NR/SIN/137 | Issue 1
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Special Inspection Notice

Recording of Warning Time for Automatic Level Crossings

Endorsement and Authorisation

Endorsed by:

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User information

This Network Rail special inspection notice contains colour-coding according to the following Red–Amber–Green classification.

Red – Critical limits – *No variations, could stop the railway*

- Red indicates critical limits to be complied with and achieved at all times.
- Critical limits are presented in a red box and expressed as a direct instruction.
- Accountability for the efficacy of critical limits lies with the Professional Head/special inspection notice owner.
- Critical limits are monitored for compliance.
- If non-compliance is identified, this will be investigated under the Network Rail fair culture process.
- Corrective actions are to be enforced if variations are discovered through functional checks (such as engineering verification visits, audit or operations self-assurance).

Amber – Baseline limits – *Controlled variations, approved risk analysis and mitigation*

- Amber indicates baseline limits to be complied with unless variation has been approved in advance.
- Baseline limits are presented with an amber sidebar and expressed as a direct instruction.
- Accountability for the efficacy of baseline limits lies with the Professional Head/special inspection notice owner, or their nominated delegated authority.
- Baseline limits are monitored for compliance.
- Variations may be permitted. Variations are approved by the process owner or through existing delegated authority arrangements.
- Corrective actions are to be enforced if non-approved variations are discovered through functional checks (such as engineering verification visits, audit or operations self-assurance).

Green – Guidance

- Green indicates guidance. This is presented with a dotted green sidebar and with the word ‘should’ (usually in notes) or expressed as a recommendation.
- Guidance is based on good practice and represents supporting information to help achieve critical and baseline limits.
- Guidance is not mandatory and is not monitored for compliance.
- Alternative solutions may be used. Alternative solutions do not need to be formally approved.
- Decisions made by a competent person to use alternative solutions should be backed up by appropriate evidence or documentation.

Contents

Tables

1 Introduction

1.1 Purpose

1.1.1 The purpose of this Special Inspection Notice (SIN) is to mandate the collection of train arrival time data from automatic level crossings and return it to a central point in a specified format.

1.2 Scope

1.2.1 The SIN applies to the list of automatic level crossings now contained in the spreadsheet that was collected under the scope of NR/SIN/133.

1.3 Background

1.3.1 Following on from SIN133, this document defines the action plan for the second stage in collecting and evaluating arrival time data at automatic level crossings.

1.3.2 While it was the Motts Lane incident and a RAIB recommendation that led directly to this work, behind the recommendation was a perception that there may be significant numbers of trains arriving well beyond the designed minimum warning times at NR's other crossings. This may in turn be a factor in encouraging zig-zagging or crossing against the red lights. At present Network Rail does not know the spread of arrival times at its automatic level crossings (including MSL's), so the risk of long arrival times cannot be properly assessed. This action plan will meet that need.

1.3.3 The data generated will be used to assess the risks associated with long warning times at automatic crossings. It may lead to work being undertaken at some sites to reduce arrival times, and work to produce more technical solutions that will contribute to a much reduced range of warning times.

2 Terms and abbreviations

2.1.1 Terms and abbreviations used in this document are described in the tables below.

Term	Definition
Minimum Warning Time	The time taken from a train striking in at a level crossing and operating the warning (visual and audible) to the level crossing user, to the point when the train arrives at the crossing.
Strike-in	Point at which a train approaching a level crossing initiates the warning (visual and audible). This is usually a physical point on the railway infrastructure, such as a track circuit joint, treadle or axle counter head.
Automatic Crossing	Under normal operating, a level crossing that is automatically initiated and reset by passage of trains, not signallers, using signalling equipment and train detection.

Table 1 – Terms

Abbreviation	Description
ABCL	Automatic Half Barrier, Locally Monitored (by the train driver)
AHB	Automatic Half Barrier (not monitored in normal traffic)
AOCL	Automatic Open Level Crossing, Locally Monitored (by the train driver). For the purpose of this document, it includes the AOCR type crossing (Automatic Open Crossing, Remotely Monitored).
AOCL+B	Originally designed as an AOCL, altered to include half-barriers. There are very minor differences between an AOCL+B and an ABCL.
MSL	Miniature Stop Light crossing. For the purpose of this document, it includes the historic MWL type crossing (Miniature Warning Lights).
RACI	responsible, accountable, consulted and informed

Table 2 – Abbreviations

3 Risk Ranking

3.1.1 In accordance with NR/L2/RSK/00001, a risk ranking exercise has been completed. The review panel using the corporate risk scoring matrix has assessed the risk as follows:

- Stakeholder impact score of 3 and a Likelihood score of 4, thereby giving an overall risk score of 7.

4 Responsibilities

4.1.1 The RAM (Signalling) is responsible for arranging all actions in this SIN and for co-ordinating with Route based resources (such as Level Crossing Managers) required in collecting and interpreting the data.

5 Work planning

5.1.1 The resources required for this task shall be appointed by or on behalf of the RAM (Signalling). The task is broken down into two phases.

5.1.2 The **first phase** is collection of data, in accordance with the requirements in Section 6 The time taken by this work will be minimised if the level crossings being assessed are fitted with event loggers and remote or central monitoring. Where no fixed event logger exists, it is advisable to fit a temporary event logger, otherwise planning of this work will require an extra resource to manually record train movements.

5.1.3 The **second phase** is desk-top Interpretation and formatting of the data into the histogram (in accordance with the requirements in Section 6.1.4), and returning the data (in accordance with requirements in Section 6.1.5.)

5.1.4 The **priority** for the action plan should be in the following order of level crossing type:

a. MSL

b. AHB

c. ABCL, AOCL, AOCL+ B

6 Method of inspection

6.1.1 Collection of train warning times is required for each line, at each level crossing identified by the scope required by NR/SIN/133.

6.1.2 The sample size shall be for a minimum of seven consecutive days, and include at least 100 trains on each line.

6.1.3 Data collection may utilise timings that end when the back of the train is past the level crossing, then adjusted to take the difference in train length and position into account. It is also permitted to utilise a track circuit joint close to the crossing as the timing point for the train arriving at the crossing.

6.1.4 After collection of the basic event timings, the data shall be processed and interpreted to extract train arrival data. This shall be the time between the crossing activating as seen by the public (strike-in), and the front of the train arriving at the crossing. The data shall then be formatted as a histogram of the train arrival times.

6.1.5 The histogram output for each line at each crossing shall be put into a specific Microsoft EXCEL spreadsheet as supplied with this SIN as Appendix C. One separate spreadsheet is required for each line of each assessed crossing. The file names given to the spreadsheet files shall be formatted as follows.

[Route Code]-[Crossing name]-[ELR+Line name]-[Direction].[File extension]

Route Code (max 4 letters)	**Crossing name** (max 8 letters and numbers)	**Line name** (max 8 letters)	**Direction** (2 letters)	**File extension**
A = Anglia SE = South East WX = Wessex WN = Western WA = Wales LNWS = London North Western South LNWN = London North Western North SC = Scotland LNE = London North Eastern EM = East Midlands	The full name or as close to it, with at least the first letter at the start of this element of the name. Please make this letter combination unique for each crossing that is assessed by the Route.	ELR, plus line name, total of 8 letters. This element includes the nominated direction of the line, not the direction trains are being monitored, although they may actually be the same.	UP = Up DN = Down UD = Up and Down	xls = Excel 2003 format file xlsx = Excel 2010 format file

Table 1 – Format of MS EXCEL file name

6.1.6 The geographic detail entries required in each spreadsheet must match the data supplied by the Routes for NR/SIN/133.

6.1.7 It is not required to collect data for reverse direction approaches only used under perturbed working. To avoid skewing the results, data collected for trains running

under these conditions should be deleted from the data before operating the histogram.

6.1.8 Guidance and instruction for completing the actions is given in the text of Appendix B.

7 Progress reporting

7.1.1 Reporting of progress shall be undertaken at the following stages:

- At monthly intervals after receipt of the SIN, a simple report shall be sent indicating progress expressed as a percentage of completed EXCEL spreadsheets done against the total required.
- When all spreadsheets are completed, submission of the SINAC (Appendix A) shall show all actions are complete.

Reporting and completed spreadsheets shall be by e-mail to signalengineers@networkrail.co.uk

8 References

8.1.1 The following referenced documents are indispensable for the application of this special inspection.

a. NR/SIN/133 Version 1: “Assessment of Level Crossing Closure Times”

9 Timescales

9.1.1 The nominated resource is required to send batches of completed spreadsheets as they are completed, no more frequently than weekly and no less frequently than four-weekly. They shall be sent by E-mail to signalengineers@networkrail.co.uk.

9.1.2 On completion of the actions required, the resource delegated shall complete a SINAC form (Appendix A) for their area of responsibility. This form shall then be forwarded onto the RAM (S).

9.1.3 The RAM (S) shall examine the locally produced SINAC forms for completeness and shall generate a summation SINAC form for their Route. This shall then be forwarded by E-mail to signalengineers@networkrail.co.uk.

9.1.4 The completion date is 30th June 2015.

10 Standard Job Number

10.1.1 Should it become necessary for manual collection of data from site, ELLIPSE has a Standard Job Number set up to cover the cost. This number is 008062.

11 Contact details

11.1.1 If you have any queries about this special inspection notice, please contact Kevin Boyd, Senior Engineer, ST&E Technical Services at kevin.boyd@networkrail.co.uk or by phone on Mobile: 07920 856003.

Appendices

Appendix A – SINAC

Special Inspection Notice

Action Completion Form

NR/SIN/137

Issue 1 – 12/Jan/2014

Recording warning times for Automatic Level Crossings

Area of where action completed_____

* I confirm that the mandated actions for the above mentioned SIN have been completed.
Summary of area inspected:

_____
_____
_____
___

* I confirm that there are no actions to be carried out for the above mentioned SIN.

* Delete if not applicable

Notes (record significant findings, problems or other information here):

_____
_____
_____

Name (BLOCK CAPITALS):

_____

Signed: _____

Delivery Unit: _____

Route: _____

Date: _____

Forward this completed form to RAM (S) once all the actions for which you are responsible for have been carried out.

Appendix B – Guidelines for collecting and processing data

B.1 Quality and accuracy of data

B.1.1 Data collected should be representative of real conditions, and that includes perturbation. So long as the reason for perturbation is known, and is short in duration compared with the overall recording exercise and does not affect the vast majority of the data collected, then it is acceptable. Any perturbations should be identified if possible, and the reason recorded in the reporting area of the spreadsheet. It is preferable to record realistic times of trains, but it is anticipated that some level crossings will be subject to long term factors that increase warning times.

B.1.2 It is not necessary for train arrival times to be accurate to a fraction of a second, as long as they are consistent for each train. Analysis of the data is based on accuracy to within the nearest second.

B.2 Collection of data

B.2.1 It is anticipated that most train arrival information will come from collection and interpretation of the records in event loggers located at the crossing sites, or other means of recording events located off site. For sites without event recording, it is advisable to fit a temporary logger for a period to collect the data. If no event logger is fitted, manual recording methods will be required.

Automated Collection of Data

B.2.2 MPEC has central monitoring of many level crossing event loggers, and Technical Services has trialled automated input of data into the spreadsheet directly. If any routes wish to use this service, it will be possible to negotiate a common method of obtaining this data from MPEC, subject to funding. If the Route wishes to make use of a common facility with MPEC, please contact the author of this document at the earliest opportunity.

Manual Collection of data

B.2.3 At sites where there is no fixed event logger and a temporary one cannot be arranged, then it may be practical to time train arrivals manually.

B.2.4 At sites with Wig Wags, the timing can be done fairly accurately from the red lights initiating after the initial warning to the timer given by the Yellow lights and audible warnings starting. Then add 3 or 5 seconds as necessary to the timings recorded.

B.2.5 At MSL’s or station crossings with audible warnings, then manual timing might also be practical, but if no audible warnings exist then it will be impractical to gather reliable timings.

B.3 Recording of Warning Time

Selection of strike-in and train arrival points

B.3.1 Unless it is a single line, then strike in points usually need to be direction specific. Approach tracks, treadles, TPSR’s are good examples. HER or CON SR should not be used in isolation on multiple lines, but are acceptable for single lines as the strike-in point.

B.3.2 Train arrival points at most crossings may be a track joint or treadle near the crossing on the line concerned. Usually the train is at speed so the fact a track joint or treadle is not exactly at the crossing should not be significant. The closest function to the front of the train arriving at the crossing is preferred. If the function is beyond the crossing, then adjust the figures to remove significant skew to the results, and record any assumptions and calculations in the report.

Review of Raw Data

B.3.3 When a large number of events is gathered, it would not be unusual to get some unusual values. Inspection of other data recording these events (e.g. TRUST) will normally show if that event was a “real train” and whether the timing is correct or is non-operational in nature. If it can be ascertained it was not a “real train” then the information can be discarded.

B.3.4 If the results show a train arriving before the minimum warning time has elapsed, then this should be investigated to see if it was a “real train”. Any that appear “real” should be escalated to Operations for further action. It would not be a surprise if the exercise finds routine speeding of trains!

B.3.5 Please keep the raw data securely, so it can be examined later in more detail if necessary. The central function will be processing the histogram data, but as this does not include time stamp data it may be useful to look at the raw data to examine this information during this activity.

Preparation of the Raw Data for processing

B.3.6 After collection of the basic event timings from site, it will be necessary to interpret the data to produce a histogram of train arrival times. The range of the histogram set is 20 – 200 seconds in second intervals, with a further cell counting any trains arriving over 200 seconds. These figures collected should be entered on the second page of the spreadsheet in the column provided.

The Spreadsheets and their relationship

B.3.7 Appendix D is supplied to provide guidance for processing the raw data into the format required by the Appendix C spreadsheet. Instructions are supplied in cells coloured light green. The output of this is the data that may be imported on to the Calc tab on the Appendix D spreadsheet, which then automatically creates the graphs on the Graph tab.

B.4 Summary of design requirements for minimum arrival times

B.4.1 The EXCEL spreadsheet has an entry for the minimum arrival time of the crossing. The designed minimum arrival times were defined in the NR/SIN/133 EXCEL spreadsheet. If these were not correct, use the corrected one for this SIN. Below is guide for the times in the design requirements, but you should use the times for the level crossing if they are different.

B.4.2 For an AHB, this is usually 27 seconds plus any extra added for the length of the crossing. (One second for every 3m over 15m.) Where a strike-in track is positioned at 29 seconds from the crossing, this is generally to give two seconds response time for the relays and the minimum arrival time is still 27 seconds. Enter the corrected minimum arrival time in the spreadsheet after removing any response time.

B.4.3 MSL crossings have a designed minimum warning time depending on the traffic and situation. 20, 30 or 40 seconds has often been used. Where it is unclear what

the minimum designed arrival time was, the timing for the physical strike-in point at line speed should be used.

B.4.4 AOCL, AOCL+B and ABCL are not required to have a specific minimum arrival times by current standards. However, in the era in which most were designed, 27 seconds was used. Please use this value as default unless it is known another value was used. Design rules for AOCL & ABCL mean arrival times are crossing speed sensitive. Even a modern design of ABCL with crossing speed of 55mph, cannot be approached in less than 35 seconds from the crossing activating.

Appendix C – Graph, Calcs and Commentary Spreadsheet

C.1 General Guidance

C.1.1 The Appendix C spreadsheet represents the formal record of train warning time data as required by this Special Inspection Notice.

C.1.2 There are two main components to this spreadsheet that require manual input:

(i) "Calcs" tab – input the results from the "Histogram Operations" exercise defined in Appendix D. This is further detailed in Section C.2.

(ii) "Notes" tab – geographic notes, some of which were defined in the results from NR/SIN/133. This is detailed further in Section C.3.

C.2 Instructions for filling in the manual data detail

C.2.1 The data generated by the Histogram Operations spreadsheet (Appendix D) consists of a series of totals of trains arriving at the assessed level crossing between 20 and 200 seconds inclusive. Copy this data into the "Calcs" tab on the Graph, Calcs and Commentary spreadsheet, column B.

C.2.2 On the "Calcs" tab, enter the designed minimum warning time in the box highlighted yellow (grid reference B192). This will then copy into another area of the "Calcs" tab and sets up the minimum warning time line on the "Graph" spreadsheet.

C.3 Recording Notes in the Spreadsheet

C.3.1 Guidance and instruction within this section refers to the "Commentary" tab within the spreadsheet.

C.3.2 The notes boxes should be used for items of local knowledge, especially the items suggested below.

C.3.3 It is suggested that if more than one peak occurs in the histogram figures, and it can be identified that they represent different classes of train, or that stopping/ non-stopping trains are recorded, then that information be recorded in the notes.

C.3.4 If complications such as signal regulation exist, then the distance of the signal from the crossing and the signal regulation timer value, are recorded in the notes.

C.3.5 Enter the crossing speed (in miles per hour) and the designed warning time (in seconds) of the existing physical strike-in point into the notes. Note that at AOCL, AOCL + B and ABCL, the arrival timings will usually be well above the designed minimum that was used as the design minimum at the time.

C.4 Recording details on the Graph Tab

C.4.1 These instructions refer to the "Graph" tab within the spreadsheet.

C.4.2 There are four boxes at the top of the worksheet. These should match the detail provided by the return provided for NR/SIN/133. The four boxes are:

(i) Site name – equals the name of the level crossing. Entering this detail will copy into the Notes tab.

(ii) Line Name – equals the name of the line, inclusive of its direction. There is another field where this value is required to give detail of which direction the data applies.

(iii) Direction – defines the direction that trains approach the level crossing. Normally this is restricted to either Up or Down, except for single and bi-directional lines where all trains are monitored in both Up and Down.

(iv) Crossing Type. The value inserted here should match the NR/SIN/133 entry unless this is incorrect.

C.4.3 When the operation in Section C.2 is complete, the two graphs on this tab will automatically complete. The red line represents train arrival data, the green line indicates the designed minimum warning time.

C.4.4 It is now necessary to analyse the graphs, and investigate any patterns that appear. It is particularly useful to know what is causing any distinct peaks, as described elsewhere in this document. The outcome of the analysis should be summarised in the “notes” tab.

C.4.5 Once all the notes text is complete, and the graph is drawn, the spreadsheet is ready to return as required in the reporting process.

Appendix D – Histogram Operations Spreadsheet

D.1 Guidance for operation

D.1.1 Instructions for using this spreadsheet are included within it, inside a series of cells coloured light green.

D.1.2 Output from the Appendix D Spreadsheet column G should be copied into Appendix C “Calcs” tab column B.

Issue record

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