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Ms Carolyn Griffiths
Chief Inspector of Rail Accidents
Rail Accident Investigation Branch
Block A, 2nd Floor
Dukes Court
Dukes Street
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Dear Carolyn

Derailment at Princes Street Gardens, Edinburgh, 27 July 2011

I write to report¹ on the consideration given and action taken in respect of the recommendations addressed to ORR in the above report, published on 30 August 2012.

The annex to this letter provides details of the consideration given/action taken in respect of each recommendation where:

- *Recommendations 1 and 2 are 'In-progress' and ORR will update RAIB by 28 February 2014*
- *Recommendation 3 is 'In-Progress' and ORR will update RAIB by 31 May 2014*
- *Recommendation 4 and 5 are 'In-Progress' and ORR will update RAIB by 31 December 2013*

We expect to publish this response on the ORR website on 19 August 2013.

Yours Sincerely

Chris O'Doherty

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

Initial Consideration by ORR

1. All 5 recommendations contained in the report were addressed to ORR when RAIB published its report on 30 August 2012.
2. After considering the report / recommendations, ORR met with Network Rail on 25 October 2012 and passed all 5 Recommendations to Network Rail asking it to consider and where appropriate act upon them.
3. Details of consideration given and any action taken, in respect of these recommendations are provided below.

Recommendation 1

The purpose of Recommendation 1 is to achieve a standardised procedure for monitoring and recording the degradation of switches at risk of causing derailment and the planning of timely maintenance intervention or renewal of worn components before the limits in the 053 standard are exceeded. [NR/L2/TRK/0053 Inspection and repair to reduce the risk of derailment at switches]

This is particularly necessary for switches in high risk areas such as the approaches to busy stations which are exposed to high levels of wear, where access for inspection and maintenance is limited and where their availability for service is critical.

Network Rail should provide guidance on maintenance intervention limits and their application to manage wear on switch rails as part of its asset management strategy to reduce the likelihood of switches failing the 053 standard and the risk of derailment.

Details of steps taken or being taken to implement the recommendation

4. Network Rail in its initial response on 11 December 2012 advised that:

Network Rail will undertake a cross-discipline review of current guidance on the maintenance of intervention limits and that guidance's application to manage wear on switch rails. With input from systems engineering and modelling specialists the review will consider current literature.

Degradation modelling will be undertaken with the intent of providing qualitative and quantifiable data to enable an improvement of the risk management controls currently employed.

The intention will be to provide improved guidance on maintenance intervention limits and their application.

Timescale: 31 March 2013

5. ORR met with Network Rail on 12 February 2013 and 17 July 2013 to monitor progress. Network Rail produced a paper in March 2013, updated in 30 July 2013 setting out the inter – relationship between Recommendations 1, 2 and 3 and how these are informing Network Rail's development of controls to manage the risk of derailment due to switch wear, progress made, and on-going work to improve the management of derailment risk generally. ORR awaits a detailed programme to support the paper.

6. Network Rail has advised that it continues with modelling analysis to explore the different influences on the wheel / rail interface to better understand the causal factors associated with derailment at facing switches due to rail wear and wheel profile. The analysis is considering both similar and straight turnout configurations and aims to provide guidance on particular high risk switch configurations and risk regions on a switch. The output of this work will be risk based inspection process supported by maintenance intervention limits and safety limits.

7. This work has identified 'technical' maintenance intervention limits and safety limits, dependent on a number of factors (e.g. layout, geometry, speed, tonnage) and Network Rail is now reviewing and refining these before then developing maintenance intervention activities to assist practitioners when scoping repairs. Network Rail has begun a process of consultation and review with Route maintenance practitioners to determine impact, and practicability so they can develop an implementation strategy. The Network Rail S&C team presented the initial proposal to look at a practical solution for recommendation 1 to national RIMD's (Route Infrastructure Maintenance Directors) on the 21 June 2013; this met with positive feedback. Network Rail expects to be in a position to provide timescales when it has completed liaisons with the Routes.

8. Network Rail has advised the following steps to implementation:

1. Issue LOI to apply tighter manufacturing tolerances [**Completed**]
2. Issue briefing pack on switch repair procedures [**September 2013**]
3. Establish switch wear maintenance and safety limits [**October 2013**]
4. Develop inspection plans for monitoring switch deterioration for 'high risk' switches [**November 2013**]
5. Develop implementation plan for the proposed changes and publish maintenance limits [**December 2013**]

Timescale: by December 2013.

ORR Decision

9. After reviewing information received from Network Rail, 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.

Status: In-progress: ORR will update RAIB by 28 February 2014

Recommendation 2

The purpose of Recommendation 2 is to gain assurance that the mechanisms of derailment are fully understood, that these are fully addressed by the inspection procedures in the 053 standard and that the inspection procedures are uniformly applied as intended [NR/L2/TRK/0053 Inspection and repair to reduce the risk of derailment at switches].

- a. Network Rail should carry out a thorough technical review of the 053 standard to satisfy itself that it has a full understanding of how the standard addresses the following:

- the risk of derailment from worn wheels on a switch rail that is compliant with the TGP8 gauge;
 - the practicability of achieving a 1:600 gradient when blending-out a grinding repair of switch rail damage, or for removing a derailment hazard 1; and
 - the potential risk of a ramp being created by the introduction of a switch rail that is failing gauge 2 in the first metre, between a side-worn stock rail and wheel flange, particularly where the wheel flange is in flange contact with the stock rail.
- b. In the short term, Network Rail should also review the scope for misinterpretation and inconsistent application of the standard's requirements and take any necessary action, for example, through briefing and its competence management system, to ensure that there is a common understanding and application of the standard's procedures for inspection and repair.

Details of steps taken or being taken to implement the recommendation

11. Network Rail in its initial response on 11 December 2012 advised that:

Network Rail will undertake a thorough technical review of the NR/L2/TRK/053 standard [Inspection and repair to reduce the risk of derailment at switches].

This will be a cross-discipline review with the intent of challenging all aspects of its content and current understanding of the technique. With input from systems engineering and modelling specialists the review will take account of the wider non-technical factors that affect both how 053 is implemented and the overall effectiveness of risk controls.

Degradation modelling will be undertaken with the intent of providing qualitative and quantifiable data to enable an improvement of the risk management controls currently employed.

A full suite of technical documentation will be produced including an implementation strategy for training and competence development and the delivery of such in the field.

The action plan for this recommendation is inherently linked to, and informs, the Network Rail response for Recommendation 3.

Timescale: 31 March 2014

12. ORR met with Network Rail on 12 February 2013 and 17 July 2013 to monitor progress. Network Rail produced a paper in March 2013, updated 30 July 2013, setting out the inter – relationship between Recommendations 1, 2 and 3 and how these are informing Network Rail's development of controls to manage the risk of derailment due to switch wear, progress made, and on-going work to improve the management of derailment risk generally.

13. Network Rail advised, at the meeting on 17 July 2013, that it has completed its technical review, as set out in Recommendation 2a, and concluded that the fundamental technical requirements of 053 are sound. Network Rail is in the process of completing its report. This will make a number of recommendations largely focusing on how the standard is presented, interpreted and used, pending the

outcome of Recommendation 3. ORR awaits details of this report and Network Rail's proposed actions in response to its recommendations.

14. Network Rail has advised that, in recognition of Recommendation 2b, it is continuing to review the standard's requirements and how these are applied. It has completed the 'desk top' review of the standard, training, and briefing material and is now engaging with maintenance personnel to seek further views to inform the final outcome targeting both inspection and repair activities. Further sessions at training centres are planned commencing in August 2013.

15. The analysis carried out has highlighted the criticality of maintaining the correct switch and stock rail profiles. Network Rail is developing a number of actions to improve the accuracy of inspecting and recording contact angle and subsequent switch grinding activity.

16. In the interim, Network Rail re-affirmed the factors that influenced derailment risk at facing switches in the February 2013 Track Quarterly Standards Brief and issued a Letter of Instruction concerning the use of the TGP8 gauge.

17. Network Rail has advised the following steps to implementation:

1. Produce report confirming that the technical requirements of NR/L2/TRK/0053 are correct [**September 2013**]
2. Issue LOI for the use of the protractor gauge [**October 2013**]
3. Re-brief requirements of existing '053 standard [**December 2013**]
4. Develop plan for full re-write of '053 [**December 2013**]

ORR Decision

18. After reviewing information received from Network Rail, 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.

Status: In-Progress; ORR will update RAIB by 28 February 2014

Recommendation 3

The purpose of Recommendation 3 is to achieve a means for gauging the flange contact angle of switch rails which reduces the reported difficulties of use of the current TGP8 gauge and which engenders greater confidence in the readings obtained.

Network Rail should investigate potential improvements to the TGP8 gauge for conducting detailed inspections to the 053 standard, or develop an alternative means for assessing the flange contact angle of switch rails.

The aim should be to provide a more accurate and objective method for determining a non-compliant flange contact angle on a switch rail and which is more ergonomically suited to on-track conditions of use.

Network Rail should then take steps to implement any improvements identified, or introduce any alternative assessment method, and train/brief staff as necessary.

Details of steps taken or being taken to implement the recommendation

19. Network Rail in its initial response on 11 December 2012 advised that:

The action plan for this recommendation is inherently linked to, and is informed by, the Network Rail response for Recommendation 2. As such Network Rail will assess the appropriateness of equipment to support the derailment risk inspection and associated remediation techniques.

This will include the determination of the suitability of existing equipment and propose alternatives, where appropriate.

The implementation of revised techniques and use of equipment will be considered within the implementation plan referred to in Recommendation 2.

Timescale: 31 March 2014

20. ORR met with Network Rail on 12 February 2013 and 17 July 2013 to monitor progress. Network Rail produced a paper in March 2013, updated on 30 July 2013, setting out the inter – relationship between Recommendations 1, 2 and 3 and how these are informing Network Rail’s development of controls to manage the risk of derailment due to switch wear, progress made, and on-going work to improve the management of derailment risk generally.

21. Network Rail’s Professional Head of Track’s future vision for monitoring switch wear is that it will not rely on the use of the TGP8 gauge at (a minimum) high risk locations. Network Rail is exploring the practicality of a technical solution to inspect facing switches that provides the user with switch condition and ‘go / no go’ indication as part of a re-assessment of how derailment risk is controlled. Network Rail has identified a number of potential solutions that appear capable (with development) of delivering the requirements, informed by the modelling work under Recommendation 1, and is in active engagement with two manufacturers. ORR has asked Network Rail to provide the governance arrangements for this work, and programme of activities.

22. In parallel, Network Rail reports that it is assessing from first principles the appropriateness of current switch wear gauges (1, 2, and TGP8) and is developing a more accurate measure for contact angle by a welders protractor gauge, to build on the information contained in the Track Standards Quality Book (TSQB) in February 2013. Network Rail is also trialling a revised form in one Route to improve data recording and assessment.

Network Rail has advised the following steps to implementation:

1. Provide clarification on the use of the TGP8 gauge [**December 2013**]
2. Action any required changes to the markings on the P8 profile [**October 2013**]
3. Issue LOI for the use of the protractor gauge [**October 2013**]
4. Develop plan for the trial and implementation of a laser based switch profile inspection system [**October 2013**]

23. ORR will be seeking further information from Network Rail as to how it intends to embed the above improvements within their maintenance organisation, and will be actively monitoring progress with action 4.

ORR Decision

24. After reviewing information received from Network Rail, 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.

Status: In-Progress; ORR will update RAIB by 31 May 2014

Recommendation 4

The purpose of Recommendation 4 is to extend the criteria for fitting automatic lubricators to high risk switches which may not qualify for automatic lubrication under current standards.

Network Rail should consider whether the criteria specified in NR/L3/TRK/3510/A01 [Lubrication of Plain Line Running Rails, Check Rails and S&C] for the installation of automatic lubricators on switches should be extended to include the high rails of switches subject to side-wear in areas, such as the approaches to busy stations, where access for maintenance is limited, and where automatic lubrication could slow the development of side-wear and mitigate the risk of derailment.

Details of steps taken or being taken to implement the recommendation

25. Network Rail in its initial response on 11 December 2012 advised that:

As part of the technical review being undertaken to inform the Network Rail response to Recommendation 2 the effects of lubrication will be considered.

Informed by this research the options for mitigating derailment risk in the circumstances described will be determined and appropriate guidance given. This may require revision to NR/L3/TRK/3510/A01 [Lubrication of Plain Line Running Rails, Check Rails and S&C] or indeed alternative technical standards developed.

Network Rail will then take appropriate steps to implement any documented revisions, or introduce alternative technical standards. Training and briefing of staff will be fully considered and implemented as necessary.

Timescale: 31 September 2013

26. At a meeting on 17 July 2013, Network Rail advised that the outcome of its analysis of coefficient of friction is that (unsurprisingly) lubrication significantly increases the margin of safety and reduces the risk of flange climb. However, Network Rail also found that the wheel profile and extent of wear also has a material effect on the margin of safety. Network Rail is developing further analysis of different wheel profiles to understand better the effect of wheel profiles on the margin of safety. It has identified options to revise the requirements of Standard NR/L3/TRK/3510/A01, but that it is reviewing how aggressive lubrication might affect visual and ultrasonic inspection of the rail. This will inform the need for new or alternative methods to reduce friction at switches.

27. In the short-term Network Rail plan to issue clarification and guidance on the existing requirements for lubrication near higher risk switches, the application of lubricants following repair work, and the requirement to remove lubrication build up before a detailed inspection.

In the longer term, it is discussing with Routes the impact of different lubricant types and process on switches and considering different lubricant types.

Network Rail has advised the following steps to implementation:

1. Brief out clarification and guidance on switch lubrication [**September 2013**]
2. Develop short term and longer term policy for the lubrication of switches [**November 2013**]

ORR Decision

28. After reviewing information received from Network Rail, 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.

Status: In-Progress; ORR will update RAIB by 31 December 2013

Recommendation 5

The purpose of Recommendation 5 is to address factors which were also found in the RAIB's investigation of similar derailments at London Waterloo and Exhibition Centre, Glasgow.

Network Rail should review the actions taken in response to the recommendations in the RAIB report 44/2007 [Two derailments at London Waterloo, 11 September and 24 October 2006] to identify why these were insufficient to prevent the recurrence of issues they were intended to address.

The review should include an assessment of how operational expectations of availability for service influence the implementation the 053 standard and consider the need for a reappraisal of how derailment risks at switches are managed to prevent their recurrence in future.

Details of steps taken or being taken to implement the recommendation

29. Network Rail in its initial response on 11 December 2012 advised that:

To address this recommendation a review of the RAIB derailment reports and standards concerning London Waterloo (11/09/06 and 24/10/06) and Exhibition Centre, Glasgow (03/09/07) will be undertaken.

Action plan:

- *Review the Waterloo and Exhibition Centre, Glasgow reports.*
- *Consider whether the Waterloo and Exhibition Centre recommendations as closed met the intent of the report.*
- *Consider whether the recommendations as intended or closed would have mitigated the Princes Street Gardens, Edinburgh incident.*
- *Assess how operational expectations of availability for service (i.e. performance) influence the implementation of the 053 standard.*

- *Assess the human factors associated with the practical implementation of the 053 standard in the 'real world'.*
- *Identify any key issues and next steps to address.*

Timescale: 23 July 2013

30. Network Rail advised ORR on 30 July 2013 that it is progressing the review and that emerging findings are being built into the implementation plans for Recommendations 1 to 4. ORR has not yet seen the output of Recommendation 5, but will review this to ensure relevant findings are built into Recommendations 1 to 4, or are mapped to other work streams.

ORR Decision

31. After reviewing information received from Network Rail, 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.

ORR will write to RAIB it becomes aware that the information above is inaccurate.

Status: In progress, ORR is awaiting confirmation that Network Rail has completed its proposed actions. We will update RAIB by 31 December 2013.