



Rail Accident Investigation Branch

Rail Accident Report



Dangerous occurrence at Lindridge Farm user worked crossing, near Bagworth, Leicestershire 22 March 2012

Report 11/2013
July 2013

This investigation was carried out in accordance with:

- the Railway Safety Directive 2004/49/EC;
- the Railways and Transport Safety Act 2003; and
- the Railways (Accident Investigation and Reporting) Regulations 2005.

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This report is published by the Rail Accident Investigation Branch, Department for Transport.

Dangerous occurrence at Lindridge Farm user worked crossing, near Bagworth, Leicestershire, 22 March 2012

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Summary

At about 07:38 hrs on 22 March 2012, a motorist used the telephone at Lindridge Farm user worked crossing, near Bagworth in Leicestershire, to ask the signaller at Network Rail's East Midlands Control Centre for authorisation to cross the railway. The signaller checked the indications on his workstation, observed that a train had already passed over the crossing, and gave permission to cross. The motorist opened the near gate, crossed the railway line on foot, and while opening the far gate saw a train approaching. The motorist called the signaller back to report what had happened.

The immediate cause of the incident was that the signaller believed the train had already passed the level crossing when he gave the motorist permission to cross because his workstation view showed the level crossing in the wrong place. This error had been present on the workstation view from the time it was commissioned on 3 January 2012 as part of a project to transfer control of the railway from Leicester signal box to the East Midlands Control Centre.

This project had redrawn a signalling plan for the Leicester area and introduced an error; a track circuit was incorrectly named. This error was not noticed and was copied into a scheme plan, which was subsequently used to check the design of the signaller's workstation views. During these design checks, the level crossing was moved to the wrong track section on the view, so that it corresponded with the error on the scheme plan. The error on the view was not identified during testing so the signaller's workstation was commissioned with the level crossing shown in the wrong place.

The RAIB also observes: the signaller did not report the incident straight away; the workstation had been commissioned with two other user worked crossings shown in the wrong place; and the other two level crossings had also previously been shown in the wrong place on the signaller's panel at Leicester signal box prior to the transfer of control to the EMCC.

The RAIB has made five recommendations, all directed at Network Rail. These cover the management of signalling source records needed for a re-control project, ways of reducing the likelihood of errors on signalling or scheme plans, correlating new signalling displays to the existing display, improving the management of deferred test logs, and better controls for installing telephones at level crossings. The RAIB also identified a learning point for the railway industry, about the importance of immediately reporting allegations of incidents that are received from members of the public.

Introduction

Preface

- 1 The purpose of a Rail Accident Investigation Branch (RAIB) investigation is to improve railway safety by preventing future railway accidents or by mitigating their consequences. It is not the purpose of such an investigation to establish blame or liability.
- 2 Accordingly, it is inappropriate that RAIB reports should be used to assign fault or blame, or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.
- 3 The RAIB's investigation (including its scope, methods, conclusions and recommendations) is independent of all other investigations, including those carried out by the safety authority or railway industry.

Key definitions

- 4 All dimensions in this report are given in metric units, except speed and locations which are given in imperial units, in accordance with normal railway practice. Where appropriate the equivalent metric value is also given.
- 5 The report contains abbreviations and technical terms (shown in *italics* the first time they appear in the report). These are explained in appendices A and B.

The incident

Summary of the incident

- 6 At about 07:38 hrs on 22 March 2012, a motorist used the telephone at Lindridge Farm *user worked crossing*, near Bagworth in Leicestershire (figures 1 and 2), to ask the signaller at Network Rail's East Midlands Control Centre (EMCC) for authorisation to cross a single railway line. At this level crossing, users in a vehicle must always call the signaller to get permission to cross.

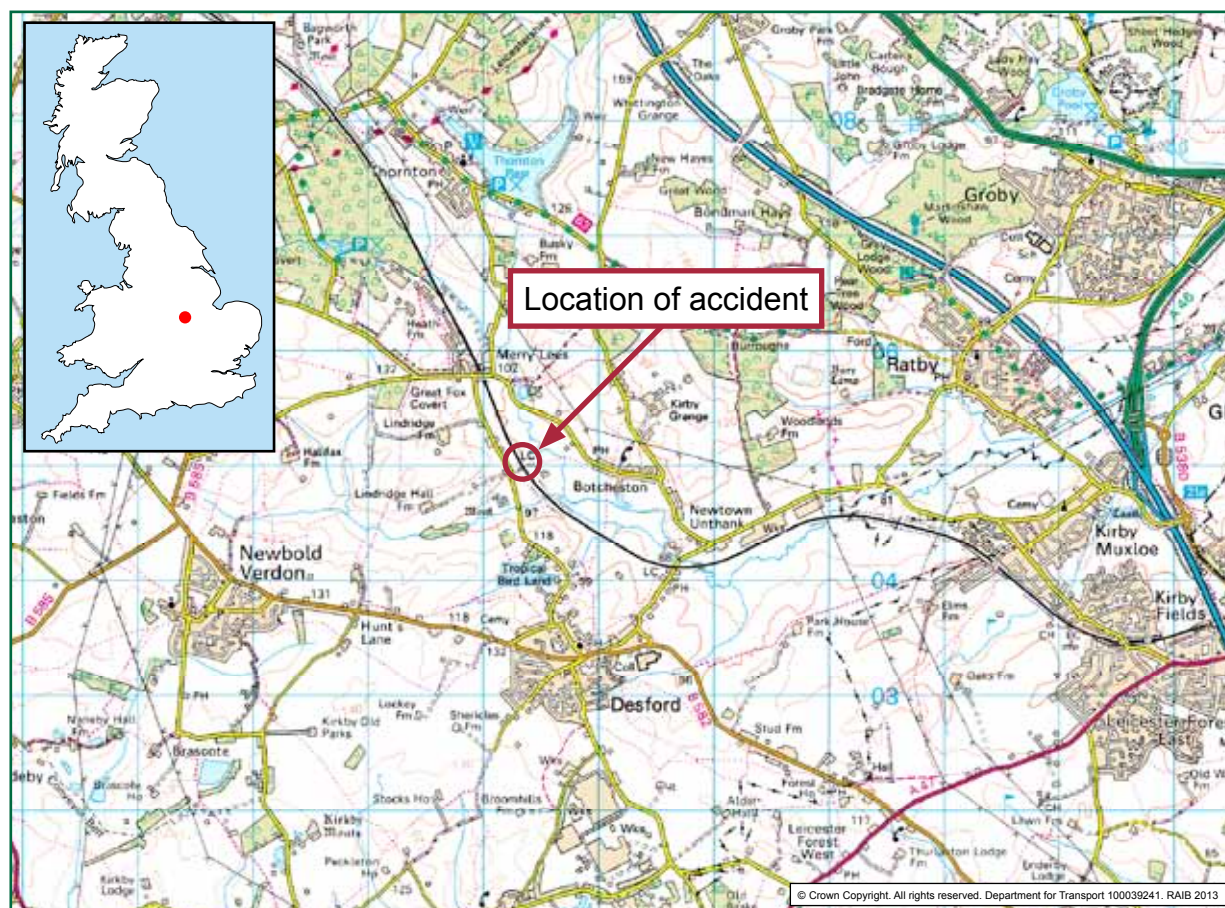


Figure 1: Extract from Ordnance Survey map showing location of incident

- 7 The signaller checked the indications shown on one of the *views* on the Leicester *workstation* in the EMCC, observed that a train appeared to have already passed over the crossing, and gave permission to cross. The motorist opened the near gate, crossed the railway line on foot, and while opening the far gate saw a train approaching. The motorist called the signaller back to say what had happened.
- 8 The motorist returned to the crossing later that morning and spoke to a different signaller. After being given permission to cross, the motorist complained about what had happened earlier. The complaint was passed to the Signaller Shift Manager who initiated Network Rail's investigation.



Figure 2: Google Earth view of the location where the incident happened

Context

Location

- 9 Lindridge Farm user worked crossing is located at 105 miles 64 *chains*, from a zero reference at London St Pancras station, and crosses a single track railway which is referred to as the Up & Down Burton line (figure 3). This line, on which trains run in both directions, goes from Knighton Junction, which is about 1.5 miles (2.4 km) south of Leicester station, to Bagworth Junction at 109 miles 74 chains where it becomes a double track railway. After Bagworth Junction, the railway continues through to Coalville and on to Birmingham Curve Junction where it joins the Derby to Birmingham line just south of Burton on Trent.
- 10 At the crossing, the *permitted speed* for trains in both directions is 20 mph (32 km/h). Only freight trains operate over this line, with the majority of these serving either Bardon Hill Quarry or Cliffe Hill Stud Farm Quarry.
- 11 The signalling in the vicinity of the crossing is *track circuit block* with *colour light signals*, controlled from the EMCC.

Organisations involved

- 12 Network Rail owns, operates and maintains the infrastructure, including the crossing, and employs the signaller. DB Schenker operated the train.

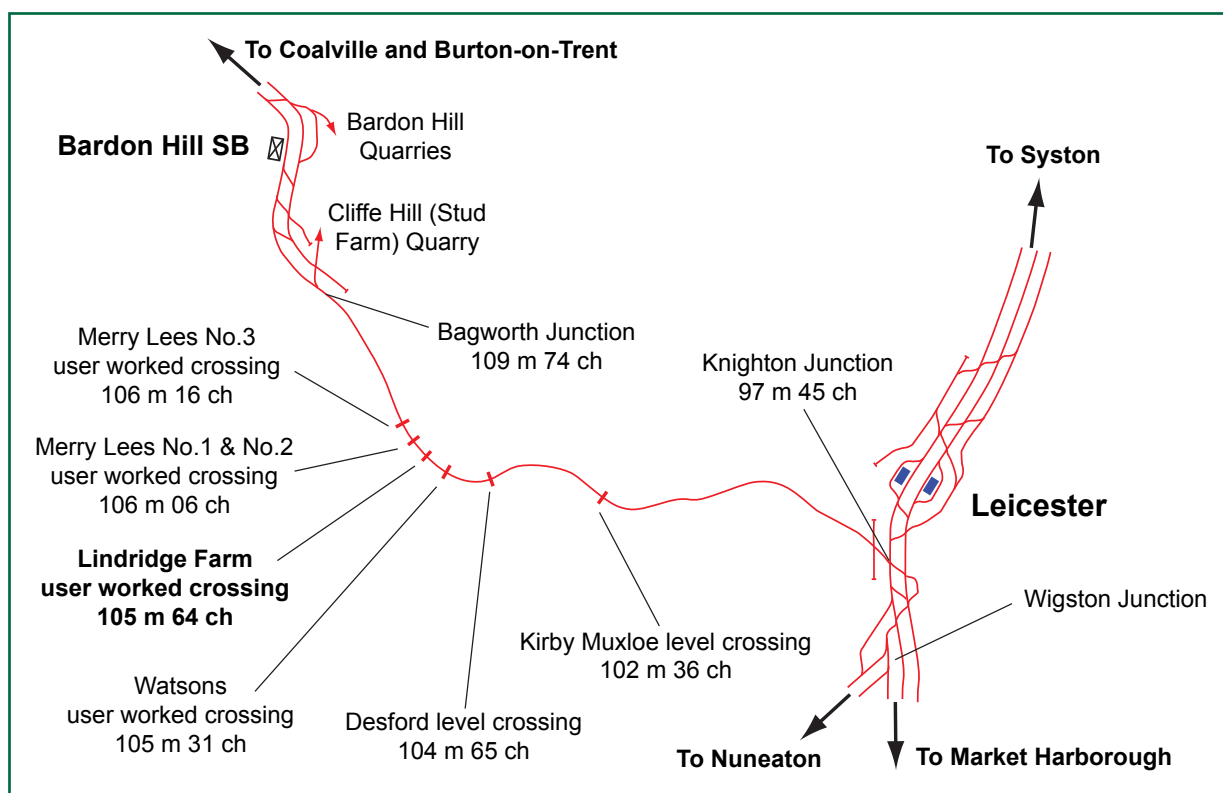


Figure 3: The railway lines in the vicinity of Lindridge Farm user worked crossing

- 13 Network Rail Infrastructure Projects managed the East Midlands Signalling Renewals (EMSR) project which provided the signaller's workstation in the EMCC. It contracted Invensys Rail to carry out the signalling works to design, install and commission the workstation. It commissioned the Network Rail Signalling Design Group (SDG) to produce *signalling plans* and *scheme plans* which show the position of equipment and infrastructure along the railway in this area.
- 14 Network Rail, Invensys Rail and DB Schenker freely co-operated with the investigation.

Train involved

- 15 The freight train that approached the crossing was train number 6Z75, the 07:05 hrs service from Cliffe Hill Stud Farm Quarry to Hothfield Siding (which is near Ashford, Kent).

Rail equipment / systems involved

Lindridge Farm user worked crossing

- 16 At this crossing the railway intersects a private road, which gives access to and from a dwelling and some farm buildings. The approach to the crossing taken by the motorist is shown in figure 4.
- 17 The crossing is fitted with a telephone on each side to provide a direct connection to the signaller on the Leicester workstation at the EMCC. Signs at the crossing (figure 4) require all vehicle users to stop and call the signaller to get permission to cross. Once the signaller has given permission, a vehicle user must open a five bar metal gate on each side, drive their vehicle over the crossing and then close both gates. A separate gate is provided on each side for pedestrians, who are not required to call the signaller before crossing.



Figure 4: The approach to Lindridge Farm user worked crossing and its signage

18 The crossing is located on a curve in the railway (figure 5). The motorist approached from the inside of the curve. From the gate on this side, in clear conditions and in daylight, trains approaching from the right (from the Bagworth Junction direction) can be seen about 250 metres from the crossing, while trains approaching from the left (from the Knighton Junction direction) can be seen from about 230 metres away.



Figure 5: The view of approaching trains in both directions from the gate on the side of the crossing that the motorist approached

Signaller workstations at the East Midlands Control Centre

- 19 The EMCC is a large *signalling control centre* located in Derby. It controls parts of Network Rail's East Midlands route, which extends from London St Pancras station to Sheffield, and includes Leicester, Derby and Nottingham stations plus a number of secondary lines that branch off the main line.
- 20 The EMCC opened in 2008 and since then its area of control has increased as part of a phased transfer of control from the existing signal boxes on the East Midlands route by Network Rail's EMSR project. Control of the incident area's signalling was transferred from Leicester signal box to the EMCC on 3 January 2012.
- 21 At the time of the incident, six signaller's workstations were housed in one large room in the EMCC, known as the operating floor. One signaller operates each workstation and there is also a supervisor's workstation which is manned by a Signaller Shift Manager. The manager supervises the signallers and assists with the management of out-of-course events.
- 22 Each workstation has several flat screen visual display units (VDUs) onto which the track layout and the position of trains is displayed using a series of views. The signaller monitors the trains and operates the equipment to set *routes* and operate *points* etc using a trackerball, buttons and a keyboard (figure 6). Each workstation also includes equipment for communicating with a train driver by radio, a touch screen telephone system, a facility to place all signals in the workstation's control area back to red, and two additional VDUs for displaying running information for trains outside the workstation's area of control.

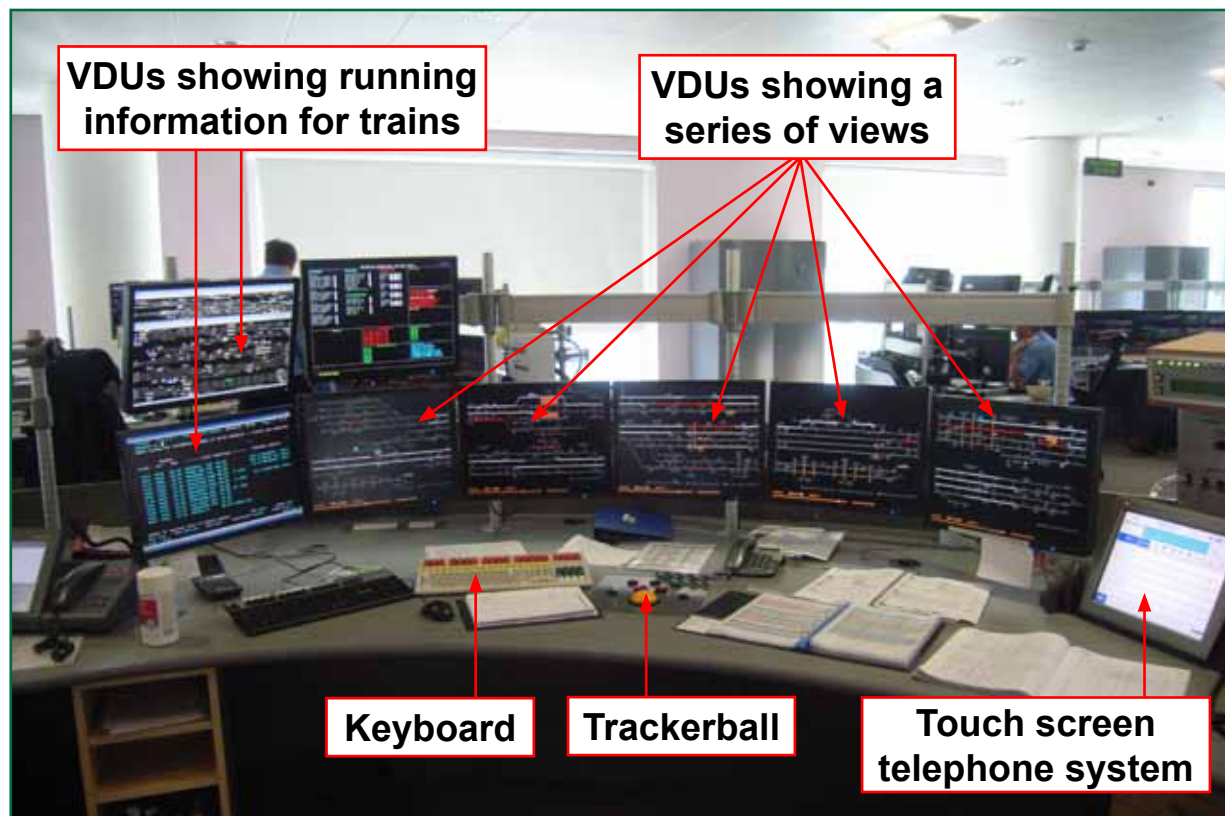


Figure 6: The Leicester workstation at East Midlands Control Centre

- 23 The Leicester workstation covered the area from Knighton Junction in the south to Loughborough in the north. This included the freight line from Knighton Junction, on which Lindridge Farm user worked crossing is located, as far as Bagworth Junction (figure 3).

Individuals involved

- 24 The motorist involved is listed by Network Rail as an *authorised user* of the crossing and had used the crossing almost every day for over 20 years.
- 25 The Network Rail signaller who answered the telephone and gave the motorist permission to cross was based at the EMCC. He had eight years experience as a signaller, and had been operating signaller workstations at the EMCC since September 2008. During this time he had been subject to Network Rail's competence management system, which features six-monthly assessments. On 22 December 2011 he was assessed as competent to operate the Leicester workstation. At the time of the incident, the signaller was answering telephone calls while another signaller sat alongside him operating the workstation to gain practical experience of controlling the Leicester workstation area.
- 26 Of those people who participated in the EMSR project to transfer control of the signalling from Leicester signal box to the EMCC, the ones particularly involved in this incident were:
- The Designated Project Engineer who worked for Network Rail Infrastructure Projects and had overall responsibility for the co-ordination of technical and engineering aspects of the project. He had seven years experience in delivering this type of project work and held an engineering manager *licence* from the *Institution of Railway Signal Engineers* (IRSE).
 - The designer and checker who were employed by Network Rail SDG and were responsible for producing the signalling plans and scheme plans for the EMSR project. Both held the relevant signalling designer and signalling design verifier licences from the IRSE as required by Network Rail to do this type of work.
 - The staff employed by Invensys Rail who produced, checked and tested the Leicester workstation. Each held the relevant IRSE licences required by Network Rail for the activities they carried out.

External circumstances

- 27 It was light at the time of the incident. The local weather conditions that morning were dry and clear.

Events preceding the incident

- 28 Early in the morning of 22 March, train 6Z75 was prepared at Cliffe Hill Stud Farm Quarry for its journey to Kent. It departed from the quarry sidings and at 07:27 hrs, the signaller on the Leicester workstation at the EMCC gave the signaller at Bardon Hill signal box permission to set the route onto the single line at Bagworth Junction towards Knighton Junction. Train 6Z75 passed Bagworth Junction at 07:29 hrs and at 07:32:53 hrs it occupied *track section* T511 (figure 7).

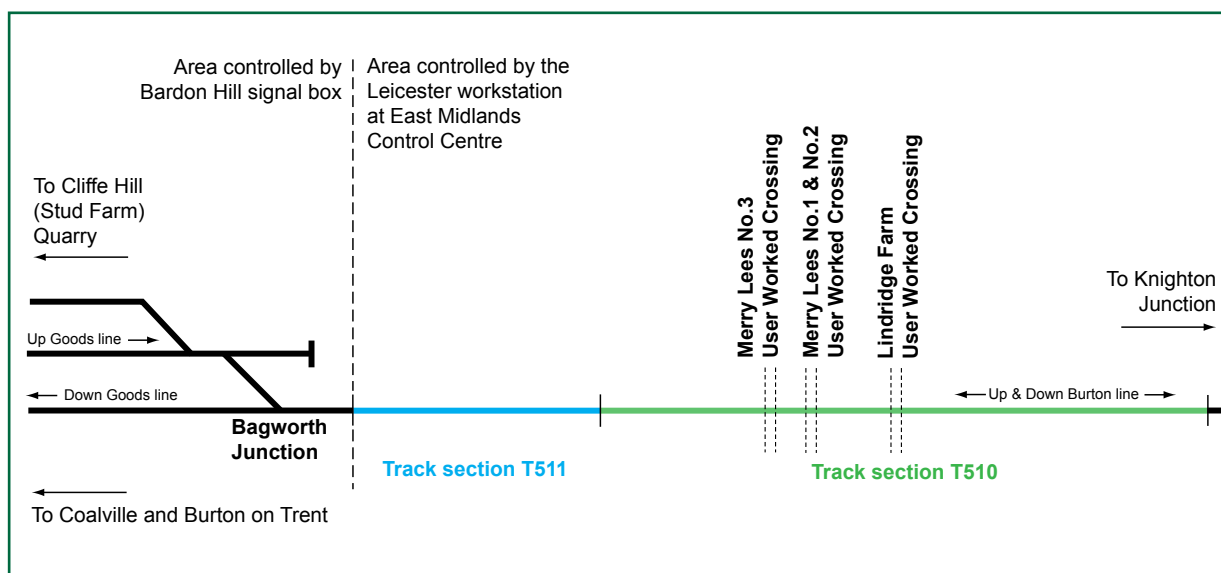


Figure 7: The track layout on the Up and Down line in the vicinity of Lindridge Farm user worked crossing showing the extent of track sections T511 and T510

- 29 At 07:37:25 hrs, the train occupied track section T510 and at 07:37:43 hrs track section T511 became unoccupied as the rear of the train moved clear of it. At about this time, the motorist arrived at Lindridge Farm crossing and picked up the telephone at the crossing to call the signaller to ask for permission to cross. The signaller answered the telephone call at 07:37:57 hrs.

Events during the incident

- 30 The conversation between the motorist and the signaller was recorded, as are all telephone calls to and from the signaller's workstation. At the start of the conversation the motorist asked the signaller for permission to cross. Initially the signaller asked the motorist whether a freight train had passed and the motorist answered no. After 16 seconds of silence while he checked his workstation views, the signaller queried what vehicle type the motorist wanted to cross in. The motorist replied that she was crossing in a car and at 07:38:30 hrs the signaller gave his permission to cross and the call was ended.
- 31 The signaller then took another telephone call which lasted for 24 seconds. The motorist stated that during this time she opened the near gate, crossed the railway on foot and opened the far gate. The motorist then saw a train approaching the crossing and called the signaller at 07:39:02 hrs from the telephone on the far side. The motorist told the signaller that she could see a train approaching and that she would have been in a very dangerous situation if she had followed his advice and crossed in her car. The signaller expressed his surprise and explained that his display was showing that the train had already passed the crossing. During their conversation, at 07:39:24 hrs, the train arrived at the crossing. The motorist then ended the call at 07:39:34 hrs.

Events following the incident

- 32 Once the train had passed, the motorist crossed in her car and closed both gates. At 07:42:35 hrs track section T510 became clear as the train continued towards Knighton Junction, where it arrived at 07:55 hrs. The train driver did not report seeing the motorist or the open gates.
- 33 At 08:56 hrs the motorist returned to the crossing and again used the telephone to obtain permission to cross. The other signaller working on the Leicester workstation answered this time, and after checking it was safe to do so, gave the motorist permission to cross. The motorist then complained to him about what had happened earlier and the complaint was passed to the Signaller Shift Manager.
- 34 The Signaller Shift Manager called the motorist to obtain further details about what had happened and initiated an investigation. The signaller who gave the motorist permission to cross at 07:38 hrs was relieved of duty and took a drugs and alcohol test, as is routine after an incident is reported. The results of these tests were clear.
- 35 Network Rail's technical and operations staff investigated and by 10:30 hrs they had found that Lindridge Farm user worked crossing and also Merry Lees No.1 & No.2 and Merry Lees No.3 user worked crossings were all shown in the wrong place on the signaller's workstation view. They identified that these crossings were shown on track section T511 when they should have been shown on track section T510 (figure 8).

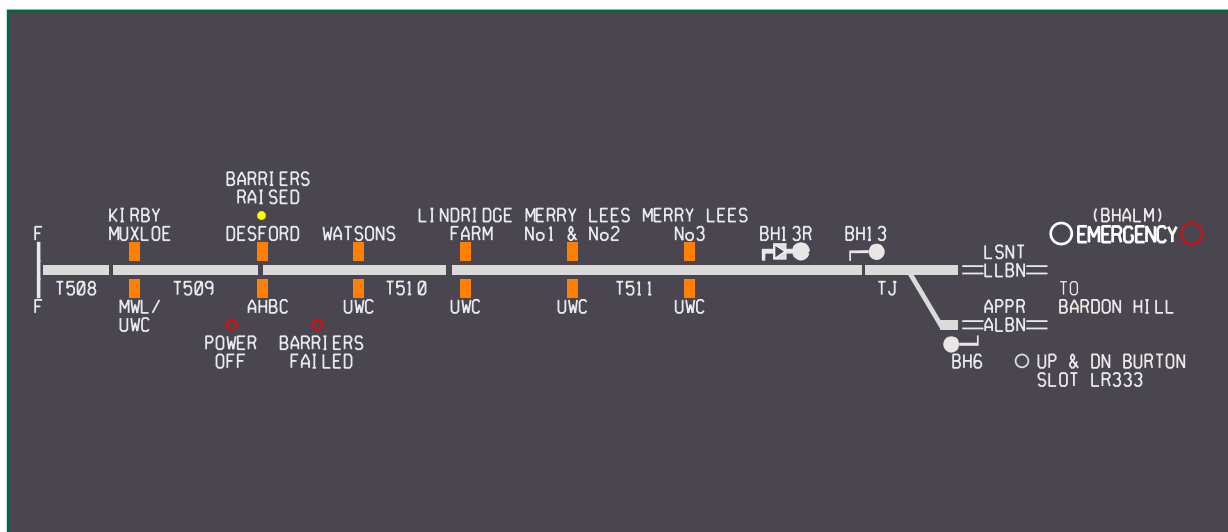


Figure 8: Track sections T510 and T511 as displayed on the Leicester workstation view at EMCC before the incident

- 36 Network Rail's *Local Operations Manager* at the EMCC prepared and issued a special instruction to the signallers. This required signallers to check that both track sections T510 and T511 were unoccupied before giving a user permission to cross Lindridge Farm, Merry Lees No.1 & No.2 or Merry Lees No.3 user worked crossings. The signallers who were on duty were briefed and signed to say they understood the new instruction.

37 Invensys Rail was informed that day and design staff changed the workstation view to correct the problem (figure 9). They tested the change, and staff travelled to the EMCC later that afternoon and installed the updated view on the Leicester workstation.

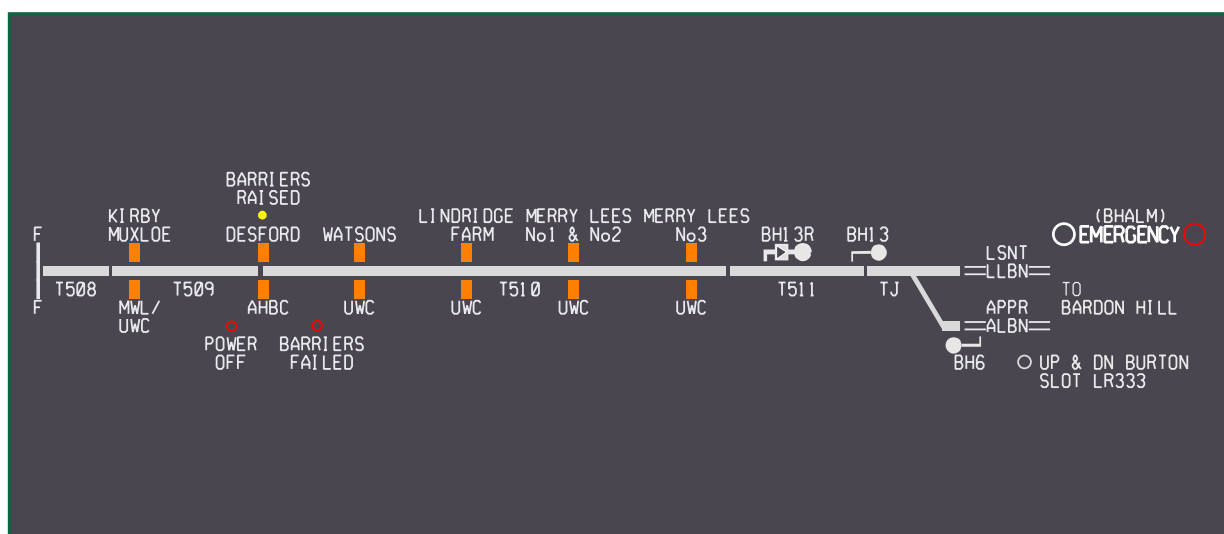


Figure 9: Track sections T510 and T511 as displayed on the Leicester workstation view at EMCC after being changed following the incident

The investigation

Sources of evidence

38 The following sources of evidence were used:

- witness statements;
- site photographs and measurements;
- Network Rail project documents for the EMSR project;
- Invensys Rail project documents, including signalling design and testing records, for the EMSR project;
- records for the work by Network Rail SDG;
- information related to the safety verification activities undertaken for the EMSR project;
- details of the incident as logged by Network Rail's staff working in the EMCC;
- voice recordings of telephone calls to and from the Leicester workstation;
- information about signals, *track circuits* and points recorded by the Leicester workstation equipment;
- Network Rail company standards and Railway Group standards;
- weather reports and observations at nearby weather stations;
- a review of previous reported occurrences at the crossing (none of which transpired to be relevant to this incident); and
- a review of previous RAIB investigations that might have had relevance to this incident.

Key facts and analysis

Background information

The GRIP process

- 39 Network Rail manages and controls the projects that renew or enhance its infrastructure through the Governance for Railway Investment Project (GRIP) process. Network Rail has defined this process to minimise and mitigate the risks associated with delivering projects and it is documented in company standard NR/L1/INI/PM/GRP/100, 'GRIP Policy Standard'.
- 40 GRIP is divided into eight stages, with each stage providing a set of project deliverables. The stages are shown in table 1.

GRIP Stage	Description
1	Output definition
2	Feasibility
3	Option selection
4	Single option development
5	Detailed design
6	Construction test and commission
7	Scheme hand back
8	Project close out

Table 1: The GRIP stages

- 41 The principle underlying GRIP is that deliverables from one stage are used as the input for the next. Network Rail will hold formal reviews at different stages within the project lifecycle to gain assurance that the project can successfully progress to the next stage. The GRIP stages that are most relevant to this incident are stages 4, 5 and 6.

Correlation of signalling records

- 42 Network Rail requires the records for its signalling, including documents such as signalling plans, to accurately reflect the equipment and wiring they represent. However, it is possible for the records not to match the physical equipment or wiring on site for a number of reasons such as:
- records for the signalling equipment or wiring were not adequately controlled when the original design, installation and commissioning activities took place;
 - the equipment on site was altered at some point without the corresponding master records being updated;
 - works were carried out in a different order from that for which the changes were designed; and
 - equipment or wiring is present on site but not shown on the master records, because equipment or wiring was installed but never commissioned or made redundant by changes but not removed.

- 43 Network Rail has a process known as *correlation* to check that records match the actual equipment and wiring at the site they represent. Network Rail requires that all projects must carry out a correlation of signalling records before the start of any design work which will alter the existing signalling system. This means that any discrepancies between the records and equipment are addressed in updated records before the project begins designing its changes to the signalling. This requirement is stated in Network Rail company standard NR/L2/SIG/11201 Mod A7, 'Signalling Design: Module A7 – Correlation of Signalling Records'. This standard also describes the process to be followed when correlating signalling records, who can do this work and the circumstances in which a project can ask the Route Asset Manager responsible for signalling for correlation to be waived.

The East Midlands Signalling Renewals (EMSR) project

- 44 Network Rail's EMSR project is an ongoing series of 13 signalling projects to progressively replace signalling equipment on the East Midlands route between London St Pancras and Sheffield and also on a number of secondary routes. The order in which the projects were to be carried out was driven by the condition of the existing signalling equipment. The EMCC was built by the project to control all of the replaced signalling equipment.
- 45 Part 5 of the project was relevant to this incident and comprised two concurrent stages:
- stage 1 was the transfer of control of the railway from Leicester and Croft signal boxes to the EMCC, which happened from June 2010 to the start of January 2012; and
 - stage 2 was the renewal of the *interlocking* for the signalling in the Leicester station area, which happened from June 2010 to March 2013.

Appendix C provides a timeline of the key events for part 5 of the EMSR project which are relevant to this incident.

- 46 The EMSR project contracted with Invensys Rail to deliver stage 1 of part 5. The scope of stage 1 was the *re-control* of eight *relay interlockings* controlled by Leicester signal box (figure 10) and the area covered by the *solid state interlocking* controlled by Croft signal box (between Leicester and Nuneaton). To control these interlockings, two new signaller workstations were installed at the EMCC: the Leicester workstation (with Lindridge Farm user worked crossing shown on it) and the Kettering workstation. These workstations came into use on 3 January 2012.
- 47 At the same time as the control of the signalling was moved, the telephones and controls for the level crossings that were connected to Leicester and Croft signal boxes were also transferred to the two new workstations at the EMCC.
- 48 For stage 2 of part 5, the EMSR project commissioned Network Rail SDG to carry out the early stages of the design work (GRIP stages 1 to 4), which included the production of an up-to-date signalling plan for the interlocking at Leicester. The deliverables from this work were passed to Invensys Rail as it was contracted to deliver the later stages (GRIP stages 5 to 8) which included the detailed design, installation and commissioning of the new interlocking. Different organisations are often used on a project, as in this case, to ensure each stage is delivered by an organisation with the relevant capabilities.

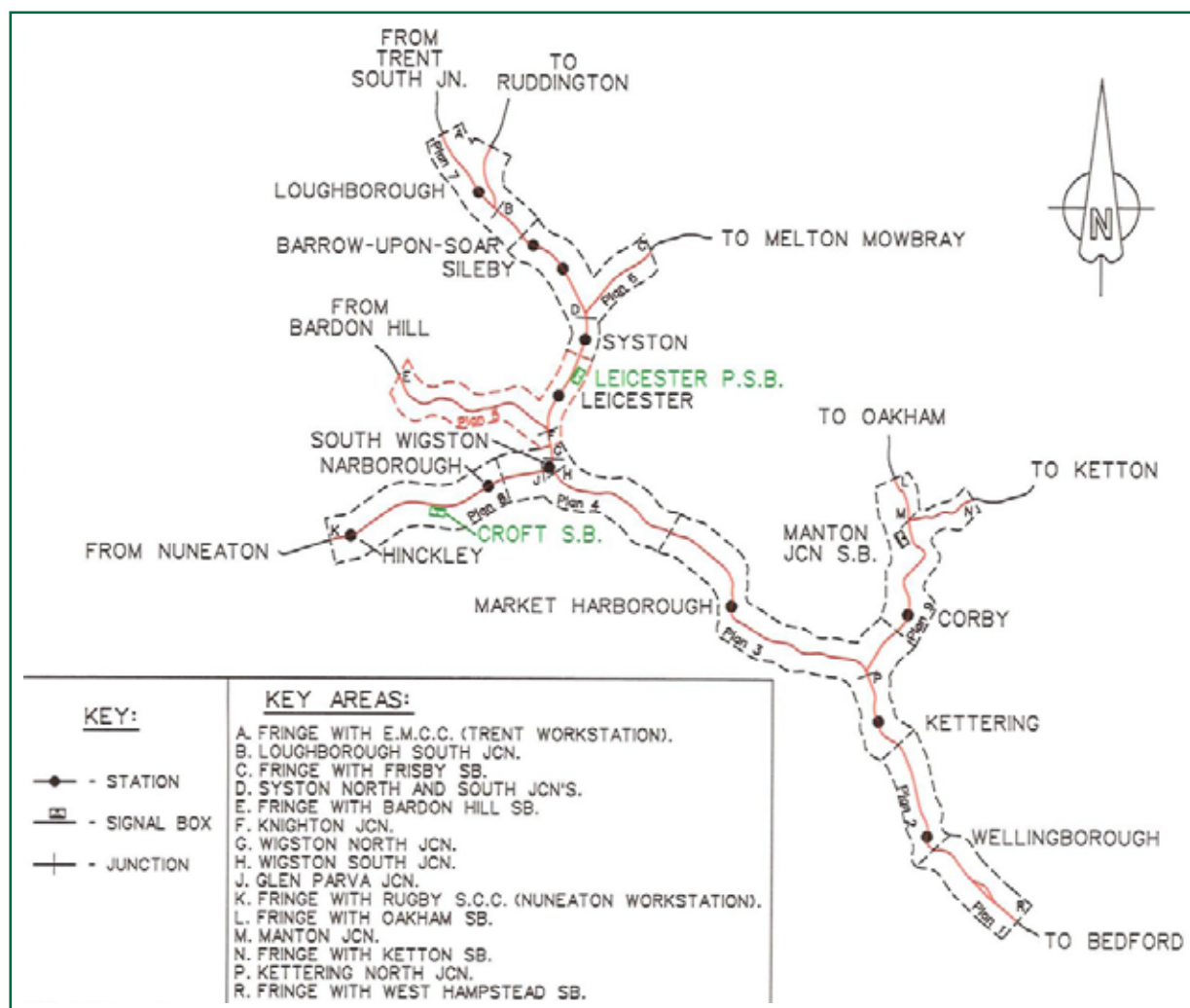


Figure 10: Area that was controlled by Leicester signal box

Minor Scheme Plan Review Panel

49 Network Rail company standard NR/L2/SIG/30035, 'Signalling Scheme Plan Approval Process', mandates that all scheme plans produced for works on Network Rail infrastructure must be approved by either a Major or Minor Scheme Review Panel. At the start of stage 1, Network Rail's Head of Signal Engineering delegated the authority to approve the scheme plans for this stage to the chair of the Minor Scheme Review Panel as the changes being made were minor. The role of the Minor Scheme Review Panel was to carry out an end-to-end review of the scheme plans, concentrating on the consistent application of standards and policy. The Panel was also tasked with reviewing supporting documentation, to verify that the correct processes, as defined in Network Rail's standards, had been followed when producing the scheme plans.

Safety verification under the Railways and Other Guided Transport Systems (Safety) Regulations 2006 (ROGS)

50 The Railways and Other Guided Transport Systems (Safety) Regulations 2006 (referred to as ROGS) implement European Railway Safety Directive (2004/49/EC), the aim of which is to establish a common approach to railway safety. These regulations have since been amended by the Railways and Other Guided Transport Systems (Safety) (Amendment) Regulations 2011.

- 51 At the time part 5 of the EMSR project was being delivered, safety verification was a requirement of ROGS. It was a process operators were required to follow when introducing new, or altering existing, vehicles or infrastructure. The process that Network Rail followed for safety verification was defined in company standard NR/L2/RSE/100/02, 'Safety Verification'.
- 52 Network Rail's process required that first of all the project categorised the risk associated with its work. There were five categories, designated level 0 to 4 (with 4 being the highest risk), and the project team responsible for the re-control of Leicester signal box proposed that its work was a category 2 project. The project team saw its work as a complex renewal that could introduce new or increased safety risks that had the potential to be significant, because it was the first time control had been transferred from a large signal box the size of Leicester in one go (previous re-control projects had transferred control of such a large signal box in stages).
- 53 The project team then registered its work with *Network Rail's Acceptance Panel* (NRAP), along with its proposed category, to establish whether or not a Competent Independent Person¹ (CIP) was needed to carry out safety verification. NRAP agreed that it was a category 2 project so safety verification by a CIP was required. NRAP appointed a CIP from within Network Rail and his remit was to ensure the project had identified all relevant risks arising from the changes being implemented and that these risks had been mitigated so far as was reasonably practicable. The CIP also had to determine who the risk had the ability to adversely affect.
- 54 The CIP assessed the risk through two safety verification reviews. For each review the CIP followed a check-list approach and the project team provided documents to demonstrate compliance. The CIP conducted an interim review once the project's chosen option for re-controlling Leicester had been developed and was ready for implementing. The CIP conducted a second review before the new signalling equipment entered into service. The certificate issued by the CIP after this review was the Entry Into Service Certificate. Network Rail's procedures specified that this certificate was needed before commissioning of the new or changed equipment could begin.

Identification of the immediate cause²

55 The immediate cause of the incident was that the signaller believed that train 6Z75 had already passed Lindridge Farm user worked crossing when he gave the motorist permission to cross, because his workstation view showed the level crossing on track section T511 and the train on track section T510.

56 When the Leicester workstation was commissioned, it included an error on one of its views. This showed Lindridge Farm user worked crossing on track section T511 (figure 8) when it should have been shown on track section T510 (figure 9).

¹ NR/L2/RSE/100/02 defines the competencies that a Competent Independent Person must have and requires all Competent Independent Persons to be accredited by NRAP. NR/L2/RSE/100/02 also explains that for some projects, the Competent Independent Person may be assisted by a project safety verification group. The group is chaired by the Competent Independent Person and may include relevant engineers and specialists from each affected discipline and from maintenance and operations as applicable.

² The condition, event or behaviour that directly resulted in the occurrence.

Identification of causal³ and underlying⁴ factors

- 57 The error on the Leicester workstation view was introduced during the process for designing and reviewing the views and was not identified when the workstation was tested before it was commissioned.
- 58 The sequence of events that led to the incident occurring is shown in figure 11. Each of these events and the factors associated with them are now considered in turn.

Signalling source records for the Leicester interlocking area

59 Signalling source records held by *National Records Group* for the Leicester interlocking area, such as the signalling plan, had not been kept up to date when the infrastructure was changed. This is an underlying factor.

- 60 The signalling plan for the Leicester area that was held by National Records Group was produced in 1984 and last amended in 1988. Over time, British Rail and Railtrack had made changes to the infrastructure but the signalling records had not been updated in line with these changes. For example, when telephones were fitted to user worked crossings, the Leicester signalling plan should have been updated to show these changes. However, as figure 12 shows, although telephones were fitted to Lindridge Farm user worked crossing, this change was not shown on the signalling plan held by National Records Group.
- 61 In the past, when minor changes were made to the infrastructure, the local records held by the maintainer were often marked up with the changes but the master records were not updated. In 1997 Railtrack took steps to reduce the likelihood of changes being made to signalling infrastructure and not being shown in the corresponding master records by issuing a series of standards to improve the management of its signalling records. These standards required that once the person making the change knew that the corresponding infrastructure record was deficient, a form available from Railtrack Records Group (now National Records Group) had to be completed and sent to the holder of the record for inclusion in a *deficiency register*. This requirement can now be found in Network Rail company standard NR/L2/INF/02018, 'Specification for the Management of Safety Related Infrastructure Records'.
- 62 There were 16 entries in the deficiency register covering the Leicester control area, plus another 19 entries for locations adjacent to it. The earliest entries dated back to 1997, corresponding to when Railtrack introduced its standards for signalling records. Of these, 21 entries were added to the register on 31 March 2007, following an investigation into the state of the records at the time they were being transferred to the EMSR project. Only one of these new entries referenced a discrepancy on a signalling plan (for Kettering). All of the other entries referred to discrepancies found in a range of drawings, diagrams, schematics and plans: these were records that were missing, out of date, obsolete or contained known inaccuracies. The proposed action in most cases was to investigate, correlate and update as required to provide replacement records.

³ Any condition, event or behaviour that was necessary for the occurrence. Avoiding or eliminating any one of these factors would have prevented it happening.

⁴ Any factors associated with the overall management systems, organisational arrangements or the regulatory structure.

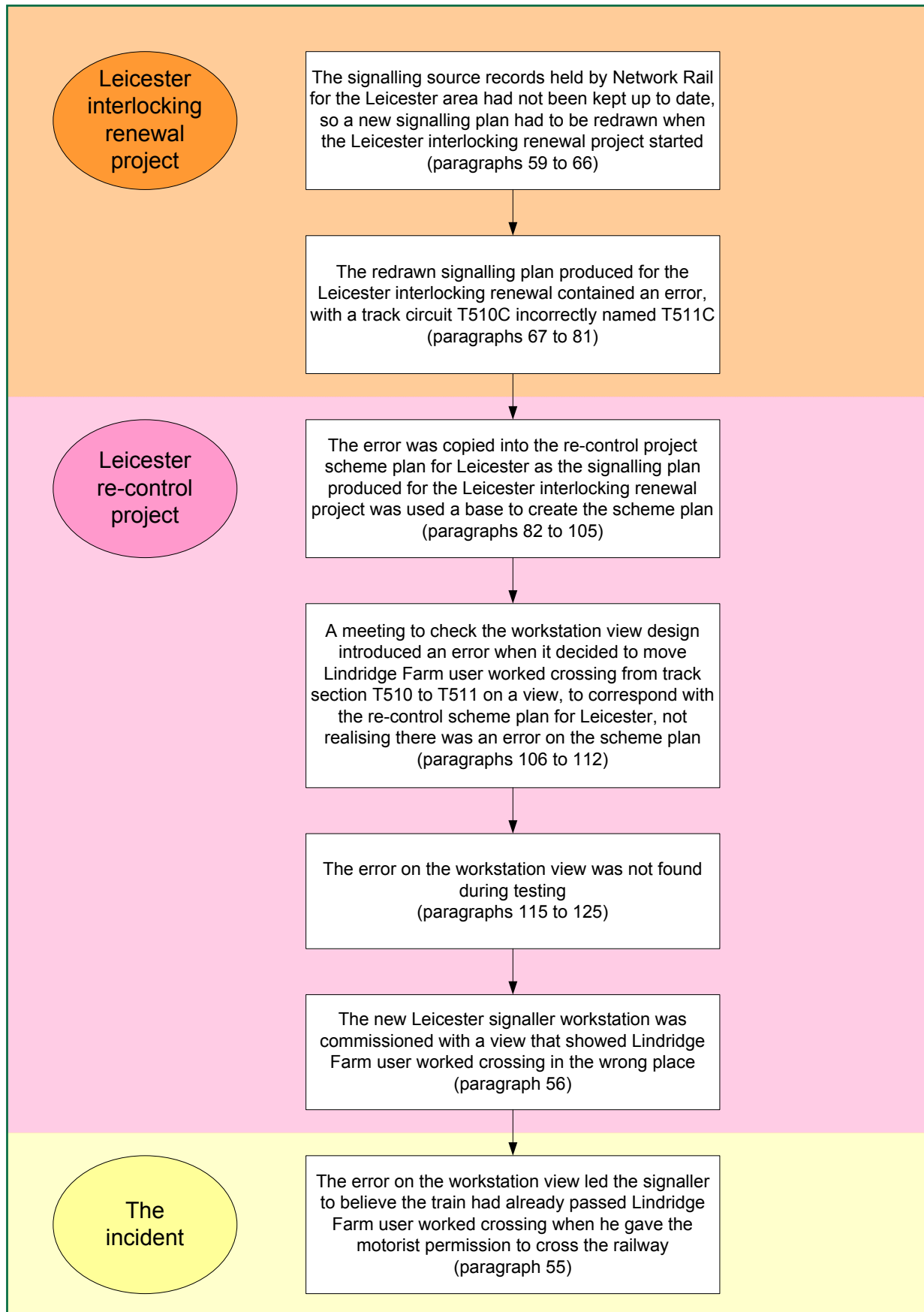
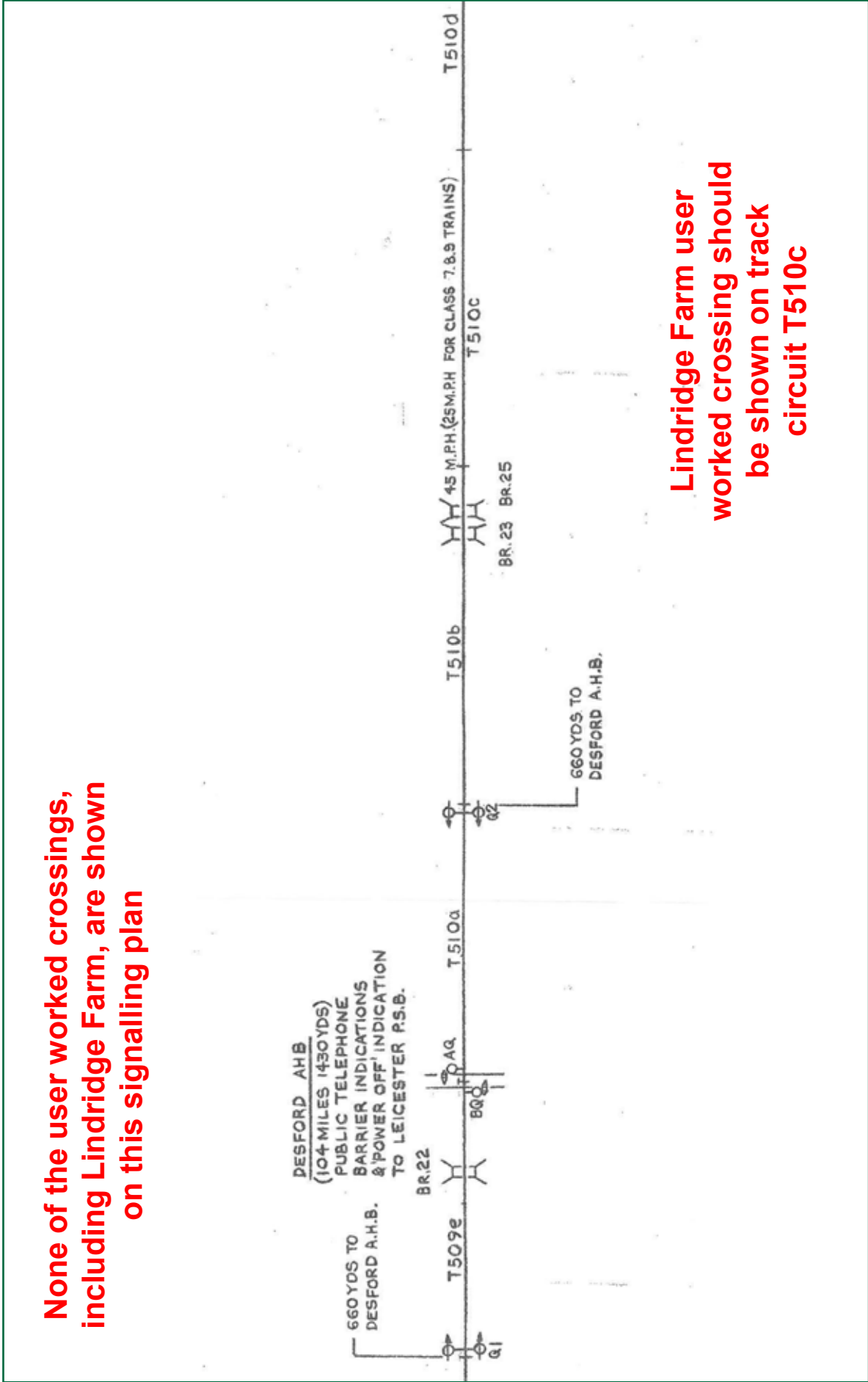


Figure 11: Diagram showing the sequence of events

None of the user worked crossings, including Lindridge Farm, are shown on this signalling plan



Lindridge Farm user worked crossing should be shown on track circuit T510c

Figure 12: The Up and Down Burton line as shown on the existing signalling plan for Leicester, dated 1984

- 63 The EMSR project and Invensys Rail established what signalling source records were held by National Records Group before starting work on part 5, which included both the Leicester interlocking renewal and the re-control of the signalling in the Leicester area. This was primarily to understand what records existed so they could be requested by the project. However, there is no evidence that either organisation referred to the deficiencies register or took any other steps to determine the actual state of these source records. Consequently no one fully understood the poor state of the source records for the Leicester area before the EMSR project work started.

The Leicester interlocking renewal project

- 64 The signalling plan for the Leicester interlocking renewal had to be redrawn and correlated by the EMSR project as the existing version was out of date. This is a causal factor.**

- 65 Part 5 stage 2 of the EMSR project was to replace the interlocking at Leicester. As this work involved making changes to the interlocking, primarily to make it comply with current standards, the EMSR project needed a correlated signalling plan which showed the existing signalling equipment before any alterations could be made to it, as required by NR/L2/SIG/11201, Module A7 (paragraphs 42 to 43). When the EMSR project defined the scope of work for this stage, it soon identified that the existing signalling plan had not been kept up to date, so it did not accurately depict what signalling equipment was on the trackside. Therefore the scope of work to be undertaken by Network Rail SDG included activities to survey and correlate the existing Leicester interlocking area. This information would then be used to redraw the signalling plan for the Leicester interlocking before any design work started.
- 66 In June 2010, the EMSR project commissioned Network Rail SDG to develop the options for replacing the Leicester interlocking. One of Network Rail SDG's first tasks was to produce a redrawn signalling plan so its staff carried out a signalling equipment survey of the Leicester interlocking between the end of August and the middle of September. The survey was recorded in a report which was used by a designer in October to redraw the signalling plan. However, the signalling plan that was produced contained an error as described in the following section.

Signalling plan for the Leicester interlocking renewal project

- 67 The signalling plan for the Leicester interlocking renewal, which was redrawn by Network Rail SDG, contained an error that incorrectly named track circuit T510C as T511C. This is a causal factor.**

- 68 The views on the signaller's workstation display the track layout and the position of trains, with the track layout divided into a series of track sections. A track section can be shown in three colours: red when a train is occupying it, grey when it is unoccupied and white when a route is set across it, ie a train has been signalled to pass over that track section but has not yet occupied it.

- 69 Lindridge Farm user worked crossing lies within track section T510 which is 1.86 miles (2.99 km) long. This is too long for just one track circuit of the type fitted to this railway line to detect the absence of a train. Therefore track section T510 comprises four track circuits: T510A, T510B, T510C and T510D. If any of these track circuits has a train on it, the interlocking indicates that track section T510 as a whole is occupied. This combined indication is displayed on the workstation view, so the signaller only sees T510 as a single track section. However, signalling and scheme plans are often drawn to show each individual track circuit.
- 70 Figure 13 shows the approved signalling plan for the Leicester interlocking renewal work, which was created by Network Rail SDG. On this plan, track circuit T510C was incorrectly named as T511C, so the four track circuits that make up track section T510 were shown as T510A, T510B, T511C and T510D.
- 71 This arose due to a combination of the following:
- The designer entered the wrong track circuit name when producing the signalling plan (paragraph 72).
 - The error was missed during the checking process (paragraph 77).
- Each of these factors is now considered in turn.

Signalling plan design

72 The designer entered the wrong track circuit name when producing the signalling plan. This is a causal factor.

- 73 In October 2010, the designer incorrectly labelled track circuit T510C as T511C when he drew the signalling plan for the Leicester interlocking renewal. Source records used by the designer included the existing signalling plan that dated back to 1984. This track circuit was labelled correctly on the 1984 plan (figure 12).
- 74 Designers within Network Rail SDG use a specialist version of Computer Aided Design (CAD) software to produce these types of plan. The CAD software automatically checks for repeat entries when signal or points names are entered. If a repeat is found then the name is rejected so the designer knows it has already been used. There is no similar facility in the CAD software to automatically check for repeat track circuit names.
- 75 Track section T511 is adjacent to T510 and comprises track circuits T511A, T511B, T511C. If there had been a facility in the CAD software to check for repeat track circuit names, the T511C error might have been discovered.
- 76 When producing scheme plans for resignalling works, a designer will use a check list for recording which track circuit names have been used in order to avoid using the same name again. The designer did not use a check list when redrawing the Leicester signalling plan because he considered it was not necessary since he was not designing the signalling and allocating new track circuit names, but instead copying the track circuit names over from an existing source record.

Note: Lindridge Farm user worked crossing is incorrectly named as Lindridge Fields House user worked crossing on this plan

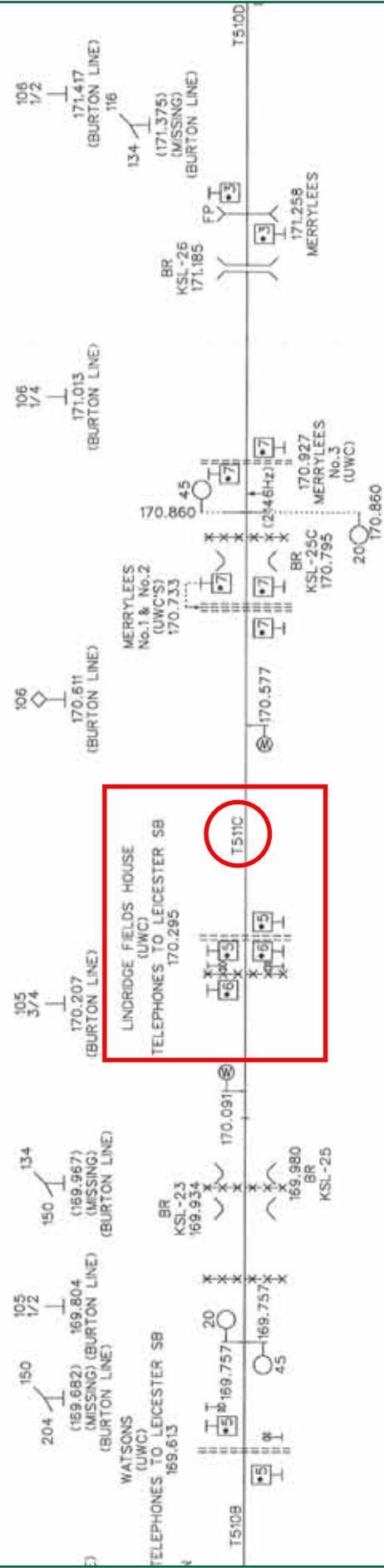


Figure 13: The error on the approved signalling plan for the Leicester area

Signalling plan checking

77 The error was missed during the checking process. This is a causal factor.

- 78 The designer did not spot the T511C error when he carried out his own checking of the work he had produced. The designer then issued the plan to an independent checker on 14 October 2010.
- 79 The independent checker did not find the error either. The checker compared the new plan against various source records, such as the existing plan, the *sectional appendix*, gradient plans, etc. The checker should check all of the track circuit names as part of this work. The copy of the plan looked at by the checker shows the tick marks he made on it (figure 14).
- 80 This copy does not have any tick marks against the track circuit names. The checker explained that he checked the track circuit names against a paper copy of the existing signalling plan and put his tick marks on this document rather than on the copy of the new plan. The RAIB could not obtain this evidence as the copy of the existing plan was disposed of when Network Rail SDG moved offices in February 2012.
- 81 The designer updated the signalling plan to address the checker's comments and issued an updated copy to the checker on 22 December 2010. The checker confirmed that his comments had been addressed, and the signalling plan was signed off by the designer and checker. It was then approved by the Minor Scheme Review Panel and signed off by the Network Rail signatories on 13 January 2011 as an accurate record of the infrastructure. However it still contained an error with track circuit T510C incorrectly named as T511C.

The Leicester re-control project

- 82 In June 2010, at the same time that Network Rail SDG started its work on the Leicester interlocking renewal (stage 2 of part 5), the EMSR project awarded a contract to Invensys Rail to start working on the Leicester re-control work (stage 1 of part 5). Invensys Rail's scope of work was to carry out all of the activities, from GRIP stages 4 through to 8, needed to transfer control of the railway from Leicester and Croft signal boxes to the EMCC (paragraphs 46 to 47). This included the design, review and testing of the signaller workstation views.
- 83 It was during the production of the new signaller workstation views that Lindridge Farm user worked crossing came to be shown on the wrong track section on a view. The sequence of events that led to this happening was as follows:
- Invensys Rail did not provide correlated scheme plans for the re-control work that it was delivering. The scheme plans that it did produce were rejected by Network Rail so the EMSR project team commissioned Network Rail SDG to produce new scheme plans (paragraphs 84 to 94).
 - Network Rail SDG produced new correlated scheme plans, including one for the Leicester area with Lindridge Farm user worked crossing on it. However, this scheme plan contained an error (paragraphs 95 to 96).
 - Network Rail SDG used the signalling plan it had produced for the Leicester interlocking renewal work as a base for the new Leicester scheme plan. In doing this, it copied an error in the signalling plan across into the new scheme plan (paragraphs 97 to 99).

Note: Lindridge Farm user worked crossing is incorrectly named as Lindridge Fields House user worked crossing on this plan

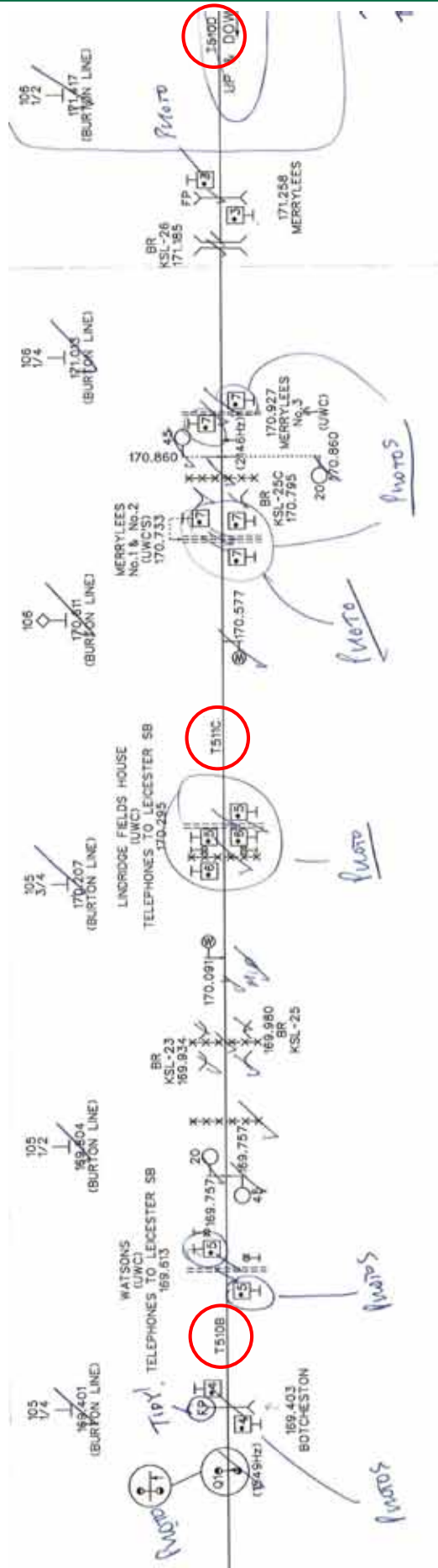


Figure 14: The tick marks and error on the copy of the signalling plan looked at by the checker

- No one within Network Rail SDG noticed the error when the Leicester scheme plan was produced and checked (paragraphs 100 to 103).
- The EMSR project held a meeting to check that the new signaller workstation views designed by Invensys Rail corresponded with the scheme plans produced by Network Rail SDG. At this meeting, the attendees were misled by the error on the Leicester scheme plan and moved Lindridge Farm user worked crossing to the wrong track section on the view (paragraphs 106 to 111).

Each of these events, and the factors associated with it, is now considered in turn.

Correlated scheme plans for the re-control project

84 The scope of work for the production of scheme plans for the re-control project was unclear so correlated scheme plans were not produced until a very late stage in the project, and were not available when the workstation views were designed. This is a causal factor.

- 85 An approved scheme plan is normally one of the deliverables from GRIP stage 4, which is the stage where a single option is developed in preparation for the detailed design work that takes place in GRIP stage 5. Such a plan should accurately reflect the signalling equipment that it represents (ie it should have been correlated). Although the EMSR project defined in its project scope for GRIP stages 1 to 4 of the Leicester re-control work that scheme plans should be provided by Invensys Rail, it did not specifically state that these plans should be correlated.
- 86 Invensys Rail's work was to transfer the control of the signalling covered by Leicester signal box to the EMCC, without the need to make any changes to the interlockings or the signalling equipment alongside the railway. Consequently, Invensys Rail only intended to take the existing signalling plans held by National Records Group and create scheme plans from these by just showing that the controlling signal box had changed. As a result, during the GRIP stage 4 work, Invensys Rail produced a series of scheme plans based on the existing signalling plans.
- 87 To create the Leicester scheme plan, Invensys Rail took the existing signalling source records, which were the Leicester signalling plan dating back to 1984 and the Bardon Hill signalling plan dating back to 1990, and used them as a base onto which it made its changes. The only changes made by Invensys Rail were to replace all references to Leicester signal box with a reference to the appropriate workstation at the EMCC.

- 88 Invensys Rail allocated a commensurate amount of resource for this task, including the use of a contractor, to produce version A of the Leicester scheme plan which was issued on 22 November 2010. Following an internal review, it was updated to version B and passed to Invensys Rail's *Contractor's Responsible Engineer* for him to review. The Contractor's Responsible Engineer was concerned that although the changes made to create the scheme plan were correct, some unchanged items shown on the plan may have been wrong or out of date. To address his concerns, the Contractor's Responsible Engineer required a warning to be placed in the scheme plan notes stating "This scheme plan has been produced from signalling plan 501-0P – A3/3 ver HL1 which is an uncertified base record of unknown accuracy. It is issued on the understanding that the East Midlands Signalling Renewals project or its contractor cannot accept any responsibility for errors or omissions arising from inaccurate source records". After this note was added to version B, the scheme plan was sent to Network Rail for review on 23 December.
- 89 Changes to the re-control project scheme plans were identified at a meeting held by Network Rail and Invensys Rail on 18 January 2011. At the same time, the EMSR project decided that it needed to redraw all of the scheme plans before they could be sent back to National Records Group, so the warning note on the Leicester scheme plan was amended to read "This scheme plan has been produced from signalling plan 5Y01B/A3/9 ver AF2 and LRP./02/4B ver EU1 which is an uncertified base record of unknown accuracy. A full survey and correlation exercise is being undertaken in parallel with this project". This change to the note, plus the other changes that had been identified, were addressed in version C of the Leicester scheme plan which was produced on 1 February.
- 90 The EMSR project team, despite deciding it needed to redraw all of the scheme plans, submitted the suite of version C scheme plans to the Minor Scheme Review Panel (paragraph 49) for review on 8 February. At this meeting, the Minor Scheme Review Panel rejected the scheme plans, noting that the pre-existing signalling plans, on which these scheme plans were based, were not in a good state and that although these new scheme plans had been correlated against the signaller's panel in Leicester signal box, there was still a risk they did not reflect the equipment that was actually on the ground.
- 91 Rejection by the Minor Scheme Review Panel meant that the scheme plans produced by Invensys Rail could not be used for the detailed design work in GRIP stage 5. Invensys Rail did not have the resources available to produce correlated scheme plans and argued that this work was not a planned activity within the scope of the project. Invensys Rail's view was because this was a re-control project, where no equipment on the ground was being changed, correlated scheme plans were not needed. However, the EMSR project insisted that correlated scheme plans were needed for testing the new signaller workstations, for safety verification by the CIP and for the return of records to National Records Group after completion of the re-control work.

- 92 To resolve the problem, in March the EMSR project commissioned Network Rail SDG to produce a set of nine redrawn and correlated scheme plans. This required the redraw and correlation of six scheme plans, and minor changes to create three scheme plans from correlated signalling plans that already existed. One of the existing correlated signalling plans was the one for the Leicester interlocking that Network Rail SDG had already redrawn for the Leicester interlocking renewal project (paragraphs 65 to 66).
- 93 This meant correlated scheme plans for the re-control work were not issued until September 2011, so were not available when the workstation views were designed (this work started in October 2010). The design should be based on correlated scheme plans but witness evidence indicates that this rarely happens in practice for re-control work. It is common for the initial workstation view design to replicate the signal box panel that is being replaced. To do this, the designers use photographs of the existing panel as their primary source information.
- 94 There was no time in the project programme to wait for Network Rail SDG to produce the correlated scheme plans. The project needed to meet the planned commissioning date and workstation views were needed for a series of test rehearsals planned for the interlockings being re-controlled. Workstation views were also needed for the creation of a signaller training workstation.

Leicester scheme plan for the re-control project

95 Versions D onwards of the re-control project scheme plan for Leicester, which were produced by Network Rail SDG, contained an error that incorrectly named track circuit T510C as T511C. This is a causal factor.

96 Invensys Rail produced versions A, B and C of the re-control project scheme plan for the Leicester area (paragraphs 88 to 89). After the Minor Scheme Review Panel had rejected version C, Network Rail SDG produced new scheme plans (paragraphs 90 to 92). However, the first version of the scheme plan produced by Network Rail SDG, version D, contained an error with track circuit T510C incorrectly named as T511C. This factor arose due to a combination of the following:

- The error was copied by Network Rail SDG into the re-control project scheme plan for Leicester from the approved Leicester interlocking renewal signalling plan (paragraph 97).
- The error was not found during the production, checking or review of the re-control scheme plan for Leicester (paragraph 100).

Each of these factors is now considered in turn.

Source of the error

97 The error was copied by Network Rail SDG into the re-control scheme plan for Leicester from the approved Leicester interlocking renewal signalling plan. This is a causal factor.

98 Network Rail SDG had already produced a correlated signalling plan for the Leicester interlocking as part of work to renew it (paragraphs 64 to 81) but it contained an error with track circuit T510C incorrectly named as T511C (figure 13).

99 In May 2011, a designer from Network Rail SDG used this approved signalling plan as a base for creating the re-control scheme plan for Leicester, thus copying the error across into the new scheme plan. As this signalling plan was correlated, the designer created the new scheme plan by just making alterations to show the controlling signal box had changed. As required by Network Rail's standards for signalling drawings, all of the alterations were identified by showing new text in red and deleted text in green.

Production, checking and review

100 The error was not found during the production or checking of the re-control scheme plan for Leicester. This is a causal factor.

- 101 The Network Rail SDG designer did not see the error when he produced the scheme plan for Leicester or when he carried out his production checks. He was focused on the alterations he needed to make to create the scheme plan and did not need to look at anything else.
- 102 In July 2011 the designer issued a copy of the new scheme plan to a checker who was responsible for checking the alterations made to produce the scheme plan. Tick marks on the copy of the scheme plan used by the checker show that he checked the alterations, ie he just looked at the red and green text (figure 15). The checker did not need to look at anything other than the alterations and he did not happen to spot the pre-existing error.
- 103 In August the designer updated the scheme plan to address comments made by the checker and issued a revised copy to the checker. The checker confirmed that his comments had been addressed and the scheme plan was then issued as version D, which superseded Invensys Rail's version C that had been rejected by the Minor Scheme Review Panel (paragraph 90).
- 104 Version D of the scheme plan was next reviewed at a design check meeting held on 12 August 2011 (see paragraph 108) and was updated to version E later that day to address some minor comments that had been made by Network Rail and Invensys Rail. The error was not noticed during this review.
- 105 Version E was reviewed by the Minor Scheme Review Panel on 23 August. It made some minor comments but the error was not noticed during this review. Network Rail SDG addressed the Minor Scheme Review Panel's comments by updating the scheme plan to version F and this version was signed off as approved in principle by all of the signatories⁵ by 16 September. At this point, Network Rail SDG's work on the re-control scheme plans ended. Ownership of the approved version F scheme plan, with the error still present, was passed to Invensys Rail, which distributed controlled copies to its staff including the testers responsible for testing the new signaller workstations.

⁵ The signatories were the responsible design engineer from Network Rail Signalling Design Group, the representative from Network Rail operations and the representative from Network Rail infrastructure.

Tick marks made by checker on scheme plan checking copy

Note: Lindridge Farm user worked crossing is incorrectly named as Lindridge Fields House user worked crossing on this plan

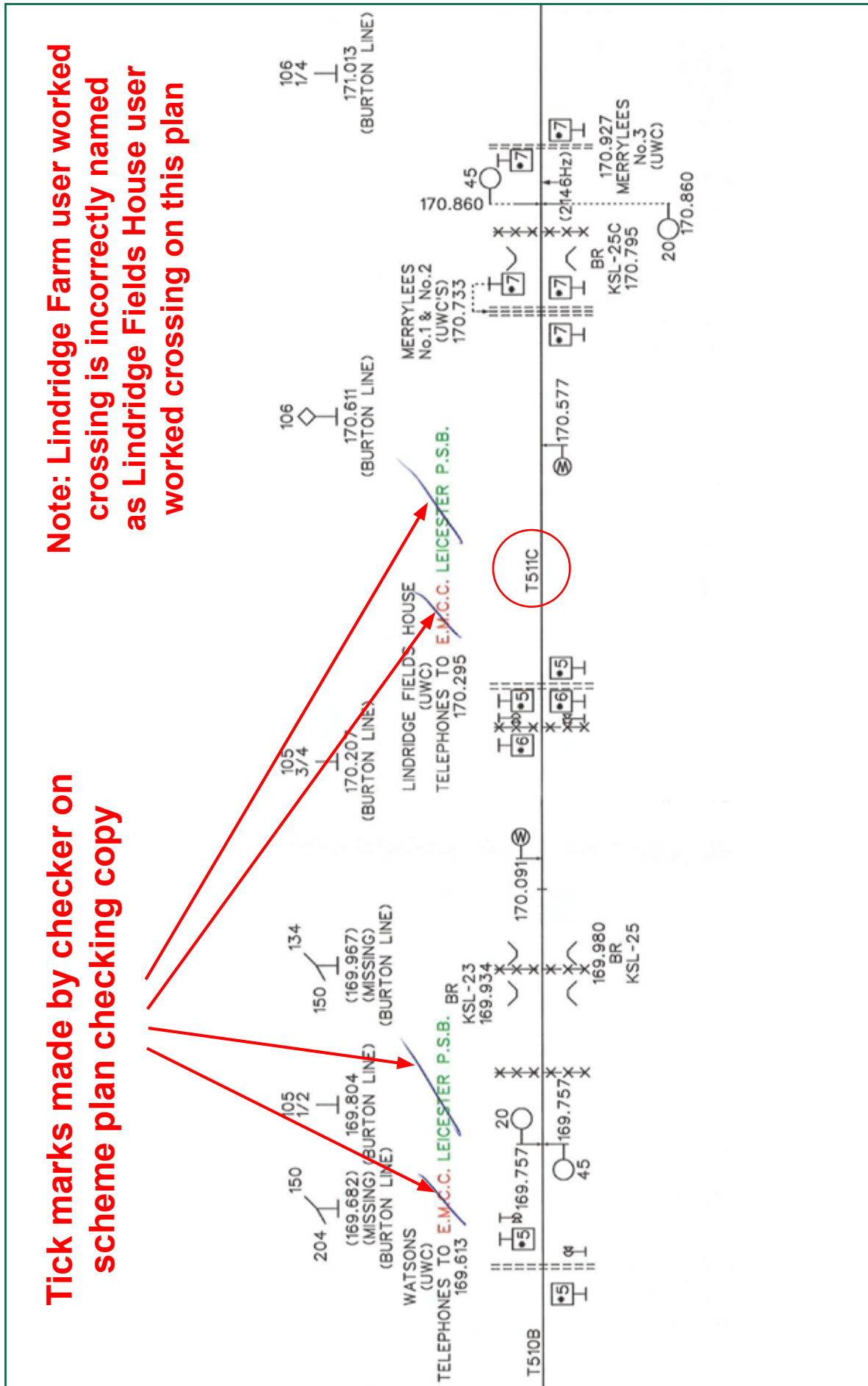


Figure 15: The tick marks and error on the checker's copy of the re-control scheme plan for Leicester

Meeting to check the new signaller workstation view design

- 106 **A meeting, held by the EMSR project team to check the new signaller workstation views designed by Invensys Rail against the re-control scheme plans produced by Network Rail SDG, decided to move Lindridge Farm user worked crossing from track section T510 to T511 on a view. This is a causal factor.**
- 107 The EMSR project team was required by Network Rail company standard NR/L2/INI/02009, 'Engineering Management for Projects', to hold meetings to check the design produced by Invensys Rail. To meet this requirement, the designated project engineer for the EMSR project held a series of meetings to check the workstation views that had been designed by Invensys Rail. He invited representatives from Network Rail's operations function (including operations managers and signallers) to these meetings so they could assess whether the design met their requirements and was compatible with how they were expecting to operate the railway that was being re-controlled. The meetings were also attended by the project team and staff from Invensys Rail who had designed the workstation views.
- 108 One of these meetings took place on 12 August 2011. The purpose of this meeting was to check the workstation views designed by Invensys Rail against the first versions of the re-control scheme plans that had been produced by Network Rail SDG (these were referenced as version D). The EMSR project team wanted assurance that these two design activities corresponded as they had been taking place in parallel.
- 109 At the meeting, an Invensys Rail attendee proposed moving Lindridge Farm user worked crossing on a view so it was shown on the other side of the boundary between track sections T510 and T511. A few days before the meeting, the attendee had reviewed the signaller workstation view design against the version D scheme plans. The track circuit naming error on the version D scheme plan for Leicester (figure 16) had misled him to conclude that Lindridge Farm user worked crossing should be shown on track section T511 on the view.
- 110 The other meeting attendees agreed to make this change after comparing the view against the scheme plan and it was recorded in the meeting minutes. Since the scheme plan was based on a correlated signalling plan (paragraphs 98 to 99), it was likely that the attendees deferred to this document as being the correct one. No one challenged the correctness of the scheme plan or checked the proposed change against other source information used to design the workstation views (eg photographs taken at Leicester signal box which showed Lindridge Farm user worked crossing on track section T510 on the signaller's panel).
- 111 As the EMSR project team considered the purpose of the meeting was to compare the output from two design activities, and was not intended to check how the railway was operated, no one from Network Rail operations was present at this particular meeting. The attendees were signalling design and project staff from Network Rail and Invensys Rail.

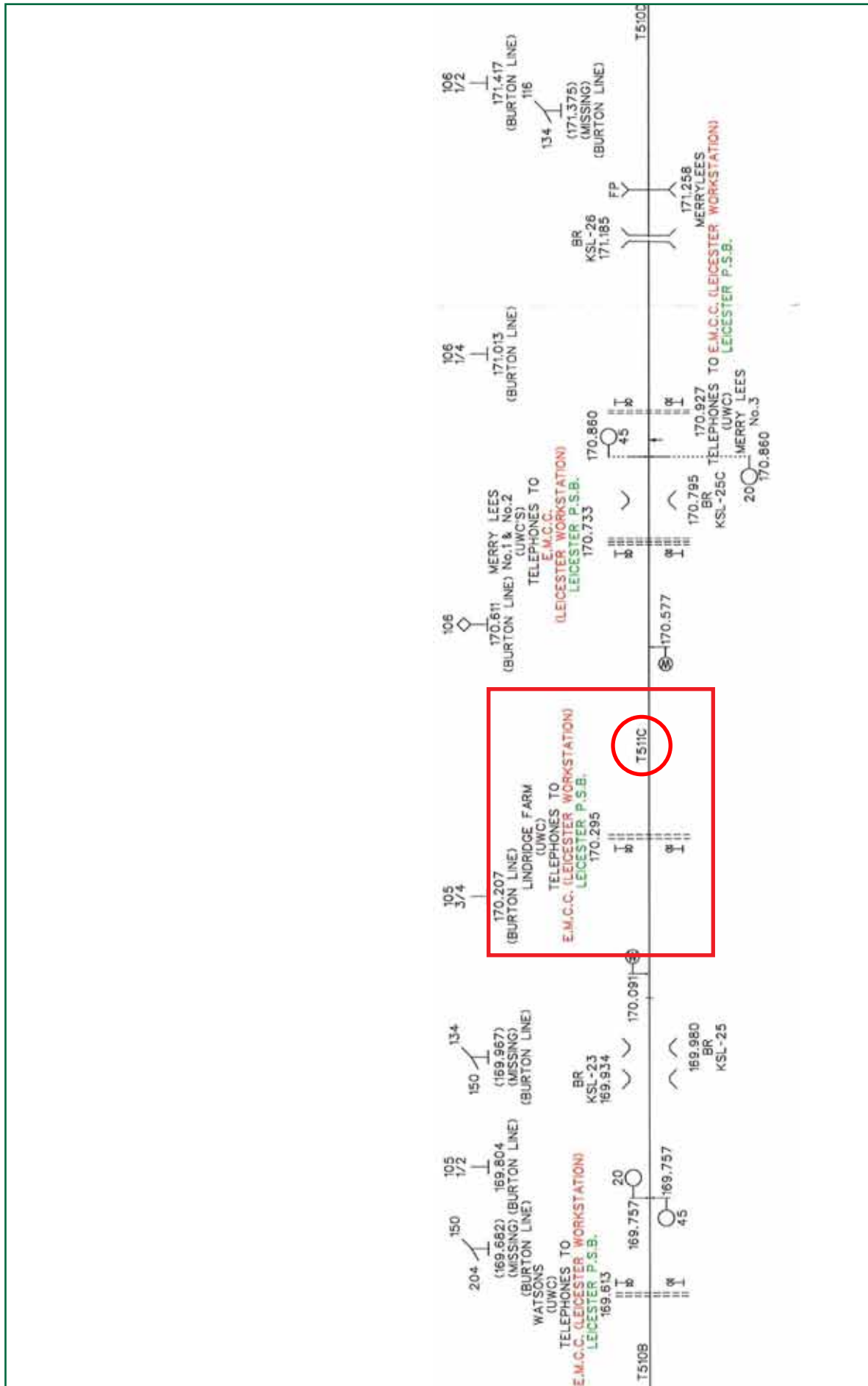


Figure 16: The error on the version D scheme plan for the Leicester area

112 Afterwards, no one from Network Rail's operations was consulted about moving Lindridge Farm user worked crossing to track section T511 on the view. Another meeting was already arranged for 20 October at which the final versions of the views were to be reviewed by staff from Network Rail operations. However, by the time this meeting took place, the view had not been updated to include this change. Instead, the action to make this change was transferred from the 12 August meeting minutes to the 20 October meeting minutes without any discussion or further review. Invensys Rail then made the change to the workstation view to close out this action, which introduced an error as Lindridge Farm user worked crossing was now shown on the wrong track section.

Safety verification by the CIP

113 The RAIB has discounted the safety verification work carried out by the CIP as a factor. The CIP carried out two safety verification reviews of the re-control project; an interim review in May and June 2011 and an entry into service review in November (paragraph 54). When the interim review took place, the CIP noted that approved scheme plans for the re-control work had not been produced by the end of GRIP stage 4. He raised this issue and the project explained that Network Rail SDG was now producing the scheme plans during GRIP stage 5. The CIP noted this item as a non-compliance. When the CIP carried out the entry into service review, all of the signed scheme plans were available so he closed this item.

114 The CIP's safety verification activities checked that the process for producing the scheme plans was followed. These were high level checks and focused on process, so understandably they did not extend to checking the actual content of the scheme plans. It was not the role of the CIP to identify errors on a scheme plan.

Testing of the new Leicester workstation by the re-control project

Testing the location of level crossings on the workstation view

115 Errors made during the production of the workstation views were not found during testing, so the Leicester workstation was commissioned with a view that incorrectly showed Lindridge Farm user worked crossing (and the Merry Lees user worked crossings) on track section T511. This is a causal factor.

116 Network Rail company standard, NR/L2/SIG/30014 'Signal Works Testing Handbook', required the new Leicester workstation to be tested by signal works testing staff. As this testing fell within the scope of Invensys Rail's work, it managed the testing activities and the staff who did it.

- 117 On 6 December 2011, a tester cross-checked the Leicester workstation views against the scheme plans produced for the re-control work (paragraphs 95 to 105). His aim was to check that the views were a correct representation of the infrastructure being controlled. As part of this activity the tester checked the location of the level crossings on the views. Witness evidence indicates that when checking the location of the Lindridge Farm and Merry Lees level crossings as shown on the workstation view against their location as shown on the scheme plan, the tester:
- identified that each of these level crossings was shown on track section T511 on the workstation view;
 - located the same level crossings on the scheme plan, identified that Lindridge Farm and Merry Lees No.1 & No.2 user worked crossings were shown on track circuit T511C and also concluded that Merry Lees No.3 user worked crossing was on track circuit T511C although it was shown on the adjacent track circuit T510D;
 - identified that the adjacent track section was T510 on the workstation view (there was no other adjacent track section as T511 is on the fringe of the Leicester control area (figure 8)); and
 - checked that the adjacent track circuit name on the scheme plan matched track section T510 (as shown on the workstation view) and saw it was track circuit T510B.
- 118 The tester did not identify that Lindridge Farm, Merry Lees No.1 & No.2 and Merry Lees No.3 level crossings were shown on the wrong track section on the workstation view. Witness evidence indicates that he was misled by the sequential numbers in the track section and track circuit names. He did not identify that the sequence of track circuit names went from T510B to T511C, although during later tests he did identify the error on the scheme plan (paragraph 120).

Testing

119 The error on the re-control scheme plan for Leicester was found during testing but no one assessed the impact of this error on the Leicester workstation view design. This is a causal factor.

- 120 Later on during 6 December, the tester noticed the error on the scheme plan when he logged that track circuit name T511C was shown twice on the scheme plan (figure 17). The tester recorded the error on a *test log*. It was the last item in a list of six scheme plan errors that the testers had noted during their checks that day.
- 121 The test log was passed to the systems team within Invensys Rail who were responsible for producing the new signaller workstations including the views. This team's Design Manager reviewed the list of errors and concluded that they were all specific to the scheme plans and none of them required any changes to be made to the workstation views. He passed the test log to Invensys Rail's *Contractor's Engineering Manager* recommending that he bring it to the attention of Network Rail, so Network Rail could decide whether to correct the scheme plan errors before the commissioning to allow the test log to be closed, or make no changes at this time which would require the test log to be deferred instead.

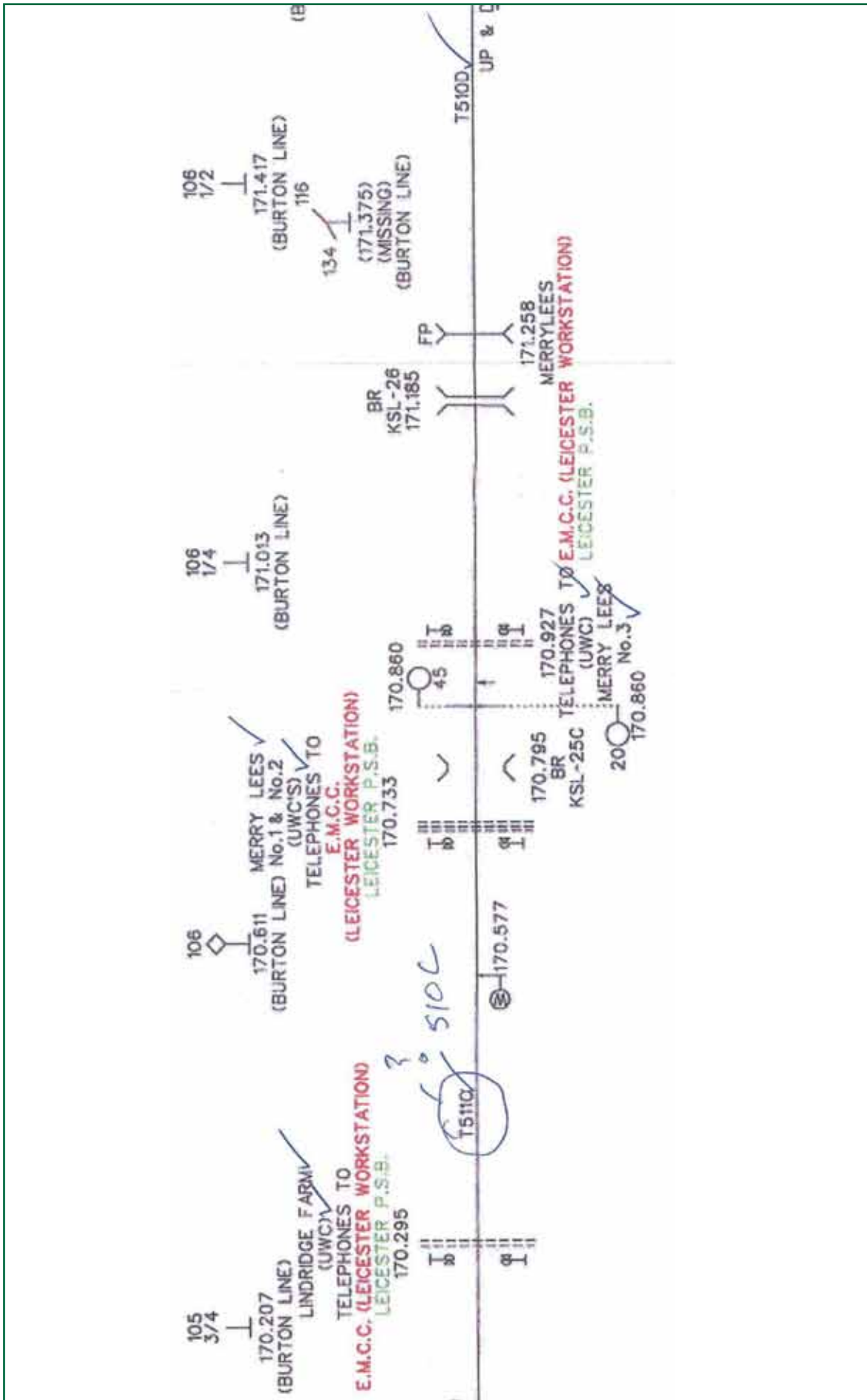


Figure 17: The tester's marks identifying the error on his copy of the re-control scheme plan for Leicester

- 122 On 19 December, the Contractor's Engineering Manager decided not to pass the test log to Network Rail but defer the scheme plan errors instead. This was because Invensys Rail had already raised a *technical query* previously on 28 November relating to a number of other scheme plan errors. One of these errors affected the workstation view design, so technical query, reference TQ034, was raised to ask Network Rail what should be done. Invensys Rail proposed three options in TQ034:
- Option 1 – update both the workstation view and scheme plans.
 - Option 2 – update just the workstation view and amend the scheme plans as a post commissioning update.
 - Option 3 – do not update the workstation view or the scheme plans (this option was included for completeness but it was not expected that either party would choose it).
- 123 Network Rail had responded on 1 December that Invensys Rail should adopt option 2, with scheme plan updates to be made after the commissioning. The Contractor's Engineering Manager decided this response to TQ034 now meant any scheme plan errors that were found could be deferred until after the commissioning, so he wrote on the test log that "errors on scheme plans are to be addressed post commissioning as agreed with NR on response to TQ034 attached". Although Network Rail's response to TQ034 referred to making an update to the workstation view, no such updates were planned by the Contractor's Engineering Manager as the Design Manager had already concluded that none were needed. Once the Contractor's Engineering Manager had deferred the test log, no further action was taken, so it was not passed to Network Rail as had been suggested by the Design Manager. This meant that both the EMSR project and Network Rail SDG were not aware of the scheme plan errors that the testers had found.
- 124 The next time the test log was looked at was on 2 January 2012, towards the end of the commissioning of the two new workstations at the EMCC. The Invensys Rail *Tester In Charge* reviewed all of the test logs that were still open or had been deferred alongside Network Rail staff prior to signing the Leicester workstation into service the next day. This was the first time that anyone from Network Rail had seen this test log. The review agreed with the response provided by the Contractor's Engineering Manager, so once the Tester In Charge had agreed to defer the test log he was able to sign the workstation into service the next day.
- 125 As a result, despite the tester raising a test log for the error found on the scheme plan, no one from Invensys Rail or Network Rail identified its potential impact on the safety of the signaller workstation design. Consequently the Leicester workstation was commissioned with errors on one of its views.

Factors affecting the severity of consequences

- 126 The motorist's car was not on the crossing when the train arrived there. However, there was potential for a collision because after being given permission to cross by the signaller, the motorist could well have driven onto the crossing without looking for an approaching train first.

Observations⁶

Merry Lees user worked crossings incorrectly shown on the signaller's panel at Leicester signal box

127 Merry Lees No.1 & No.2 and Merry Lees No.3 user worked crossings were incorrectly marked up on track section T511 on the signaller's panel at Leicester signal box from April 2011.

128 At the start of 2011, Network Rail's *Operations Risk Advisor*, who was responsible for operational safety on the East Midlands route, decided to install telephones at the Merry Lees No.1 & No.2 and Merry Lees No.3 user worked crossings (figure 3). The Operations Risk Advisor did not consider these level crossings to be high risk, but with the EMSR project work taking place, there was an opportunity to install telephones to improve safety at a relatively low cost.

129 Telephones were installed and tested by the local telecommunications maintenance team and brought into use on 30 April. Prior to this, staff working for the Operations Risk Advisor:

- briefed the authorised users of the Merry Lees crossings on the introduction of the telephones;
- arranged for the sectional appendix to be updated and published an entry in the weekly notice that is issued to railway staff, such as drivers and signallers, to advise them that telephones were now fitted at the Merry Lees crossings; and
- asked the Local Operations Manager at Leicester signal box to amend the signaller's panel to show the Merry Lees crossings, as this railway line was still under the control of this signal box at this time.

130 The Local Operations Manager at Leicester signal box was given some labels for the level crossings to stick on the signaller's panel and a copy of the updated sectional appendix with the Merry Lees crossings shown on it. This showed the location of the crossings in terms of their mileage, but it did not tell him which track section the crossings were located on. To find this out, he referred to an electronic copy of the signalling plan for the Leicester interlocking renewal (paragraphs 67 to 71) and printed out a snapshot from it which showed the Merry Lees crossings (figure 18). He had a copy of this plan from when he had attended meetings about the Leicester interlocking renewal held by the EMSR project.

131 The only track circuit name shown on this snapshot was T511C, so on 28 April, the Local Operations Manager marked the signaller's panel up with the Merry Lees crossings shown on track section T511 (figure 19). As explained earlier (paragraph 67), the signalling plan for the Leicester interlocking renewal contained an error with track circuit T510C incorrectly named as T511C. This led him to incorrectly mark the Merry Lees crossings on track section T511 instead of T510. The signaller's panel at Leicester signal box remained like this until it was decommissioned on 31 December.

⁶ An element discovered as part of the investigation that did not have a direct or indirect effect on the outcome of the incident but does deserve scrutiny.

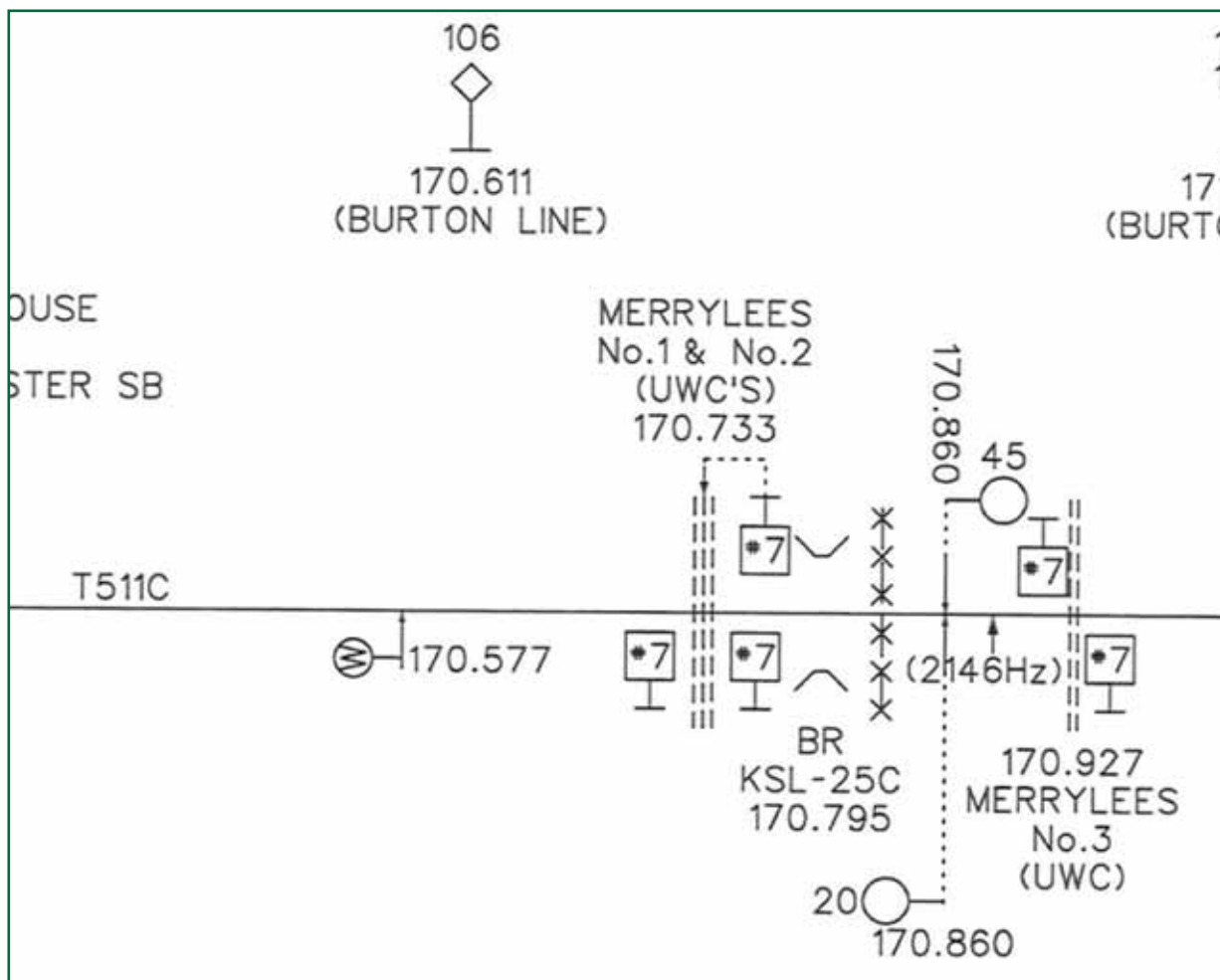


Figure 18: Snapshot of the signalling plan for the Leicester interlocking renewal



Figure 19: The signaller's panel at Leicester signal box with the Merry Lees user worked crossings incorrectly marked up on track section T511

132 The requirements for providing telephones at level crossings are described in Network Rail company standard NR/L2/SIG/30017/D, 'Telephone systems at level crossings'. It is focused on the positioning and labelling of the telephones from the user's perspective, with no information given about updating the signaller's display to show the location of the newly installed telephones. NR/L2/SIG/30017/D makes reference to Railway Group Standard GK/RT0192, 'Level Crossing Interface Requirements', which requires that the signaller's display shall identify the locations of all user worked level crossings with telephones in its control area. Neither standard includes nor references the requirements for updating the signaller's display, ie who can make the changes, how they are made and how they are checked. Standard NR/L2/SIG/30017/D also does not reference or include the need to update the signalling records, such as the signalling plan, to show the change to the level crossing.

Merry Lees user worked crossings incorrectly shown on a workstation view

133 Merry Lees No.1 & No.2 and Merry Lees No.3 user worked crossings were incorrectly placed on track section T511 at a meeting held by the re-control project in March 2011.

134 After Network Rail operations decided to fit telephones to the Merry Lees user worked crossings (paragraphs 128 to 129), the EMSR project needed to show this change on the scheme plan for Leicester and to add the Merry Lees crossings onto one of the views on the new Leicester workstation.

135 The addition of the Merry Lees crossings onto a Leicester workstation view was first raised at a design check meeting held on 29 March. This meeting was held so Network Rail operations staff could comment on the latest version of the views. The record for this meeting shows that a Network Rail operations attendee asked for these crossings to be added to track section T511. The other attendees agreed to the change and staff from Invensys Rail marked up their copy of the workstation view with the proposed change (figure 20).

136 It is likely that the Network Rail attendee who proposed this change looked at the Leicester interlocking renewal signalling plan, which had the error on it which named track circuit T510C as T511C (paragraph 67), and concluded that the Merry Lees crossings were on track section T511. At this time, the scheme plans for the re-control work were not available as they were still being produced by Network Rail SDG.

137 Invensys Rail modified the workstation view in line with meeting comments and this change was marked as complete at the next design check meeting held on 3 May 2011. The incorrect placement of the Merry Lees crossings on track section T511 was not identified at the meeting held on 12 August to review the workstation views against the first versions of the new scheme plans (paragraphs 107 to 110) or found during the testing work (paragraphs 115 to 125). The workstation view was commissioned with the Merry Lees crossings shown on the wrong track section along with the Lindridge Farm crossing (figure 8). Network Rail discovered this error when the incident at Lindridge Farm crossing was investigated (paragraph 35).

Reporting of the incident

138 The signaller did not report the incident straight away.

- 139 When the incident happened at 07:38 hrs, the motorist called the signaller back straight away to complain that she had been given permission to cross when a train was approaching. However, the incident was only reported to the Signaller Shift Manager about 80 minutes later when the motorist returned to the crossing (paragraphs 33 to 34).
- 140 The other signaller working on the Leicester workstation that morning answered the call this time, and after taking the motorist's name and contact details, the two signallers discussed what had happened and raised the incident with the Signaller Shift Manager. The incident was then investigated and the problem with the workstation view identified.
- 141 The signaller did not report the incident straight away because at the time he could not understand what had happened. The motorist had hung up the telephone before the signaller could ask her further questions to establish exactly what had happened. Although he was certain of what he had seen on the workstation view when giving the motorist permission to cross, he began to doubt his actions and to question himself.

Previous occurrences of a similar character

- 142 No previous occurrences of a similar character were identified during this investigation.

Summary of conclusions

Immediate cause

143 The immediate cause of the incident was that the signaller believed that train 6Z75 had already passed Lindridge Farm user worked crossing when he gave the motorist permission to cross, because his workstation view showed the level crossing on track section T511 and the train on track section T510 (**paragraph 55**).

Causal factors

144 The causal factors were:

- a. The signalling plan for the Leicester interlocking renewal had to be redrawn and correlated by the EMSR project as the existing version was out of date (**paragraph 64, Recommendation 1**).
- b. The signalling plan for the Leicester interlocking renewal, which was redrawn by Network Rail SDG, contained an error that incorrectly named track circuit T510C as T511C (**paragraph 67, Recommendation 2**).
 - i. The designer entered the wrong track circuit name when producing the signalling plan (**paragraph 72, Recommendation 2**).
 - ii. The error was missed during the checking process (**paragraph 77, Recommendation 2**).
- c. The scope of work for the production of scheme plans for the re-control project was unclear so correlated scheme plans were not produced until a very late stage in the project, and were not available when the workstation views were designed (**paragraph 84, Recommendation 1**).
- d. Versions D onwards of the re-control project scheme plan for Leicester, which were produced by Network Rail SDG, contained an error that incorrectly named track circuit T510C as T511C (**paragraph 95, Recommendation 2**).
- e. The error was copied by Network Rail SDG into the re-control scheme plan for Leicester from the approved Leicester interlocking renewal signalling plan (**paragraph 97, Recommendation 2**).
- f. The error was not found during the production or checking of the re-control scheme plan for Leicester (**paragraph 100, Recommendation 2**).
- g. A meeting, held by the EMSR project team to check the new signaller workstation views designed by Invensys Rail against the re-control scheme plans produced by Network Rail SDG, decided to move Lindridge Farm user worked crossing from track section T510 to T511 on a view (**paragraph 106, Recommendation 3**).
- h. Errors made during the production of the workstation views were not found during testing, so the Leicester workstation was commissioned with a view that incorrectly showed Lindridge Farm user worked crossing (and the Merry Lees user worked crossings) on track section T511 (**paragraph 115, Recommendation 3**).

- i. The error on the re-control scheme plan for Leicester was found during testing but no one assessed the impact of this error on the Leicester workstation view design (**paragraph 119, Recommendation 4**).

Underlying factor

145 The underlying factor was that signalling source records held by National Records Group for the Leicester interlocking area, such as the signalling plan, had not been kept up to date when the infrastructure was changed (**paragraph 59, Recommendation 1**).

Additional observations

146 Although not linked to the incident on 22 March 2012, the RAIB observes that:

- a. Merry Lees No.1 & No.2 and Merry Lees No.3 user worked crossings were incorrectly marked up on track section T511 on the signaller's panel at Leicester signal box from April 2011 (**paragraph 127, Recommendation 5**).
- b. Merry Lees No.1 & No.2 and Merry Lees No.3 user worked crossings were incorrectly placed on track section T511 at a meeting held by the re-control project in March 2011 (**paragraph 133, Recommendation 3**).
- c. The signaller did not report the incident straight away (**paragraph 138, Learning point 1**).

Previous RAIB recommendations relevant to this investigation

147 None of the recommendations made by the RAIB as a result of its previous investigations were found to have relevance to this investigation.

Actions reported as already taken or in progress relevant to this report

Actions reported that address factors which otherwise would have resulted in a RAIB recommendation

Leicester workstation view

148 Immediately after the incident Invensys Rail updated the view to show Lindridge Farm and the Merry Lees user worked crossings on track section T510, created a new version of the workstation software and tested it. After testing the change, Invensys Rail staff travelled to the EMCC and later in the afternoon on 22 March, they installed the new version on the Leicester workstation. The temporary instruction that had been issued by the Network Rail Local Operations Manager was then withdrawn (paragraph 36).

Other reported actions

Check of re-control scheme plans for similar occurrences

149 After the scheme plan error had been identified, Network Rail SDG reviewed all nine scheme plans for the Leicester re-control project to look for any similar instances where a track circuit had been given the wrong name. One further typographical error was found on the scheme plan for Wellingborough, where track circuit T942A was incorrectly shown as T924A. However, there were no level crossings in the vicinity of this track circuit.

150 Network Rail SDG then initiated an action across all of its design offices to verify that all current designs and recently commissioned re-control schemes did not have a similar problem to the one that had led to the incident at Lindridge Farm user worked crossing. Network Rail SDG carried out checks to ensure automatic and user worked level crossings were positioned on the correct track circuit and the track circuits adjacent to these level crossings were correctly named and in the correct sequence. No instances similar to that at Lindridge Farm user worked crossing were found.

Learning point

151 The RAIB has identified a key learning point⁷ for the railway industry:

Learning point 1

Signallers must be aware of the need to report any allegations made by members of the public straight away, even if they are unsure as to what has happened or the allegation conflicts with the information shown on their display. Prompt reporting and investigation of any such allegations are vital to discovering any latent problems within the signalling system (paragraph 146c).

⁷ A learning point is an issue which the RAIB wishes to draw to the attention of industry bodies and railway staff to disseminate safety learning that is not covered by a recommendation. They are included when the RAIB wishes to reinforce the importance of compliance with existing safety arrangements (where the RAIB has not identified management issues that justify a recommendation) and the consequences of failing to do so.

Recommendations

152 The following recommendations are made⁸:

- 1 *The intent of this recommendation is to require signalling re-control projects to establish what signalling source records exist for the area being re-controlled, how up-to-date they are and whether they are correlated. If signalling source records are not available, the project's scope should explicitly include activities at its start to produce them so they are available to designers and checkers for their design work, testers for testing the design prior to it being commissioned, and to the maintainers afterwards.*

Network Rail should revise its project management processes and company standards to require that signalling re-control projects (ie projects transferring the control of signalling from one location to another when the interlocking, trackside signalling equipment and infrastructure are unchanged) identify the signalling source records that are needed for the design, checking and testing of these works. These projects should then be required to include activities within their scope of work to obtain these signalling source records, including correlating, updating or producing records as necessary (paragraphs 144a, 144c and 145).

continued

⁸ Those identified in the recommendations, have a general and ongoing obligation to comply with health and safety legislation and need to take these recommendations into account in ensuring the safety of their employees and others.

Additionally, for the purposes of regulation 12(1) of the Railways (Accident Investigation and Reporting) Regulations 2005, these recommendations are addressed to the Office of Rail Regulation to enable it to carry out its duties under regulation 12(2) to:

- (a) ensure that recommendations are duly considered and where appropriate acted upon; and
- (b) report back to RAIB details of any implementation measures, or the reasons why no implementation measures are being taken.

Copies of both the regulations and the accompanying guidance notes (paragraphs 200 to 203) can be found on RAIB's website www.raib.gov.uk.

- 2 *The intent of this recommendation is to provide Network Rail SDG designers and checkers with a way of working which will remove the possibility of incorrect track circuit names being drawn on a signalling or scheme plan during its production, and then missed during the checking process. This way of working could be implemented in the software used by designers or by procedure. It is equally applicable to conceptual work (such as new designs) and non-conceptual work (such as the redrawing of an existing design).*

Network Rail should, in consultation with its principal signalling contractors, review the ways of detecting and addressing incorrect track circuit names for all types of signalling or scheme plan production. The review should consider what manual or automatic methods can be used by designers and checkers. The findings of the review should then be implemented by means of a time bound programme for changes to the tools and mandated design processes that cover this activity (paragraphs 144b, 144b.i, 144b.ii, 144d, 144e and 144f).

- 3 *The intent of this recommendation is to mandate that the position of fixed infrastructure on any new signaller display is correlated to its position on the existing signaller display. By doing this any discrepancies can be identified and the reasons for them understood.*

Network Rail should revise its design processes so as to specifically require that the position of fixed infrastructure, shown on any new signaller's display being installed by a project, is correlated to its position as shown on the existing signaller's display that is being replaced. This work should be carried out by staff who are qualified as competent to do correlation, and when a discrepancy is found between the new and existing signaller displays, they should record it and investigate the reason for it. Such an investigation should include a check of the accuracy of associated records, such as signalling or scheme plans, and result in the necessary corrections being made to the design or to the records to resolve the discrepancy (paragraphs 144g, 144h and 146b).

continued

- 4 *The intent of this recommendation is to improve the controls for deferring test logs before a signalling system is commissioned. It calls for the risk to safety, design and functionality to be assessed when deferring an issue raised by a tester on the test log. That way all of the implications of not addressing the test log are considered.*

Network Rail should revise the controls for managing deferred test logs so that:

- the person calling for the deferral of a test log is required to assess the risk to the safety, design and functionality of the signalling system by not closing the test log, record the outcome of their assessment and state any mitigation measures that need to be put in place before the signalling system can be commissioned; and
 - the tester responsible for commissioning the signalling system is required to review the assessment, agree to the deferral of the test log and to check that the suggested mitigation measures are in place, before allowing the signalling system to be commissioned (paragraph 144i).
- 5 *The intent of this recommendation is to show a level crossing in the correct place on the signaller's display when telephones are fitted to it. It calls for Network Rail's standards to define who can make the changes to the signaller's display, what information is needed to make the changes and how the changes will be checked afterwards. This recommendation also calls for the change to the level crossing to be recorded in the signalling records, either by updating records such as the signalling plan, or by entering the change in the deficiency register.*

Network Rail should have procedures in place that require the signaller's display to be updated in a controlled manner when telephones are being fitted at a level crossing for the first time. The requirements should also include what steps must be taken to record the change to the level crossing in the signalling source records (paragraph 146a).

Appendices

Appendix A - Glossary of abbreviations and acronyms

CAD	Computer Aided Design
CIP	Competent Independent Person
EMCC	East Midlands Control Centre
EMSR	East Midlands Signalling Renewals
GRIP	Governance for Railway Investment Project
IRSE	Institution of Railway Signal Engineers
NRAP	Network Rail's Acceptance Panel
RAIB	Rail Accident Investigation Branch
ROGS	Railways and Other Guided Transport Systems (Safety) Regulations 2006
SDG	Signalling Design Group
VDU	Visual Display Unit

Appendix B - Glossary of terms

All definitions marked with an asterisk, thus (*), have been taken from Ellis's British Railway Engineering Encyclopaedia © Iain Ellis. www.iainellis.com.

Authorised user	A person or body having the right to cross the railway at a specific private level crossing (and those visiting, trading with or servicing the authorised user).
Chain	A unit of length equal to 66 feet or 22 Yards (20.1168 metres). There are 80 chains in one standard mile.*
Colour light signal	A railway signal which uses coloured lights to indicate whether the driver has to stop, needs to be prepared to stop or can proceed without restriction. The lights may show: Green - proceed, the next signal may be displaying green or yellow; Yellow - caution, be prepared to stop at the next signal as it may be displaying a stop signal when you reach it; and Red – stop.
Contractor's Engineering Manager	A competent engineer appointed by the design contractor with overall accountability for all engineering activities applicable to that specific contract including those undertaken by sub-contracted organisations.
Contractor's Responsible Engineer	A competent engineer appointed by the design contractor to manage and be responsible for the technical aspects of the contractor's works.*
Correlation	The action of comparing the actual configuration of a signalling system with the design records for that system to ensure that they are in agreement.*
Deficiency register	A register of known deficiencies or non-conformities in the infrastructure records which render the quality of the record as unacceptable, undetermined, or not according to specified requirements.
Interlocking	A general term applied to equipment that controls the setting and releasing of signals, points and other apparatus to prevent an unsafe condition of the signalling system arising during the passage of trains.
Institution of Railway Signal Engineers (IRSE)	Founded in 1912, their objective is "...the advancement of the science and practice of railway signalling, telecommunications and related matters".*
Licence (from the IRSE)	A competence certification scheme, operated by the IRSE, to provide assurance about the competence of individuals to carry out technical safety-critical or safety-related work on signalling equipment and systems.

Local Operations Manager	An individual who manages the day to day operation of a given area of Network Rail infrastructure.
National Records Group	The central organisation that maintains and manages the signalling design records (source records) for Network Rail's infrastructure.*
Network Rail's Acceptance Panel	A panel that governs a number of processes on behalf of Network Rail's Board, which helps Network Rail comply with its statutory and health and safety responsibilities for managing the introduction of new or changed rail vehicles, infrastructure or products on its infrastructure.
Operations Risk Advisor	An individual who is responsible for all aspects of operational safety on one of Network Rail's Routes (eg level crossings, route crime, signals passed at danger, safety critical communications, etc).
Permitted speed	The maximum speed at which trains may safely negotiate a section of track, as published in Network Rail's operating publications that contain essential information about the line.
Points	A section of track with moveable rails that can divert a train from one track to another.
Re-control	The transfer of signalling control from one location to another when the interlocking, trackside signalling equipment and infrastructure is unchanged.
Relay interlocking	A collection of relays (electromechanical switches) used to control points and signals within specific geographical boundaries in a manner that prevents the signaller from setting conflicting train movements.
Route (Signal)	The signalled path from one signal to the next signal.*
Scheme plan	A plan which is drawn to a scale longitudinally, that shows the proposed alterations to an existing signalling system using a colouring convention that shows unchanged items in black, new items in red and items to be removed in green. The signalling system is shown by means of standard signalling symbols as defined in Network Rail company standard NR/L2/SIG/11201 – Mod A17, Signalling Design: Module A17 - Symbols for Plans and Sketches used in Signalling Applications.
Sectional appendix	An operating publication produced by Network Rail that includes details of running lines, permitted speeds, and local instructions.
Signalling control centre	A term used to describe more modern signal boxes housing electronic signalling control systems.*

Signalling plan	A plan which is drawn to a scale longitudinally, that shows the existing signalling system by means of standard signalling symbols as defined in Network Rail company standard NR/L2/SIG/11201 – Mod A17, Signalling Design: Module A17 - Symbols for Plans and Sketches used in Signalling Applications.
Solid state interlocking	A microprocessor based system used to control points and signals within specific geographical boundaries that are defined in data, in a manner that prevents the signaller from setting conflicting train movements.
Technical query	A written enquiry passed between a contractor (eg Invensys Rail) and a client (eg Network Rail) to seek technical information or clarify a technical issue.
Test log	A written query raised by a tester which describes an issue or problem the tester has found. Each test log is given a unique project reference and passed to a designer or installer to provide a response. The test log can be closed by the tester once any corrective action has passed a re-test or the test log can be deferred. The tester in charge maintains an index of the test logs and will review the open or deferred test logs before the new signalling can be used on the operational railway.
Tester in charge	The signalling engineer responsible for the correct testing and commissioning of a new or altered signalling system.*
Track circuit	An electrical or electronic device using the rails in an electric circuit that detects the absence of a train on a defined length of track.
Track circuit block	A signalling system where the line beyond each signal is automatically proved clear to the next signal, and sometimes beyond it, using track circuits. Track circuit block can also be implemented using any automatic train absence detector system.*
Track section	A length of track with fixed boundaries between which the train detection system provides information about its clear or occupied status.* A track section can comprise more than one track circuit.
User worked crossing	A level crossing where the barriers or gates are operated by the user. There is generally no indication of the approach of trains, but a telephone may be provided to contact the signaller.*
View	A schematic diagram showing the layout of part of the railway being controlled by a workstation. It provides information on the whereabouts and identity of trains, and is capable of showing all the information displayed on a conventional signal box panel to allow the signaller to control the movement of trains.

Workstation

A development of the signal box panel, the signaller is provided with a display of the signal box diagram on a series of VDUs, and a trackball and keyboard to operate the signalling functions.*

Appendix C - Timeline of key events for part 5 of the EMSR project

Leicester signal box controlled the area as shown in figure 10 from the mid 1980s until it closed on 31 December 2011, when control was transferred to the EMCC by part 5 of the EMSR project. The key events for this work which are relevant to this incident are shown in table C1.

	Signalling or Scheme Plans	Workstation Views	Other events
1984	<p style="text-align: center;">1984</p> <p>The last time the signalling plan for the Leicester area was correlated (this plan shows the Up & Down Burton line from Knighton Junction to Bagworth Junction)</p>		
2010			<p style="text-align: center;">June 2010</p> <p>The EMSR project tasked Network Rail SDG to start work on the Leicester interlocking renewal project</p>
			<p style="text-align: center;">28 June 2010</p> <p>The EMSR project contracted Invensys Rail to start work on the Leicester re-control project</p>
	<p style="text-align: center;">14 October 2010</p> <p>Network Rail SDG produced the first version of the Leicester interlocking renewal signalling plan for checking</p>		
		<p style="text-align: center;">29 October 2010</p> <p>Invensys Rail produced the first draft version of the new signaller workstation views (version 0.1), basing them on photographs of the existing signaller's panel at Leicester signal box</p>	
		<p style="text-align: center;">09 November 2010</p> <p>A meeting took place, attended by the project team, designers and operators, who checked whether the first draft version of the views met the requirements of the operators</p>	
	<p style="text-align: center;">22 November 2010</p> <p>Invensys Rail produced the first version of the Leicester re-control scheme plan (version A) for internal review</p>		
		<p style="text-align: center;">10 December 2010</p> <p>Invensys Rail produced the second draft version of the workstation views (version 0.2) to address the comments made at the meeting held on 9 November</p>	
	<p style="text-align: center;">23 December 2010</p> <p>Invensys Rail produced the second version of the Leicester re-control scheme plan (version B) which addressed comments made by Invensys Rail's Contractor's Responsible Engineer</p>		

	Signalling or Scheme Plans	Workstation Views	Other events
2011			Start of January 2011 Network Rail operations decided to install telephones at the Merry Lees No.1 & No.2 and Merry Lees No.3 user worked crossings (see figure 7)
	13 January 2011 Network Rail SDG issued the first version of the Leicester interlocking renewal signalling plan		
	1 February 2011 Invensys Rail produced the third version of the Leicester re-control scheme plan (version C) to address comments made by Network Rail (on version B) and then submitted the updated scheme plan to the Minor Scheme Plan Review panel for approval		
	8 February 2011 The Minor Scheme Plan Review panel reviewed the third version of the Leicester re-control scheme plan (version C) and rejected it as there was a risk it did not accurately reflect the signalling equipment that was actually on the ground		
	Start of March 2011 The EMSR project asked Network Rail SDG to produce correlated scheme plans for the Leicester re-control project		
		29 March 2011 A meeting took place, attended by the project team, designers and operators, who checked whether the second draft version of the workstation views met the requirements of the operators	By the end of March 2011 Network Rail installed telephones at the Merry Lees No.1 & No.2 and Merry Lees No.3 user worked crossings. The telephones were tested but were not yet in use
		18 April 2011 Invensys Rail produced the third draft version of the workstation views (version 0.3) to address the comments made at the meeting held on 29 March	
			26 April 2011 The Local Operations Manager at Leicester signal box updated the signaller's panel to show the Merry Lees user worked crossings on it using printed labels and a marker pen
			30 April 2011 Network Rail commissioned the telephones at Merry Lees No.1 & No.2 and Merry Lees No.3 user worked crossings
		13 May 2011 A meeting took place, attended by the project team, designers and operators, who checked whether the third draft version of the workstation views met the requirements of the operators	

Signalling or Scheme Plans	Workstation Views	Other events
<p align="center">29 June 2011</p> <p>Network Rail SDG produced the fourth version of the Leicester re-control scheme plan (version D), using the approved Leicester interlocking renewal signalling plan as its base. This version was issued for independent checking within Network SDG.</p>		
		<p align="center">30 June 2011</p> <p>The Competent Independent Person issued an interim safety verification certificate to the EMSR project</p>
	<p align="center">August 2011</p> <p>Invensys Rail addressed the comments made at the meeting held on 13 May and issued the updated views as the first version of the workstation views (version AT1)</p>	
<p align="center">10 August 2011</p> <p>Network Rail SDG completed its independent checking of the fourth version of the Leicester re-control scheme plan (version D) and copies of this plan were given to attendees of the review meeting planned for 12 August</p>		
<p align="center">12 August 2011</p> <p>A meeting took place, attended by the project team and designers, who checked the re-control project scheme plans produced by Network Rail SDG (version D) against the workstation views designed by Invensys Rail (version AT1). This meeting agreed to move Lindridge Farm user worked crossing from track section T510 to T511 on a view so it corresponded with the scheme plan, not realising there was an error on the scheme plan</p>		
<p align="center">23 August 2011</p> <p>Network Rail SDG addressed the comments made at the meeting on 12 August in the fifth version of the Leicester re-control scheme plan (version E). This version was approved by the Minor Scheme Plan Review panel on this day subject to minor changes being made</p>		
<p align="center">16 September 2011</p> <p>Network Rail SDG addressed the comments made by the Minor Scheme Plan Review panel in the sixth version of the Leicester re-control scheme plan (version F). This final version of the scheme plan was signed off as approved by all the signatories by this date. At this point, ownership of the scheme plan passed from Network Rail SDG to Invensys Rail</p>		
	<p align="center">20 October 2011</p> <p>A meeting took place, attended by the project team, designers and operators, who checked whether version AT1 of the workstation views met the requirements of the operators but these views had not yet been updated to address comments made by the meeting on 12 August</p>	

	Signalling or Scheme Plans	Workstation Views	Other events
	<p>28 November 2011</p> <p>Invensys Rail issued a technical query to Network Rail asking for a decision on what to do about a number of errors found on the version F re-control scheme plans during testing</p>	<p>November 2011</p> <p>Invensys Rail addressed the comments made at the meetings held on 12 August and 20 October and issued the views as an update to version AT1</p>	
	<p>1 December 2011</p> <p>Network Rail issued a response to the technical query informing Invensys Rail that these scheme plan errors were minor so should not be corrected until after the commissioning. The changes to the scheme plans would be made afterwards as an as-built update</p>		
	<p>6 December 2011</p> <p>An Invensys Rail tester raised a test log for further re-control scheme plan errors that had been identified during testing, including a typographical error where T510C was incorrectly named as T511C</p>	<p>6 December 2011</p> <p>An Invensys Rail tester checked the latest AT1 version of the workstation views against the version F re-control scheme plans</p>	
			<p>13 December 2011</p> <p>The Competent Independent Person issued an Entry Into Service Safety Verification Certificate to the EMSR project which was needed for the commissioning to go ahead</p>
		<p>16 December 2011</p> <p>Invensys Rail updated the workstation views to address the comments made during testing and issued the final AT1 version of the workstation views which were to be commissioned on the new signaller workstation</p>	
	<p>19 December 2011</p> <p>Invensys Rail deferred the test log raised by the tester on 6 December, referencing the previous query response from Network Rail on 1 December that stated scheme plan errors were to be corrected as as-built updates after the commissioning</p>		
2012	<p>2 January 2012</p> <p>Testing and commissioning staff from Network Rail and Invensys Rail reviewed all of the open and deferred test logs and agreed to defer the test log raised by the tester on 6 December</p>		
		<p>3 January 2012</p> <p>The Leicester signaller workstation was signed into use with version AT1 of the views, which incorrectly showed Lindridge Farm user worked crossing on track section T511</p>	

Table C1: Key events for part 5 of the East Midlands Signalling Renewals project.

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Department for Transport.

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