance activity when moving inspections to night – TME and SM[T] to confirm the robustness of the following:                                         |                                             |                                          |
| A – S&C – evidence of 053, 054 and gauge inspections. Assurance on previous repairs undertaken and risk of outstanding defects. Supplementary inspection may be required |                                             |                                          |
| B – PL – review of PLPR or BVI outputs, focusing on high risk areas and cluster of defects                                                                               |                                             |                                          |
| C – Track Geometry – trace on trace review with SD trends identifying areas of deterioration and consideration as to risk to trains before next planned inspection       |                                             |                                          |

## Phase 3b – Hot Weather Management

### Problem Statement

The elimination of unassisted lookout working by June/July 2021 has the potential to significantly impact the ability to deploy Watchpersons with the mitigation in the standard (moving directly to CRT(30/60) ESR) being reputationally damaging in line with the risk

### What have we done?

A national working group has produced guidance which has been briefed to the routes. This guidance:

- Introduces a hierarchy of mitigations that can be implemented prior to imposing the next requirement of the standard (i.e. ESR) should a watch-person not be deployed on the track
- Clarifies how rail temperature monitoring can be conducted using alternative means to site based rail thermometers
- Allows for observation of the track under traffic from a position of safety in some cases, subject to meeting certain criteria vice observing the track from the 4-foot
- Confirms that if the site can be fully observed from a position of safety, there is no requirement to be on the track

The guidance is based on the following principles:

1. Prepare the asset in advance!
2. Circa 80% of buckles have occurred on Cat 3, 4, 5, 6 track
3. The train service frequency on the Cat 3-6 lines should accommodate line blockages for watch duties
4. Track construction on Cat 1A, 1 & 2 track should be more resilient owing to the age profile and modern components present



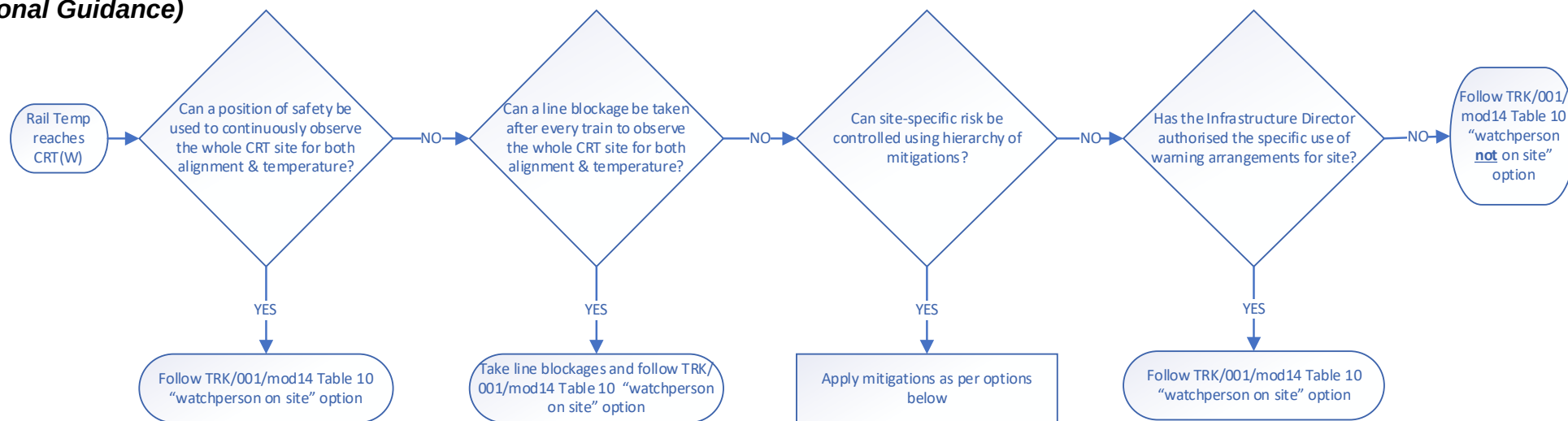
### Engineering Guidance

**Title: Critical Rail Temperature (CRT) Watchperson Means of Control – Framework for Application Summer 2021**

|                  |                                                                                                                                  |
|------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Target Audience: | All Network Rail Regional and Route Engineering teams, Track Maintenance Engineering, Safety and Track Engineering Professionals |
| Date Issued:     | 9 <sup>th</sup> April 2021                                                                                                       |

Note: This guidance will be submitted as a National Temporary Variation Pending Standards change, which is to be supplemented by Route specific TV's.

# Summary of Hot Weather Watchperson guidance – option 3 (SR version expanding on principles of National Guidance)



| Qualifying Criteria  | Not multiple timber S&C or jointed track<br>Not deficient <u>and</u> disturbed<br>Remote temperature monitor confirmed on site<br>Photos and CRT calculations for site reviewed by TME<br>ESR(s) have been designed | Qualifying Criteria  | All other sites excluding multiple timber S&C, jointed track<br>Not deficient <u>and</u> disturbed                                                                                           |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CRT (W)              | Watchperson to monitor rail temperatures and observe train lateral response over site from position of safety. If indications of track movement are observed, a line blockage must be taken.                        | CRT (W)              | Watchperson to monitor rail temperatures and observe train lateral response over site from position of safety. If indications of track movement are observed, a line blockage must be taken. |
| CRT (30/60)          | Impose 30/60mph ESR<br>Watchperson to observe train lateral response over site from position of safety. If indications of track movement are observed, a line blockage must be taken.                               | CRT (30/60)          | Impose 30/60mph ESR<br>Line blockages to be taken at a frequency agreed with HoA/Regional Engineer.                                                                                          |
| CRT (20)             | Impose 20mph ESR<br>Watchperson to observe train lateral response over site from position of safety. If indications of track movement are observed, a line blockage must be taken.                                  | CRT (20)             | Impose 20mph ESR<br>Line blockages to be taken at an <b>increased</b> frequency agreed with HoA/Regional Engineer.                                                                           |
| CRT (20) + 3 degrees | Maintain 20mph ESR<br>Line blockage to be taken after the passage of every train<br><b>OR</b><br>Maintain 20mph ESR<br>Impose 20mph ESR on adjacent road(s)                                                         | CRT (20) + 3 degrees | N/A                                                                                                                                                                                          |

Briefing of Watchpersons on all aspects of the process is critical and needs to be evidenced and assured

## EXCEPTIONAL CIRCUMSTANCES: CAB RIDING

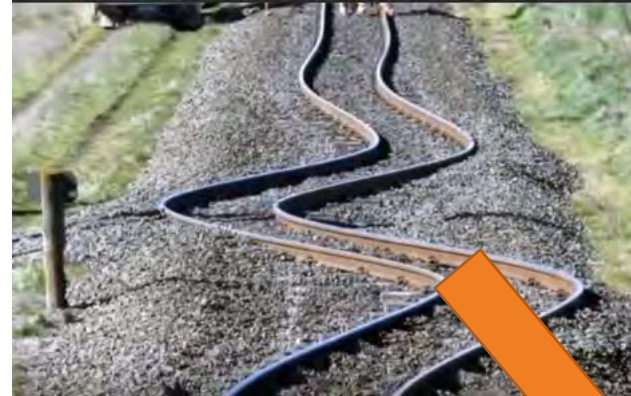
Under exceptional circumstances, it may be reasonable to undertake watchperson duties through cab riding over the affected sites

Cab riding in the rear cab is preferred, to maximise the chance to observe abnormal vehicle / track interaction. Use of the front cab is also acceptable

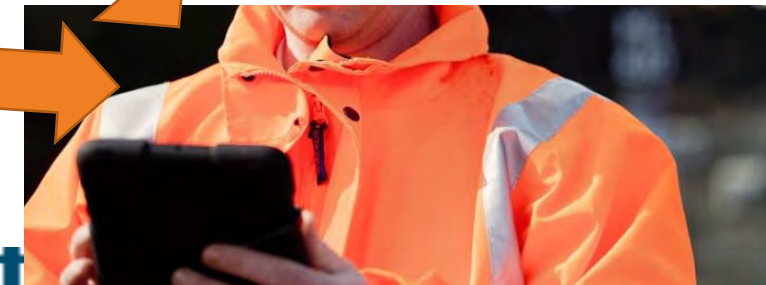
The application of cab rides as an alternative watchperson control must be agreed between the Regional and Route Track Engineers through local risk assessment\*.

\* **Note:** Cab riding is likely to result in the frequency of watchperson inspections being reduced and is also a subjective measure due to not visually observing track alignment. Local risk assessments must therefore consider the frequency that a watchperson is able to travel over the affected site.

## Hot Weather Management - Opportunity for the future



| DU    | TME       | SM Area   | Local Name                    | Temperature | Change  | Last Update                |
|-------|-----------|-----------|-------------------------------|-------------|---------|----------------------------|
| Inner | Feltham   | Wimbledon | WI2799-BTH2-1700-18M-61C      | 26 °C       | ↓ -3 °C | 17:00 19/05/21 1 Hours ago |
| Inner | Feltham   | Wimbledon | 2807 WI2807-BML1-2200-5M-38CH | 26 °C       | ↑ +5 °C | 18:03 19/05/21 0 Hours ago |
| Inner | Guildford | Woking    | ND06 GUND06-PAA2-1100-40m51c  | 25 °C       | ↓ -2 °C | 17:55 19/05/21 0 Hours ago |
| Inner | Guildford | Woking    | ND02 GUND02-PAA1-2100-33m2c   | 25 °C       | -       | 17:44 19/05/21 0 Hours ago |





# Phase 4



## Phase 4a – Track Geometry Recording

### 4 Track geometry measurement

#### 4.1 Requirement

Measurement of track geometry shall be undertaken on all passenger running lines, goods running lines, carriage lines and loops, including all crossovers and turnouts.

- For the requirements for sidings, see NR/L2/TRK/001/mod17.

| Table 1 – Frequency of Track Geometry Measurement                                                                                                                                                                                                                                                                                                                                                                                             |                                          |                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-----------------------------------------|
| Track Category                                                                                                                                                                                                                                                                                                                                                                                                                                | Frequency<br>(Nominal planning interval) | Maximum interval between<br>measurement |
| 1A                                                                                                                                                                                                                                                                                                                                                                                                                                            | 4 weekly                                 | 10 weeks                                |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                             | 8 weekly                                 | 18 weeks                                |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                             | 12 weekly                                | 26 weeks                                |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                             | 16 weekly                                | 36 weeks                                |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                             | 24 weekly                                | 52 weeks                                |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                             | 24 weekly                                | 52 weeks                                |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                             | 24 weekly                                | 52 weeks                                |
| <b>Notes:</b> <ol style="list-style-type: none"> <li>1. Additional measurement may be required on routes containing sections of track which deteriorate rapidly (e.g. embankment settlement, slips or mining subsidence).</li> <li>2. If a planned track recording run has been missed, the TME should consider whether additional measurement is needed for the whole, or part, of the route before the next scheduled recording.</li> </ol> |                                          |                                         |

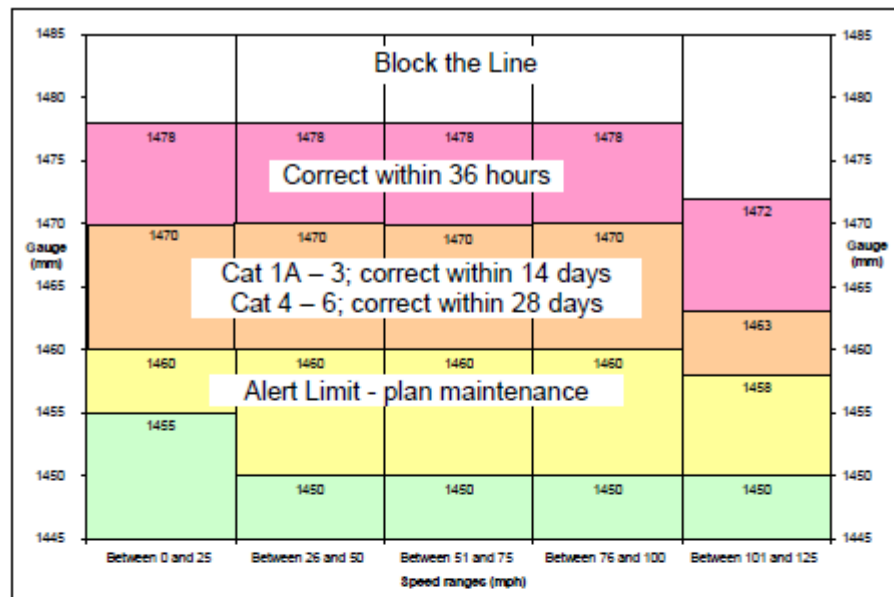


Figure C1 – Gauge faults

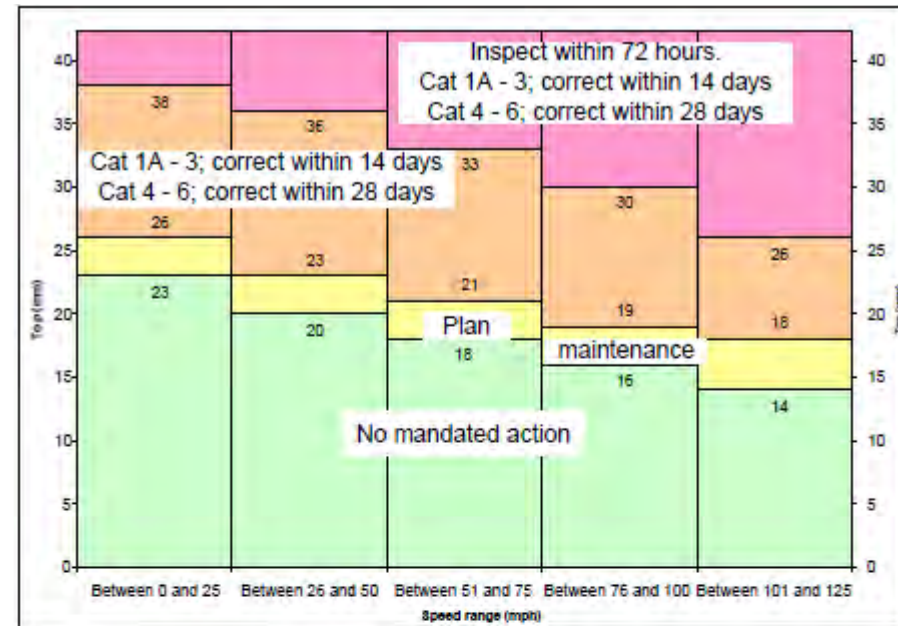


Figure C3 – Top faults

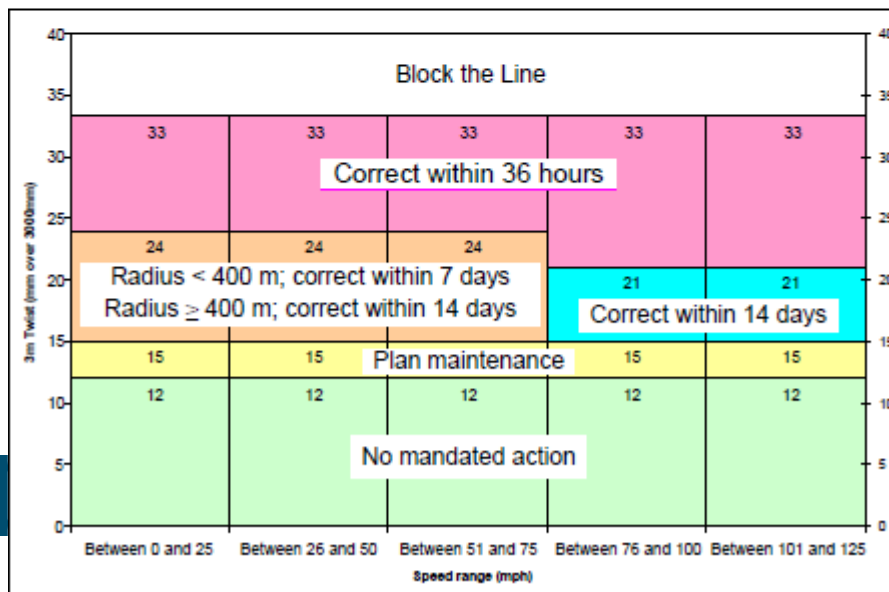


Figure C2 – Twist faults

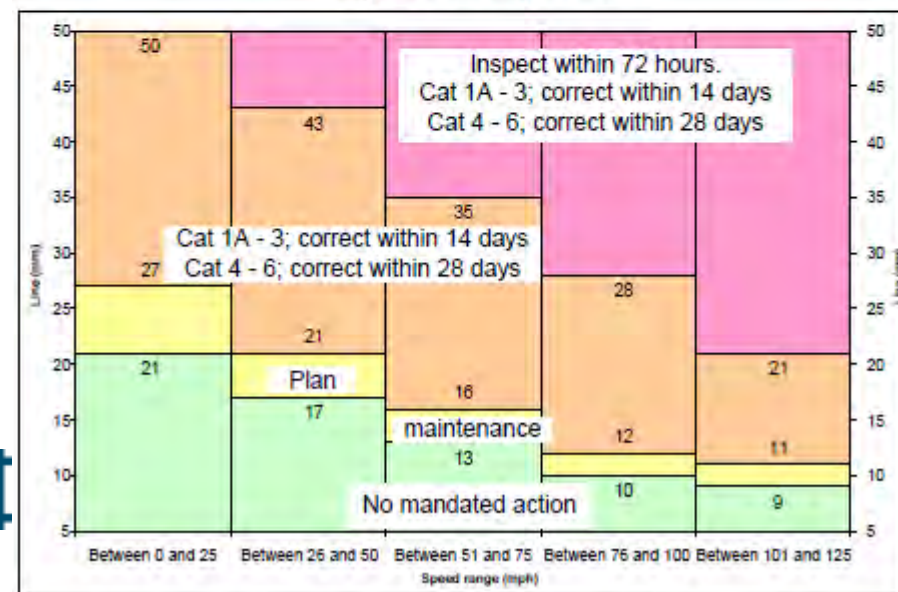


Figure C4 – Line faults

# Track Geometry Challenges

Table 1 – Minimum Frequency of Basic Visual inspections

| Activity                                            | Qualifier                                                                                            | Track Category   |                  |                  |                  |                  |                  |                  |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|                                                     |                                                                                                      | 1A               | 1                | 2                | 3                | 4                | 5                | 6                |
| Basic visual inspection of plain line jointed track |                                                                                                      | N/A              | Twice per week   | Twice per week   | Once per week    | Once per week    | Once per 2 weeks | Once per 2 weeks |
| Basic visual inspection of plain line CWR           | Flat bottom rail on concrete or steel sleepers <sup>1</sup> with pandrol, SHC or vossloh fastenings. | Once per 2 weeks | Once per 2 weeks | Once per 2 weeks | Once per 4 weeks | Once per 4 weeks | Once per 8 weeks | Once per 8 weeks |
| Basic visual inspection of plain line CWR           | All other types of construction <sup>2</sup> .                                                       | Once per week    | Once per week    | Once per week    | Once per 2 weeks | Once per 2 weeks | Once per 4 weeks | Once per 4 weeks |
| Basic visual inspection of strengthened S&C         | Fully welded shallow depth switches on concrete bearers                                              | Once per 2 weeks | Once per 2 weeks | Once per 2 weeks | Once per 2 weeks | Once per 2 weeks | Once per 4 weeks | Once per 4 weeks |
| Basic visual inspection of strengthened S&C         | All other types                                                                                      | Once per week    | Once per week    | Once per week    | Once per week    | Once per week    | Once per 2 weeks | Once per 4 weeks |
| Basic visual inspection of non-strengthened S&C     |                                                                                                      | N/A              | Twice per week   | Twice per week   | Once per week    | Once per week    | Once per week    | Once per 2 weeks |
| PLPR Inspection System for plain line CWR           | As detailed in NR/L3/TRK/1015/Mod02                                                                  | Once per 4 weeks | Once per 4 weeks | Once per 4 weeks | Once per 4 weeks | Once per 4 weeks | Once per 4 weeks | Once per 4 weeks |

**Note:**

- Can include a short length of wood sleepers (up to 60 metres) within the length.
- Frequency can be extended with RAM[T] approval by applying Appendix A requirements.

Track Geometry and PLPR captured on the same vehicle...therefore in most cases we record geometry every 4 weeks!

Table 1 – Frequency of Track Geometry Measurement

| Track Category | Frequency<br>(Nominal planning interval) | Maximum interval between measurement |
|----------------|------------------------------------------|--------------------------------------|
| 1A             | 4 weekly                                 | 10 weeks                             |
| 1              | 8 weekly                                 | 18 weeks                             |
| 2              | 12 weekly                                | 26 weeks                             |
| 3              | 16 weekly                                | 36 weeks                             |
| 4              | 24 weekly                                | 52 weeks                             |
| 5              | 24 weekly                                | 52 weeks                             |
| 6              | 24 weekly                                | 52 weeks                             |

**Notes:**

- Additional measurement may be required on routes containing sections of track which deteriorate rapidly (e.g. embankment settlement, slips or mining subsidence).
- If a planned track recording run has been missed, the TME should consider whether additional measurement is needed for the whole, or part, of the route before the next scheduled recording.

## Track Geometry – Group Standards

### **2.11 Track geometry faults**

#### **2.11.1 Corrective action**

2.11.1.1 The corrective actions set out in 2.11.2 to 2.11.7 apply to isolated track faults (that is, they are not combined with other track faults).

2.11.1.2 When track faults are discovered in combination, the circumstances shall be reviewed and, if necessary, action that is more stringent shall be taken.

- Twist – 7/14 day timescale
- Other faults – within timescale commensurate with risk of a derailment

- **Is this a risk based approach?**
- **How do we balance the over-recording of track geometry versus the requirements for repair in industry standards?**
- **Is the concept of “guilty knowledge” preventing a more risk based pragmatic approach?**

A decorative graphic consisting of a series of vertical blue lines of varying heights, resembling a stylized track or a barcode, spanning the width of the slide.

**More thinking required....**

A stylized graphic of a rail track, consisting of a series of vertical bars connected by horizontal lines, rendered in a dark blue color.

# Future Opportunities

A stylized graphic of a rail track, consisting of a series of vertical bars connected by horizontal lines, rendered in a dark blue color.

# Emerging Programmes

S&C video Trainborne examination trial – planned for Autumn 2021



OFFICIAL

Network Rail

AIVR - Bing x AIVR | Intelligent Video x AIVR Wessex x +

https://view.aivr.video

AIVR

Advanced Sighting Quick Sighting Annotate Markup Measure

SIG SIG SIG

0 1:23:05:200 40:54:00 0:01

Zoom Snapshot Export Share Speed 1.0x Source Enhanced

Richmond to New Malden  
01: 09:28:13 GMT

Wokingham to Richmond  
01: 07:50:13 GMT

Temple Meads to Bristol Temple Meads  
01: 11:48:14 GMT

Hampden Court to Surbiton  
01: 14:54:38 GMT

Search

Search for a session

VIEWING  
#3419 Gillingham -> Salisbury

MARKERS  
No route markers

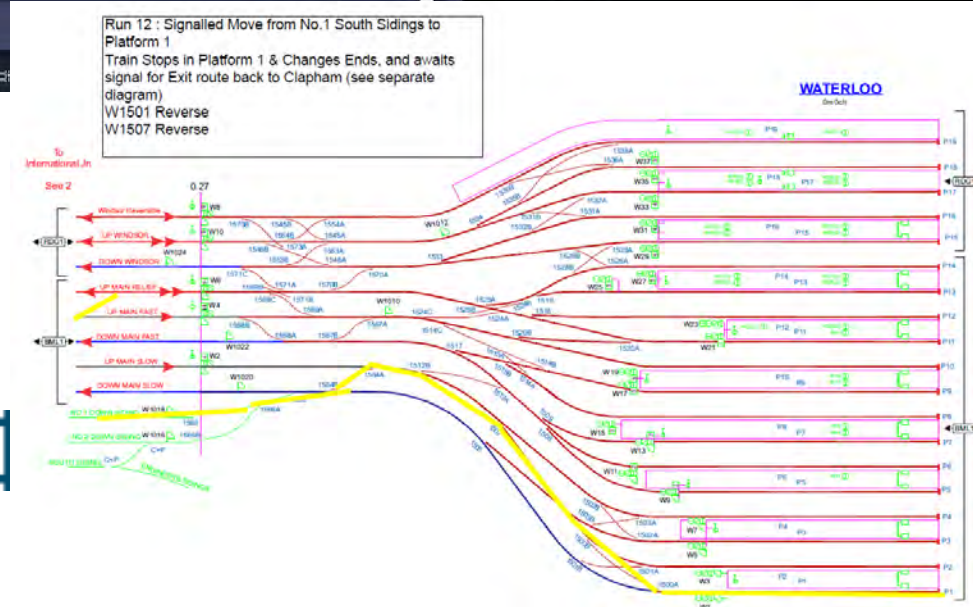
POSITION (LAT, LON)  
51.08486, -1.93382

ULR (ESTIMATED)  
EUR: BAE2 MILE: 89 CHAIN: 41 TRACK: 3400

ALTITUDE  
46m

ACCELEROMETER SPECTROGRAPH

09:55 15/09/2021



# Emerging Programmes

- Drone trials underway to supplement BVI
- PLPR images through S&C to expand on how PL is inspected

