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29 March 2017



Mr Andrew Hall  
Deputy Chief Inspector of Rail Accidents  
Cullen House  
Berkshire Copse Rd  
Aldershot  
Hampshire GU11 2HP

Dear Andrew,

**RAIB Report: Derailment at Godmersham, Kent**

I write to report<sup>1</sup> on the consideration given and action taken in respect of the recommendations addressed to ORR in the above report, published on 6 April 2016.

The annex to this letter provides detailed information regarding the action taken in respect of the recommendations. The status of recommendation 1 is **'implementation on-going'**; recommendation 2 is **'implemented by alternative means'**; and recommendations 3, 4 and 5 are **'progressing'**.

We will publish this response on the ORR website on 30 March 2017.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Oliver Stewart', written in a cursive style.

Oliver Stewart

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<sup>1</sup> In accordance with Regulation 12(2)(b) of the Railways (Accident Investigation and Reporting) Regulations 2005

## Initial consideration by ORR

1. All 5 recommendations were addressed to ORR when the report was published on 6 April 2016.
2. After considering the recommendations ORR passed recommendations 1 and 2 to Network Rail; recommendation 3 to Southeastern (LSER) and Govia Thameslink Railway (GTR); recommendation 4 to RSSB; and recommendation 5 to LSER. ORR asked each duty holder to consider and where appropriate act upon the recommendations and advise ORR of their conclusions. The consideration given to each recommendation is included below.
3. ORR also brought recommendation 5 to the attention of operators of passenger, freight and charter trains as it was concluded that there are equally important lessons for them. ORR did not ask these organisations to provide a formal reply.
4. This annex identifies the correspondence with end implementers on which ORR's decision has been based.

### Recommendation 1

*The intent of this recommendation is to improve the fence inspection process such that potentially substandard fences are properly identified for repair or renewal. This might be accomplished as part of the Business Critical Rules review of standards.*

Network Rail should modify its risk rating methodology for fencing inspections to include guidance on:

- a) the design of the fence and its appropriateness for the adjacent land use; and
- b) condition ratings based on objective and relative (benchmarked) criteria.

If necessary, Network Rail should commission research to establish the relevant criteria

### ORR decision

5. Network Rail are reviewing the specification of lineside fencing and the risk model that supports the boundary condition assessment and prioritisation of remedial work. This is to assist Network Rail staff and contractors in assessing the condition and appropriateness of the type of fencing; and to prioritise appropriately any remedial work that maybe required.
6. Any changes to the specification of fencing will be briefed suppliers and changes to the risk model to staff carrying out boundary inspections.
7. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, Network Rail has:

- taken the recommendation into consideration; and
- is taking action to implement it by 31 May 2018 (or 31 May 2019 if further research is necessary).

**Status: *Implementation ongoing.* ORR will advise RAIB when actions to address this recommendation have been completed.**

### **Information in support of ORR decision**

8. Network Rail provided an initial response containing their action plan for addressing the recommendation on 18 July 2016. Following discussion with ORR, Network Rail provided a revised action plan on 6 February 2017 which made the individual stages in the plan clearer and included the addition of a Track Work Information sheet for inspection of the relevant class of boundary measures. The updated response states:

#### Feb 2017

*We are seeking a revision to the original action plan. We have a committed programme in place and if there is no significant draw on our time for other unplanned reasons we are confident in our delivery to the revised deadlines. If unavoidable delay happens, or is expected to, we will advise of this and will submit further revised plans. We, as the Lineside team, recognise the importance of this work to address what we consider to be one of our top issues. We will reinforce this if we are asked to commit resource elsewhere.*

*Because of the delay in implementation of elements of the original action plan, we are inserting an early measure to advise and tackle risk. The rest of the content of the action plans remains the same but we have amended the order in this action plan so that it is simpler to follow.*

*To satisfy this recommendation we intend:*

- *In the short term we will implement a measure to warn and advise of risk. This will be aimed at those carrying out inspection of the boundary asset. This takes lessons from the Godmersham and Dalreoch derailment.*
- *In the medium term investigate and review our controls, specifications & designs. If necessary this will result in reissue of our relevant documents.*
- *In the long term, if it is identified necessary, further research and testing will be sought to assure our controls, specifications and design.*

*Network Rail (NR) uses standard specification of fences which are based on wider industry research and development. We will review the specification of the fences designed to deter livestock incursion to confirm their adequacy and understand how this may reduce over time.*

*The review will consider older designs and specifications reflecting what is currently installed as well as those introduced when a fence is renewed.*

*The action plan for this recommendation is broken into the following steps:*

- i. Issue a Track Work Information (TWI) sheet for inspection of Class III fences. The class III fence is the type associated with control of incursion by livestock and is typically a tensioned wire design with stock proofing measures. When the original action plan was reviewed it was identified that this shorter term step was necessary. There are obvious lessons to learn from the recent derailments which should be shared. This is the first time this matter has been raised as part of our control document hierarchy. It will be important to include the key elements that contribute to a successful inspection.*

*This is planned to be briefed in the March 2017 Briefing cascade with implementation by June 2017.*

- ii. Investigate the specification of fences designed to deter livestock incursion. This is to consider specifications of currently installed designs as well as those introduced at renewal. We will evaluate the effectiveness of the fence when newly installed and how this varies through deterioration, maintenance and refurbishment. Completion by January 2018.*

*Detailed elements of this stage are as follows:*

*Identify Performance and Strength requirements for the fencing classes used to deter livestock incursion.*

*Comment on and, if necessary propose, requirements for the fencing specification. Consult with bodies such as the RSSB and British Standards to clarify requirements.*

*Review testing carried out to prove fencing specifications and comment on adequacy. Consider what has been undertaken to understand how deterioration or intervention affects strength. Where identified necessary to assure the specifications, we will propose further testing required to be carried out in step (vii).*

*We will visit tensioned fences of varying ages and designs. We will estimate how effective they are in their current state. We will endeavour to take account of the amount of maintenance carried out that may have influenced the current effectiveness. We will use this knowledge to inform inspectors so that they are better placed to identify condition, adequacy and intervention required.*

- iii. Evaluate the current risk models included within our current standard for boundary condition assessment and prioritisation of work arising. This will consider the features/failures from previous incidents.*

*We will review current control documents and training material that include any items covering boundary inspection. By June 2017.*

- iv. *We will test alternative scenarios for control measures and risk models. We will propose changes to documents which inform or provide detail on inspection and specification of boundary measures.*

*We will review how specifications are shared and briefed. We will identify improvements for their visibility to the inspection, maintenance renewal and project organisations.*

*We will address any deficiencies by proposing revisions to standard specifications and table the approval/testing process which will be captured in step (vii). By July 2017.*

- v. *We will incorporate changes, generated from steps (i) to (iv), to the suite of control documents and training material for boundary management. This will require approval from any necessary authorising bodies for example Standards and controls group. By January 2018.*
- vi. *We will release and brief modified documents and training material in step (v). This will be aimed at those carrying out boundary inspection but the documents will be relevant to those who manage or renew the boundary measure. By June 2018.*
- vii. *Following step (ii) we will consider and if necessary identify if any field research or testing of fence types is required.*

*Work of this nature is not funded as part of a business plan so we will produce a scope for the research required which will form the basis of a project or 'technology challenge statement' submission within the Chief Engineer organisation. Authorisation for the financial and resource commitment will be required for this to proceed. By April 2018.*

- viii. *If necessary, following step (vii), carry out field research or testing on fencing specifications and design. This is to ascertain adequacy when installed from new and in stages of deteriorating condition. Where changes are necessary to the design associated with standard specifications, these will be amended and circulated within NR and our supplier base.*

*A summary paper of results of research and testing will be produced. It will identify any stages necessary for modification to control documents, specifications and training material. In particular we will alert our training organisation of any requirement for changes to learning material or the competence framework. By September 2018.*

- ix. *Changes from step (viii) will be included into the suite of control documents, specifications and training material for boundary management and gain approval from any necessary authorising bodies.*

*Brief these as part of the control document cascade, especially, to those carrying out boundary inspections. Where we have implemented alternative fencing specifications or designs to deter incursion, we will circulate within Network Rail and also to our suppliers/contractors. By March 2019.*

*The action plan is to include a period, after completion of step (ix), for production, review and sign-off of the closure statement. By 31<sup>st</sup> May 2019.*

*Note - If further research is not required (steps vii to ix) this will be sooner, approximately 31<sup>st</sup> May 2018.*

*The intent of this action plan is to inform, in particular, our boundary inspectors and maintainers to be confident on the choice of condition ratings, fence type and work prioritisation.*

*It is also to give us confidence on the adequacy of current fencing designs and identify changes for future modifications.*

## **Recommendation 2**

*The intent of this recommendation is to improve the railway's response to reports of large animals within the boundary fence in order to reduce the probability, or mitigate the consequences, of any subsequent accident.*

Network Rail should provide clarification for signallers in terms of how they may interpret the Rule Book regarding their response to reports of animal incursions, including guidance on how long to continue cautioning trains and what constitutes being 'sure' that the line is again clear, and re-brief as appropriate

## **ORR decision**

9. Network Rail has examined the issue and concluded it would not be practicable to provide comprehensive criteria to guide signallers' decision in every circumstance to reopen the line after animal incursion. Instead Network Rail have taken action to train signallers in the factors to take into account when responding to animal incursion to a running line. In doing this, ORR consider that Network Rail have taken proportionate action to the risk of trains striking animals.

10. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, Network Rail has:

- taken the recommendation into consideration; and
- provided signallers with training to assist their decision when to reopen the line after animal incursion

**Status: Implemented by alternative means.**

### Information in support of ORR decision

11. On 18 July 2016, Network Rail provided the following initial response:

*Network Rail will address this recommendation through its Operational Development Days for Signallers, which are being held from June to September 2016, raising awareness of the incident at Godmersham (incorporating RED 44 DVD) and providing clarification on responding to reports of animal incursions.*

*The refresher training will involve the discussion and briefing of a number of issues, including: the appropriate steps to take in protecting the line where there has been a report of an animal incursion; steps involved in cautioning trains and how long to continue cautioning trains; when it's appropriate to examine the line and the criteria that needs to be met in order to consider the line is again clear.*

12. Having reviewed the initial response, ORR asked Network Rail to provide an example of the material being briefed to signallers and confirmation of when the programme of refresher training has been completed.

13. ORR reviewed the slides and briefers note being used in the training, but were not satisfied two key points in the recommendation around giving guidance to signallers on:

- how long to continue cautioning trains and
- what constitutes being 'sure' that the line is again.

14. Network Rail subsequently provided a closure statement, but ORR has not yet seen evidence that the briefing being given to signallers addresses the risk of derailment of trains caused by animal incursion.

15. The closure statement, submitted on 13 September 2016, contained the following information:

*Network Rail have completed this recommendation by briefing all signallers and relief signallers via the Operational Development Day. The briefing includes the issue of animals on the line and in particular how a signaller can make sure the line is clear. This briefing is included in the competence briefing cycle for signallers.*

*There is no central mechanism to identify that all signallers have attended although they must do in order to maintain their competence. Network Rail will close the recommendation in CMO with the audit teams to monitor in the routes through the functional audit process.*

### Recommendation 3

*The intent of this recommendation is to reduce the risk of derailment arising from collisions with obstacles for electric multiple units operating exclusively on third rail lines.*

London & South Eastern Railway Limited, in conjunction with Govia Thameslink Railway, Porterbrook Leasing Company Limited and Eversholt Rail Group should develop, and then implement, a programme for retrofitting obstacle deflectors to Electrostar units that are not currently fitted, but are equipped with mountings for such deflectors

## **ORR decision**

### **Southeastern**

16. Southeastern are working with Eversholt Rail to investigate the fitment of obstacle deflectors to units with appropriate fittings. They are planning to complete this work by 'early 2017', but have not yet provided ORR with a time-bound plan.

17. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, Southeastern has:

- taken the recommendation into consideration; and
- is taking action to implement it by early 2017, but has not provided a finalised completion date

**Status: Progressing. ORR will advise RAIB when further information is available regarding actions being taken to address this recommendation.**

### **Information in support of ORR decision**

18. On 5 July 2016 Southeastern provided the following initial response:

*London and South Eastern Railway (Southeastern) has reviewed the Electrostar units which it operates; these are classes 375/3, 6-9 and class 376. Class 375/3 and 6 units are already fitted with obstacle deflectors. Class 376 units are not equipped either with obstacle deflectors or the mountings for such deflectors. Class 375/7-9 units do not have obstacle deflectors but are equipped with the mountings for such deflectors.*

*Southeastern therefore commissioned SNC Lavalin to complete a technical investigation into the potential for fitting obstacle deflectors to class 375/7-9 units. This concluded that retro-fitting was feasible and Southeastern has therefore entered into commercial negotiations with the trains' owners, Eversholt Rail, for this work to be carried out. The final project plan for this work has yet to be agreed, but both parties are working towards implementation in early 2017.*

19. On 13 March 2017 Southeastern provided the following additional information:



*An internal project team was assembled November 2016, to deliver an obstacle deflector fitment program to the Class 375/7-9 sub fleets. Following a risk evaluation workshop a process and bespoke obstacle deflector tooling were developed. A successful first in class fitment was undertaken February 2017. Due to the constraints of material supply and maintenance windows, the obstacle deflector fitment delivery plan will run until June 2017. The program is currently tracking to plan.*

### **Govia Thameslink Railway**

20. GTR have made arrangements with the ROSCO that owns the relevant units to fit obstacle deflectors as part of major overhaul work starting in February 2017. GTR have not yet provided ORR with a time-bound plan indicating when the work is expected to be completed.

21. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, GTR has:

- taken the recommendation into consideration; and
- is taking action to implement it, with a programme beginning in February 2017, but has not yet indicated when the work is likely to be completed

**Status: Progressing. ORR will advise RAIB when further information is available regarding actions being taken to address this recommendation.**

### **Information in support of ORR decision**

22. On 18 July 2016 Govia Thameslink Railway provided the following initial response:

*I can confirm that this was discussed and updated at our period Safety & Environment Executive meeting of Thursday, 14 July and that we have now agreed a quote for this work with the ROSCO, have agreed that this can be rentalised, and that the work to fit obstacle deflectors to the 377/1, 377/3 and 377/4 units will commence as part of their next major overhaul A5 Exam from February 2017. This involves the fitment of 334 deflectors across 167 units, the Class 377/2 units were already so fitted as they worked under AC overhead wires.*

### **Recommendation 4**

*The intent of this recommendation is to address the residual risk of derailment arising from collisions with obstacles for other units on the national network that are not currently fitted with obstacle deflectors, taking a targeted approach by identifying those fleets that are most likely to offer a positive case for fitting of obstacle deflectors.*

RSSB, in consultation with the industry, and involving due industry process, should consider the case for retrofitting obstacle deflectors to units that are not currently equipped, other than those referred to in Recommendation 3 (paragraph 91c). The analysis should include re-evaluation of the findings of previous research in the light of this investigation and select for initial analysis the fleets that are most likely to have a positive case for retrofitting obstacle deflectors.

### ORR decision

23. RSSB have begun a piece of work to ascertain the practicability of fitting obstacle deflectors to units that do not currently have them fitted.

24. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, RSSB has:

- taken the recommendation into consideration; and
- is taking action to implement it, but ORR has yet to be provided with a timebound plan.

**Status: Progressing. ORR will advise RAIB when further information is available regarding actions being taken to address this recommendation.**

### Information in support of ORR decision

25. The minutes of the 17 June 2016 Rolling Stock Standards Committee (RSSC) provided the following information about measures RSSB was taking to assessing the case for retrofitting obstacle deflectors:

*The Chairman said that RSSB had struggled to progress this action due to a lack of supporting data. He had spoken to M Bishop who had suggested that the previous costings for fitting deflectors to the HST fleet could be used and for which he had the information. It was agreed that the costs would be considerably higher for vehicles that had not been built for the fitment of deflectors such as the pre 1994 fleets. Both M Bishop and S Cameron agreed that they would see if they could find the relevant information in their respective company archives. After further discussion it was recalled that deflectors had been fitted to Class 458/5 vehicles when they had been converted from the Class 460 vehicles as a retrospective fitment with the last few years and this information should be readily available.*

26. The most recent update (from the 28 October 2016 RSSC) indicated that Alstom would provide data to Porterbrook to assist the assessment work.

### Recommendation 5

*The intent of this recommendation is to ensure that drivers have continuous access to a railway emergency call facility in the event of an accident that affects the on-board train radio.*

London & South Eastern Railway Limited, in conjunction with Siemens Rail Automation Ltd and Network Rail, should complete their work to understand the nature of the problem with the GSM-R train radio system in this accident, and then implement reasonably practicable measures to ensure that its drivers have the facility to make an emergency call in similar situations in future (paragraph 93b). Examples of such measures may include:

- a) improving the resilience of the GSM-R radio system following an accident such as a derailment;
- b) providing drivers with GSM-R handheld units;
- c) ensuring that all relevant signalbox telephone numbers are stored in drivers' company mobile phones; and/or
- d) providing guidance to drivers on the actions to take if the GSM-R radio becomes inoperative.

On completion of its work, LSER should update the National Incident Report it raised on this matter.

Note: This recommendation may be applicable to other train operators.

### **ORR decision**

27. Southeastern, together with Siemens and Network Rail have carried out research to understand the nature of the problem which prevented the GSM-R radio operating properly at Godmersham. An appropriate modification has been identified and options for implementing it are being explored.

28. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, Southeastern has:

- taken the recommendation into consideration; and
- is taking action to implement it, but ORR has yet to be provided with a timebound plan.

**Status: Progressing. ORR will advise RAIB when further information is available regarding actions being taken to address this recommendation.**

### **Information in support of ORR decision**

29. On 5 July 2016 Southeastern provided the following initial response:

*Southeastern is supporting Network Rail, who are leading the investigation into the GSM-R system behaviour experienced in this incident. Network Rail, Siemens and Southeastern have completed high voltage simulation tests at Siemens' test facility in Chippenham, which confirmed the hypothesis proposed by Southeastern and detailed in the National Incident Report (NIR 3195). This testing is currently being documented by Siemens, and the results*

*being used to develop proposed solutions to the issue. Southeastern will continue to work closely with Network Rail on this issue to identify and implement a solution in a timely manner.*

*Until recently Southeastern provided all drivers with direct access to Network Rail signalling centre telephone numbers via an application on their BlackBerry devices, but this was lost in the replacement of BlackBerries by Windows Phones. Work is now under way to provide apps for both the driver's Windows Phone and their iPads with similar functionality. This work is expected to complete later in 2016.*

30. ORR requested further information from Southeastern about their work on GSM-R radios and when they were planning to provide apps for driver's phones/tablets; and any action being taken in the meantime to provide signallers telephone numbers to drivers. On 29 September 2016, Southeastern provided the following update:

#### GSM-R

*Investigation has identified that the GSM-R radio did not work as the MCB had tripped. The radio at the other end of the four car unit (375703) had also tripped its MCB, although both radios on the attached four car unit (375612) had not tripped. Monitoring data from Stoke TEC indicated the radios MCBs tripped when the train became derailed.*

*When the radio was inspected by Siemens and Southeastern, it was identified that the voltage dependent resistors (VDR) were damaged. This suggests that the radio tripped due to an over-voltage which operated the VDR device. It is believed that the GSM-R system design is a contributory factor. The radio case is connected to earth (running rail), and the case is also connected to the VDR in order to protect the internal GSM-R components against over-voltage. When the train became derailed, the lead vehicle lost its earth return, as all wheels were off the rails. When the vehicle de-rails and is electrically isolated, the chassis return will be raised to line voltage (750V) due to no negative return path, which will cause a potential difference of the line voltage minus control supply (e.g.  $750V - 110V = 640V$ ) across the VDR. The VDR operated at 200V DC, pulling the 110V supply to a direct short to earth allowing greater than 5 amp to flow through VDR, until the MCBs tripped.*

*In the event of a derailment, the radio is unavailable to make the REC, which is a key safety function to prevent further collisions. It is also noted that this issue is likely to cause reliability issues with the GSM-R radios. If the train earth return is high resistance (due to leaves, sand, high impedance bonds etc), then there are likely to be transients which could reduce the operating life of the component. This damage has been seen on other defective radios returned by Southeastern.*

*A tri-party working group (Southeastern, Network Rail and Siemens) has undertaken controlled environment testing, and successfully replicated the fault. However, to date, a solution to this issue has not been identified. This*

*has been escalated to Network Rail's Route Director for the South East as we are concerned at its slow progress.*

### Signal box numbers

*The driver's iPad already has access to the Periodical Operating Notice, which contains the relevant signal box numbers. We do not plan to produce an iPad app. The current Windows phones are not data-enabled and therefore it is not possible at present to place apps on them or even to "push" a list of numbers into their contacts directories. We are still looking at options to provide this information to the phones, which is likely to require them to be data enabled. If this proves to be excessively difficult we will consider other options such as aide-memoirs.*

31. An NIR was circulated to industry by Southeastern highlighting the problem. Southeastern, Siemens and Network Rail have subsequently researched different options of addressing the issue and reached the following conclusion:

*A number of potential options to address the problem were discussed and developed at a workshop hosted by Southeastern on 17th November 2016. This workshop was attended by Engineering representatives from Southeastern, MerseyRail, Govia Thameslink Railway, South West Trains and Freightliner. These options are as follows:*

#### *Option 1*

*Add a thermal fuse (or similar device) in line with each varistor. These fuses will operate when the reported fault occurs, disconnecting the radio from the source of high voltage whilst retaining the power supply and so keeping the radio operative. The effect of the fuse operating is to remove the varistor over-voltage protection on the radio; therefore the radio will also need to monitor the condition of these fuses. This addresses safety and potential reliability issues, however in order to monitor the fuses potentially complex GSM-R hardware modifications would be required.*

#### *Option 2*

*Remove varistor over-voltage protection from the GSM-R radio. This removes the high voltage path experienced during the incident. However, the radio would no longer be protected against high voltage transients on the power supply. This will potentially affect the GSM-R reliability, which Siemens and Network Rail are unlikely to accept.*

#### *Option 3*

*Add a polyswitch on the 110V input to the radio, limiting current flow and so preventing the MCB from tripping. This addresses the safety issue; however the workshop attendees were unsure of the likely effectiveness of this proposal.*

#### *Option 4*

*Add a galvanically isolated DC-DC power supply between the input (TC18) and return (RW16), and add simple isolation devices (e.g.fuses) to each train wire input / output (external to the GSM-R radio). This breaks the available fault path on all circuits through the train radio, so fully addressing the safety issue.*

#### *Preferred Option*

*Option 4 is the preferred option to resolve this issue. This is due to its high likelihood of success, and it being a modification to the rolling stock, rather than the GSM-R radio. This means that only applicable fleets need to be modified, rather than changing all GSM-R radios which are a common component on all fleets. A further advantage is that such a modification need not delay the development of Version 4 of the cab mobile software which is currently under development.*

*When compared to the RAIB recommendation cited on page 4, the author feels that this option is reasonably practicable, and will improve the resilience of the GSM-R radio system following an accident such as a derailment. This option therefore satisfies the demands of RAIB.*