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Mr Andrew Hall
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Dear Andrew,

RAIB Report: Derailment at Porthkerry, South Wales, 2 October 2014

I write to report¹ on the consideration given and action taken in respect of recommendations 1- 3 addressed to ORR in the above report, published on 6 August 2015.

The annex to this letter provides details in respect of each recommendation. The status of all three recommendations is '**Implementation on-going**'. ORR will advise RAIB when further information is available regarding actions being taken to address these recommendations.

We will publish this response on the ORR website by 8 August 2016.

Yours sincerely,

Oliver Stewart

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

Initial consideration by ORR

1. All 3 recommendations were addressed to ORR when the report was published on 6 August 2015.
2. After considering the recommendations ORR passed recommendations 1, 2 and 3 to Network Rail asking them to consider and where appropriate act upon them and advise ORR of its conclusions. The consideration given to each recommendation is included below.
3. ORR also brought recommendation 3 to the attention of other rail infrastructure managers (LU, Nexus, SPT and the HRA) as it was concluded that that there are equally important lessons for them. ORR did not ask these organisations to provide a 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 processes for detecting VLS defects in rails to increase the likelihood of detection before they develop to the extent that they can cause rail failure.

Network Rail should review the methods it uses to verify suspected VLS type defects in rails and make improvements to increase the likelihood of their detection. The methods to be considered should include always using a U8 test when verifying VLS suspects, regardless of the extent of loss of rail bottom signal.

ORR decision

5. ORR did not think Network Rail's initial response contained a sufficiently developed plan to address the risk of failure to detect and manage VLS faults the recommendations were trying to address. Following a meeting with Network Rail's Principal Engineer and Head of Track, a more developed set of outputs and timescales for achieving them have been agreed.
6. 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 13 May 2016.

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

Information in support of ORR decision

7. On 9 February 2016, Network Rail provided the following initial response:

In responding to this recommendation it is important to note that prior to the rail break the rail was known to have a Loss of Rail Bottom (LORB) suspect; identified through manual and train based inspection.

This was assumed to be associated with Rolling Contact Fatigue (RCF) surface damage at the same location which was being managed through proactive rail grinding; a recognised form of mitigation for this type of defect.

What was not fully understood was that the LORB caused by the RCF surface damage was hiding the presence of a VLS within the rail head.

Once the VLS defect was identified by ultrasonic testing 9 weeks before the rail broke, its removal was not mandated by existing standard requirements as no visible cracking or bulging of the rail head was identified.

Therefore whilst the actions taken were compliant within the requirement of Network Rail standards as written at the time the full impact of the combination of adverse factors was not fully understood.

Network Rail has improved the processes for detecting Vertical Longitudinal Splitting (VLS) defects in rails to increase the likelihood of detection before such defects develop to the extent that they can cause rail failure.

This has been addressed in a number of ways:

1. *Review of NR/L2/TRK/055, Rail Testing: Ultrasonic Procedures*
2. *Additional guidance on the use of the Ultrasonic U8 Testing Procedure when confirming a suspected VLS defect*
3. *Introduction of BowTie Risk Management Methodology – Guidance for Frontline teams*
4. *Assurance Monitoring and Trend Analysis*

1. Review of NR/L2/TRK/055, Rail Testing: Ultrasonic Procedures

At the time of the Porthkerry derailment Network Rail had already initiated controls for the management of risk where a repeat 'Loss of Rail Bottom Signal' (LORBS) was identified. This had been introduced on Track Category 1A, 1 and 2 track; Porthkerry is Track Category 4 and therefore this process

was not applicable This followed an earlier review of NR/L2/TRK/055, Rail Testing: Ultrasonic Procedures (Issue 1A, Feb 1998).

The review identified a need to revise the management (testing) of rail where LORBS was identified and further work is currently underway to look at the practicality of applying a similar process to Cats 3 to 6; this is being addressed within the response to Rec 3.

Furthermore a new process to identify the situation where the rail bottom signal is consistently lost, whether due to VLS type defects, surface condition, dipped joints or geometry issues, was introduced into production on 2 December 2013, for Track Categories 1a, 1 and 2. Analysis has shown that the process, if applied, would have successfully identified a number of VLS type breaks and defects before they reached a critical size. The protocol being followed is that:

- Where a LORB signal occurs over a short length in isolation on an individual test run it will not be reported as a suspect - this can occur due to testing conditions which can be difficult to maintain particularly through S&C
- Where a LORB with a length of 150mm or greater occurs at the same location on two test runs it is reported as a P3 suspect requiring verification

The intent of the protocol was to limit the number of new suspects requiring verification whilst identifying potential VLS and surface spalling type defects as early as possible, which may not have been detected under previous reporting rules.

Revision to the analysis procedures was agreed and implemented by Sperry (our UTU testing & analysis provider) and has been in place since September 2013.

Network Rail is currently working with Sperry looking at the impact of rolling this approach out across all lower track categories 3, 4, 5 and 6. However the scope to do so may be compromised as such track categories attract a higher number of LORB suspects not driven by VLS but by track quality and rail profile conditions. This is being addressed within the wider response to RAIB Recommendation 3.

2. Additional Guidance on the Use of the Ultrasonic U8 Testing Procedure when confirming a suspected VLS defect

The ultrasonic U8 testing procedure is a recognised standard procedure and mandated in NR/L2/TRK/055. It is used to verify the presence, or not, of VLS defects when LORB is indicated (Clause 10.6(b) applies).

The review of TRK/055 considered that the need to amend this mandated requirement was unnecessary as it was already within the procedure and

training module although this has been rebriefed – this had been further emphasised in NR/BS/LI/276/U15 where clause 11.2.3 states:

If the loss of rail bottom signal is not caused by any of the examples in 11.2.2 the rail shall be considered suspect. Carry out further investigations using other approved techniques.

U8 being one of the approved techniques.

3. Improved Competency & Training

In association with the review of TRK/055 the opportunity has been taken to engage with Serco to review and update supporting training documents and material for all ultrasonic testing procedures including the testing requirements for the detection of LORB. This has been completed and approved by the appropriate company 'Level 3' BINDT Certification practitioners within both NR & Serco. This has been adopted.

Implementation has taken various forms with new operators being trained at Serco to the new module; existing practitioners will be trained as their competency is due for recertification (up to 4 years) but recognising this a technical brief for all operators was delivered at Route level during late 2014/early 2015. This technical brief included a 'Track Guidance Note' which described the circumstances found at Porthkerry and advocated the use of a U8 hand scan test to be carried out to confirm, or not, the presence and length of any VLS defect.

Briefing of the Track Guidance Note was given at the Quarterly Track Governance and Safety Briefing held on 27th November 2014.

Anecdotal feedback from operators indicates that the clear and intelligible guidance provided within LI/276 has greatly improved their understanding, engagement and execution of the calibration of equipment which directly improves detection.

4. Introduction of BowTie Risk Management Methodology – Guidance for Frontline teams

Through the adoption of the BowTie risk management methodology for significant loss events a continuous improvement approach is advocated. Within the BowTie for 'Broken Rail' the threat of 'Inherent defects (vertical longitudinal splitting) is identified. The following 'Means of Control' are associated with this threat:

- *Remove pre 1976 rail*
- *Visual Inspection*
- *Train borne and manual ultrasonic testing*
- *Use of asset data*

5. Assurance Monitoring and Trend Analysis

The management of rail testing and the review of trends is undertaken on a monthly basis with Network Rail (Engineering and Asset Information) and Sperry. This review seeks to better understand causal analysis and initiate changes to both process, practice and repair.

Conclusion

It is considered that through these actions, and those committed to in our response to Recommendation 3, the intent of this recommendation has been met and therefore CLOSED

8. The ORR panel thought Network Rail's response was not clear on the actions it would take to improve the detection of VLS defects in rails before they could develop to the extent they can fail and cause a derailment. It was agreed to meet with Network Rail to give them the opportunity to explain their thinking.

9. ORR held a meeting with Network Rail Principle Engineer and Head of Track on 11 April 2016. Network Rail agreed to update their response to include the outcome and dates of the two reviews completed on approaches for track categories 3-6.

10. Network Rail also agreed to include in their response consideration of the implications (and any unintended consequences) of mandating U8 inspection to verify or not the presence of VLS when LORB indicated and include within the closure statement the reasoning and actions taken

Recommendation 2

The intent of this recommendation is to improve the process for detection of surface breaking cracks from VLS defects which have been identified as being present in the rail.

Network Rail should improve the detection of surface breaking cracks and head spread. The methods to be considered should include the use of non-destructive test methods such as dye penetration or magnetic particle inspection to look for cracks, particularly at the upper fillet radius.

ORR decision

11. As with recommendation 1, ORR did not think Network Rail's initial response contained a sufficiently developed plan to address the risk associated with the recommendation. Following a meeting with Network Rail's Principal Engineer and Head of Track, a more developed set of outputs and timescales for achieving them have been agreed.

12. 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 30 June 2017.

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

Information in support of ORR decision

13. On 9 February 2016, Network Rail provided the following initial response:

Network Rail recognises that in recent years working with Sperry, (our UTU testing & analysis provider), the detection of suspects which may be surface breaking / head spread has greatly improved.

However the minimum actions and associated timescales for the removal of Vertical Longitudinal Splitting (VLS), as mandated in NR/L2/TRK/001/mod 07 (Table 6), requires challenge. Network Rail will seek to identify options to improve these minimum actions taking due recognition of the ultrasonic testing techniques available, their appropriateness and the potential to adopt alternative methodologies e.g. the use of non-destructive test methods such as dye penetration or magnetic particle inspection to look for cracks.

This will be implemented by:

1. *Understanding the background to and the underlying intent of currently published minimum actions*
2. *Identify the range of potential actions for the management of VLS suspects / defects*
3. *Propose alterations to NR/L2/TRK/001/mod 07 Table 6 at Track Standards Steering Group (TSSG) and progress to publication; with input from key stakeholders*
4. *Confirm outcome with Routes at Quarterly Track Governance and Safety Briefing*
5. *Network Operations (Route) implement identified improvements (if required and with appropriate transfer of recommendation ownership)*

14. ORR held a meeting with Network Rail on 11 April 2016 to discuss the recommendations in the Porthkerry RAIB report. ORR sought clarification from Network Rail on why they were focussing on developing new methods rather than improving existing ones, with the aim of intervening at or before the time that other Non-Destructive Testing (NDT) methods would identify action required. In doing this, Network Rail need to demonstrate that they have properly considered alternatives (in particular MPI and dye-penetrant) and provide narrative to support their conclusions.

Recommendation 3

The intent of this recommendation is to improve the process for detection of surface breaking cracks from VLS defects which have been identified as being present in the rail.

Network Rail should improve the detection of surface breaking cracks and head spread. The methods to be considered should include the use of non-destructive test methods such as dye penetration or magnetic particle inspection to look for cracks, particularly at the upper fillet radius.

ORR decision

15. The ORR panel was not confident from Network Rail's initial response that they had a reliable method to understand the volume and location of pre-1976 rail.

16. ORR held a meeting with Network Rail's Principal Engineer and Head of Track on 11 April 2016 to discuss the recommendations in the Porthkerry RAIB report. Network Rail have agreed to submit a revised plan by 13 May 2016, addressing ORR's concerns over the reliability of their proposed method for understanding the volume and location of pre-1976 rail.

17. 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 9 December 2016.

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

Information in support of ORR decision

18. On 9 February 2016, Network Rail provided the following initial response:

Network Rail will undertake an assessment of the risk of having unidentified pre-1976 rail in use in track, including sites where cascaded rail has been installed.

There are 2 distinct actions:

- *Develop a risk based matrix / decision tool to inform / guide Routes in this respect with particular consideration being given to Track Category*
- *To share best practice where it is proven that changes to route characteristics e.g. enhancement, however subtle, may increase the risk of rail breaks*

This recommendation will be informed by Network Rails Formal Investigation into the Porthkerry Derailment; Recommendation A6.1.

This will be implemented by:

- 1. Understand the volume and location of pre-1976 rail using rail profile measurement data to identify older 109 and 110lb rail sections; overlaying with known RCF sites*
- 2. Develop a risk based strategy for management of such rail at susceptible sites against a pre-determined risk matrix*
- 3. Confirm outcome with Routes*
- 4. Develop supporting documentation to initiate mandation (if required)*
- 5. Network Operations (Route) to confirm implementation (if required and with appropriate transfer of recommendation ownership)*

The significance of using available data sources to inform this assessment will be considered and it is recognised that these may require enhancement e.g. data verification.

Reference to the BowTie Means of Control (MoC) 'Remove pre 1976 rail' will be a key consideration especially when seeking to improve its effectiveness.

19. The ORR panel was not sufficiently confident from Network Rail's initial response in the reliability of the method they were proposing to use to understand the volume and location of pre-1976 rail. Network Rail were planning to use rail profile measurement data to identify older 109lb and 110lb rail sections and overlaying this with known RCF sites.
20. ORR held a meeting with Network Rail on 11 April 2016 to discuss the recommendations in the Porthkerry RAIB report. Network Rail agreed to submit a response covering the following key areas:
 1. greater detail on how the Routes will identify pre '76 rail and actions being taken (at Route or STED level) to demonstrate rigour and consistency in the methods utilised
 2. the reliability of the proposed identification methods, and hence the likelihood that undetected pre'76 rail remains in track
 3. the timescales for the completion of the identification activity and
 4. provide a view as to the level of residual risk (associated with unidentified rail) and how this is managed by existing BAU processes (e.g that unknown pre '76 rail would be id'd if LORBS found by UTU etc; and appropriate action taken). As the recommendation makes specific

reference to cascade sites, the statement should also explicitly make comment on how unidentified rail has been mitigated in such sites.