

Chris O'Doherty
RAIB Relationship and Recommendation Handling
Manager

Telephone: 020 7282 3752
email: chris.o'doherty@orr.gsi.gov.uk



17 July 2012

Ms Carolyn Griffiths
Chief Inspector of Rail Accidents
Rail Accident Investigation Branch
Block A, 2nd Floor
Dukes Court
Dukes Street
Woking GU21 5BH

Dear Carolyn

Accident Falls of Cruachan, Argyll

I write to report on the 6 recommendations addressed to ORR in the above report, published on 14 July 2011.

The annex to this letter provides details of the consideration given/action taken in respect of each recommendation where recommendations 2 -6 have been implemented¹ and recommendation 1 is in progress.

We do not propose to take any further action in respect of recommendations 2 -6 unless we become aware that any of the information provided becomes inaccurate, in which case I will write to you again². We expect to update you with progress on recommendation 1 by November 2012.

Yours Sincerely

Chris O'Doherty

¹ In accordance with Regulation 12(2)(b)(i)

² In accordance with Regulation 12(2)(c)



Initial Consideration by ORR

All 6 recommendations contained in the report were addressed to ORR when RAIB published its report on 14 July 2011.

After considering the report / recommendations, on 15 August 2011, ORR passed:

- Recommendations 1 to 5 to Network Rail; and
- Recommendation 6 to First ScotRail

asking them to consider and where appropriate act upon them.

Details of consideration given and any action taken, in respect of these recommendations are provided below.

ORR also brought recommendations 1 to 5 to the attention of London Underground, The Heritage Rail Association, Tyne and Weir Metro (Nexus) & HS1 and recommendation 6 to the attention of other train operating companies and the Heritage Rail Association to bring to the attention of its members.

Recommendation 1

The intention of this recommendation is to ensure that for earthworks in Scotland sufficient vegetation clearance is undertaken to allow adequate examination and evaluation of slopes to determine their condition.

In respect of earthworks in Scotland, Network Rail should review its existing arrangements for the clearance of vegetation to enable examinations and evaluations of earthworks to be carried out.

If this review indicates that the current arrangements do not enable a sufficient understanding of their condition of earthworks to be obtained, and if there is no alternative means of assessing the risks associated with such slopes, Network Rail should define the extent of vegetation clearance that is required to enable examinations and evaluations to be carried out, and then implement a strategy for achieving it (paragraph 137a).

Details of steps taken or being taken to implement the recommendation

1. Network Rail in its initial response on 6 September 2011 advised that:
A review of existing arrangements will be undertaken and appropriate actions taken if the existing arrangements are found to be inadequate for determining the condition of the earthwork.

Timescale: 16 December 2011

2. ORR in consideration of Network Rail's initial response concluded it needed sight of the outcomes and actions from Network Rail's review and therefore wrote to Network Rail on 20 September 2011 seeking this information.
3. Network Rail in its response on 23 December 2011 advised that:

The impact of vegetation on examination activities in Scotland & nationally has been assessed and the process and plans for de-vegetation to facilitate earthwork examinations has been strengthened and briefed to all parties.

The earthworks database system has been upgraded to capture sites requiring vegetation clearance and report incomplete examinations due to vegetation.

Controls have been added to avoid the scoring of incomplete examinations.

Clearance of vegetation to allow examination in accordance with NR/L3/CIV/065 [Examination of Earthworks] is carried out by a vegetation contractor. This is then followed by an earthwork examination by the CEFA [Civil Engineering Framework Agreement] examination contractor.

4. ORR in consideration of Network Rail's response on 23 December 2011 concluded the response did not provide enough detail on what was strengthened and how it was briefed to all parties.

5. ORR met with Network Rail Scotland Route on 15 May 2012 to discuss this recommendation. At the meeting Network Rail described its revised arrangements for ensuring that, where necessary, slopes are sufficiently de-vegetated to facilitate proper examination of earthworks and it plans to monitor the effectiveness of the revised arrangements.

6. At the time of the meeting the de-vegetation in accordance with the revised arrangements had yet to begin.

7. Network Rail agreed to formally provide ORR with appropriately detailed clarification of how the process and plans for de-vegetation to facilitate earthworks examinations has been strengthened and briefed to all parties.

8. ORR is awaiting a response from Network Rail.

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.

ORR is considering Network Rail's responses and will update RAIB in November 2012.

Status: *In-progress – Update to be provided in November 2012.*

Recommendation 2

The intention of this recommendation is that where a cutting comprises mixed ground of soil and rock, all parts of the slope should be examined and reported.

In respect of all cuttings equal to, or greater than, three metres high through mixed ground of soil and rock, Network Rail should implement arrangements so that (paragraphs 137b and 139b):

- a. in accordance with NR/L3/CIV/065 [examination of earthworks], examination results are reported for both the soil and rock materials; and
- b. both the soil slope hazard index [SSHI] and the rock slope hazard index [RSHI] are reported.

Details of steps taken or being taken to implement the recommendation

10. Network Rail in its initial response on 6 September 2011 advised that:
Arrangements will be implemented such that examinations are reported and recorded for cuttings equal to, or greater than, three metres high through mixed ground of soil and rock.

Timescale: 28 October 2011

11. ORR in consideration of Network Rail's initial response concluded it needed sight of the arrangements to be implemented and therefore wrote to Network Rail on 20 September 2011 seeking this information.

12. Network Rail in its response on 23 December 2011 advised that:
As part of the annual briefing of examination related issues on 10th October 2011, the Civil Engineering Framework Agreement (CEFA) contractor (AMEY) was briefed on the requirement for reporting soil and rock materials in accordance with NR/L3/CIV/065. The briefing, see Items for General Discussion points 5 and 6, addressed both elements of this recommendation.

Discussion Point 5: Examination of all earthworks within the specified 5-chain length, including RHSI or SSHI [Rock Slope Hazard Index or Soil Slope Hazard Index] where pre-existing records are not present but the material type is present and could pose a risk to the railway)i.e. rock outcrops of <2m should still get an examination). There is an on-going commercial issue regarding payment for multiple earthworks sections within a 5 chain length.

Discussion Point 6: Rock slope examinations to be carried out even where rock outcrops are indistinct and discontinuity information cannot be collected. See examples from OBN2 line. Remind examiners that they need to look at historic comments and do the risk assessment. Two examples from Scotland discussed. To be included in EE [Earthwork Examiner] training.

13. ORR in consideration of Network Rail's response on 23 December 2011 concluded the response did not address the recommendation and wrote to Network Rail on 2 February 2012 saying that: 'It appears that the current standard (which predates the incident and has not subsequently been amended to implement the RAIB recommendation) still conflicts with the requirement defined in Recommendation 2; and no evidence has been presented that the CEFA contractor has been instructed to examine in accordance with the requirements of the recommendation rather than

the requirements of NR/L3/CIV/065. ORR cannot therefore accept that this recommendation has been complied with. ORR would therefore appreciate it if you would review the current position and **either** provide clear and unambiguous evidence that RAIB recommendation 2 has been implemented **or** provide a clear statement of the steps which Network Rail intends to take (with firm timescales) in order to implement the recommendation.'

14. Network Rail its response on 6 February 2012 advised that:

Network Rail now finds recommendation 2 ambiguous. The recommendation actually states that Network Rail should implement arrangements... "in accordance with NR/L3/CIV/065"... and provide examination reports for both the soil and rock materials. Network Rail's interpretation of the recommendation was to reinforce the requirements of the existing standard and not that it was recommending that Network Rail changed it.

Network Rail will clarify the position with RAIB and if necessary provide a standard change and a revised plan to close out the recommendation.

15. Network Rail in its response on 28 February 2012 advised that:

Network Rail's interpretation of the Recommendation 2 remains as previously stated i.e. "to reinforce the requirements of the existing standard" which Network Rail feels has been achieved.

However, following a further review and discussions with the RSHI Development Group (that was established following Cruachan) Network Rail has proposed a change to standards such that for mixed slopes, in excess of 3 metres height, a condition rating will be established and reported for both rock and soil.

The programme for making the changes are:

- 1) Proposal to Standards Steering Group 28th February 2012; and*
- 2) The Standard Change will be progressed and, subject to stakeholder review, will be published in September 2012 such that it is in force for the next examination season.*

ORR Decision

16. 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: Network Rail is taking action to implement the recommendation

Recommendation 3

The intention of this recommendation is to improve Network Rail's management of its earthworks by requiring examiners and examining engineers to give their professional judgement on the condition of earthworks; to take that judgement into account when managing earthworks; and to resolve any inconsistencies between successive condition ratings determined from the SSHI or the RSHI

Network Rail should amend its earthworks management system so that: (paragraphs 137g and 139c):

- a. earthwork examiners and earthwork examining engineers record on all examination reports whether, in their professional judgement, the condition ratings determined by the SSHI and RSHI are a reasonable reflection of slope condition;
- b. where examiners and examining engineers disagree with the SSHI and/or RSHI condition ratings, their judgement of the slope condition rating should be recorded on the examination report and taken into account when deciding how to manage the earthwork; and
- c. any inconsistencies between condition ratings from successive examinations should be identified and resolved.

Details of steps taken or being taken to implement the recommendation

17. Network Rail in its initial response on 6 September 2011 advised that:

The first two bullet points cover the same topic. It is proposed to address them jointly by making provision in the data collection and reporting tools and processes to record any disagreements with the SSHI/RSHI calculated condition ratings. Inconsistencies between condition ratings from successive examinations will be reported and actioned accordingly.

Timescale: 28 October 2011

18. ORR in consideration of Network Rail's initial response concluded it needed sight of the details of the provision to be introduced to the data protection and reporting tools and processes and therefore wrote to Network Rail on 20 September 2011 seeking this information.

19. Network Rail in its response on 23 December 2011 advised that:

This recommendation has been addressed through the issue on 2nd December 2011 of Letter of Instruction NR/BS/LI/246 [Change in Earthwork Condition]

20. Network Rail provided ORR with a copy of the letter of instruction. Extract from letter of instruction:

(2) Scope: This letter of instruction applies to the type of earthwork and the types of Examination that fall within the scope of NR/L3/CIV/065: Examination of Earthworks.

(3) Changes: Clause/sub clause 6.2.2 Review / add new text following the initial paragraph: The report of an examination could indicate that the condition of an Earthwork (over a 5 chain length) has improved from that reported in the preceding

examination. In such cases, the condition rating reported in the preceding examination shall be retained until that earthwork is next evaluated.

The Earthwork Examiner shall identify and comment on any apparent inconsistency between the condition ratings reported in successive examinations of an earthwork. The comments on such an inconsistency shall be recorded in the comment field of the (latest) examination report.

The Earthwork Examiner shall report each instance where the Soil Slope Hazard Index (SSHI) or Rock Slope Hazard Index (RSHI) does not seem to correctly describe the condition of a slope. For each case, the reasons for the inconsistency shall be recorded in the comment field of the examination report.

Clause/sub clause 6.4.2 Methodology (for undertaking an evaluation) / add additional bullet point: • comments of the Earthwork Examiner on inconsistencies in the reported condition rating. (see 6.2.2)

ORR Decision

21. 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
- has taken action to implement it.

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

Status: *Implemented*

Recommendation 4

The intention of this recommendation is to identify whether the process for planning remediation works which includes the use of the Earthworks Prioritisation Model could be changed to improve the likelihood of remedial works being carried out before failure occurs.

In the light of experience, and the associated application of professional judgement, Network Rail should review the process for planning remediation works which includes using the Earthworks Prioritisation Model and, if necessary, make any changes to it so that the likelihood of remedial works being carried out before the occurrence of the failure of earthworks is improved (paragraphs 138 and 139a).

Details of steps taken or being taken to implement the recommendation

22. Network Rail in its initial response on 6 September 2011 advised that:
A review of the pre-existing condition ratings for historic failure sites will be undertaken, and also the work flow process and timeline, to inform on any trends

which could impact adversely on the timing of interventions relative to safe asset performance. The use and application of the Earthworks Prioritisation Model will be considered in the review.

Timescale: 29 February 2010

23. ORR in consideration of Network Rail's initial response concluded it needed sight of the outcomes and actions from Network Rail's review and therefore wrote to Network Rail on 20 September 2011 seeking this information.

24. Network Rail in its response on 30 April 2012 advised that:

The Earthwork Prioritisation Model has been updated into separate Earthwork Policy Charts for soil cuttings, rock cuttings and embankments; Prioritisation of work to soil and rock cuttings has been raised relative to work to embankments in order to better address cutting safety risk.

These Earthwork Policy Charts are included in the Earthwork Asset Policy and are now used for prioritisation of earthwork preventative schemes. Pre-existing condition ratings for historic failure sites and planned repair schemes were reviewed as part of the development of Earthwork Policy Charts.

25. ORR in consideration of Network Rail's response concluded it lacked sufficient detail to demonstrate that it had carried out a review of the process for planning remediation works and made adequate changes so that the likelihood of remedial work being carried out before a failure of earthworks is improved and therefore wrote to Network Rail on 16 May 2012 seeking a more detailed explanation on what changes are being made to the process and how it will achieve the intention of the recommendation.

26. Network Rail in its response on 18 June 2012 advised that:

In response to this recommendation a review was undertaken to establish whether there were many other sites where failure had occurred prior to the commencement of planned intervention works. A review of the business plan against a sample of failures determined that this unusual and has occurred very infrequently.

Since the failure at Cruachan, the 'GISMO' [Geographical Information System – mobile] examination data collection tool to provide the examiner with additional information, historic failure and derailment for all assets has been enhanced. This will further support the Examining Engineer on site in his scoring and consideration of slope attributes and risks. The Earthworks Examination standard, NR/L3/CIV/065 [Examination of Earthworks] Issue 3 June 2012, to improve the recording of condition data for mixed slopes has also been modified. Both these changes will improve the assessment of the condition and potential risk posed by slopes and support improved planning and timing of interventions.

In order to move to a more risk based approach and support the planning of remediation works going forward risk matrices for rock cuttings, soil cuttings and embankments that build on the existing RSHI and EPM [Earth Works Prioritisation Model] have been developed. To support this approach, an EPM score for all assets

has been calculated, not just those being considered, for an investment paper, in either next year's plan or a control period plan. The risk matrices have been built into our draft SBP [Strategic Business Plan] policy and are being used for workplan development in the Routes.

The risk matrices enhance the Route Asset Manager's planning capability for managing the portfolio of rock slopes, soil slopes and embankments.

At the present time there is no industry model that will accurately predict exactly when a failure on a rock slope will occur. The RSHI, Earthworks Prioritisation Model (EPM) and Risk Matrices are tools to support the experienced engineer in the evaluation process of the risks and priority for any particular slope. However, the decision on slope selection for remediation and on the timing of the proposed intervention works is made an experienced geotechnical engineer or geologist. The engineer may choose to deploy monitoring, additional exams, TSR's [Temporary Speed Restrictions] or other control measures that he considers are necessary to safely manage the railway operations between slope defect detection and completion of remediation works. The choices and timing of mitigations and interventions are made by the engineer using his professional experience, knowledge, skill, care and diligence

The RSHI, EPM and risk matrices tools are under constant review and will continue to be improved in light of experience, feedback from the Routes and Network Rail's continuous analysis of asset performance.

With respect to the Oban branch, some £7 million pounds of work was in the CP4 [Control Period 4: 2009-2014] Business Plan prior to the occurrence of the derailment, much of this was concentrated in the Pass of Brander area and whilst it is the case that this incident would not have occurred had intervention works been undertaken, Network Rail has generally been successful in intervening prior to failure in the remaining works in the CP4 Business Plan'.

ORR Decision

27. 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
- has taken action to implement it.

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

Status: *Implemented*

Recommendation 5

The intention of this recommendation is to improve the calculation of the rock slope hazard index so that it gives a more realistic indication of a railway rock cutting's condition.

Network Rail should review the algorithm which calculates the rock slope hazard index so that its output gives a more realistic indication of a railway rock cutting's condition (paragraph 139c).

Details of steps taken or being taken to implement the recommendation

28. Network Rail in its initial response on 6 September 2011 advised that:

A review of the pre-existing condition ratings for historic rock cutting failure sites will be undertaken to inform on any trends which could impact adversely on the management of safe asset performance.

Any required change of the RSHI [Rock Slope Hazard Index] system, determined by the review, will be phased such that any new requirements, to deliver safety improvements, are planned for delivery in a sustainable and prioritised manner.

Timescale: 30 March 2010

29. ORR in consideration of Network Rail's initial response concluded it needed sight of the outcomes and actions from Network Rail's review and therefore wrote to Network Rail on 20 September 2011 seeking this information.

30. Network Rail in its response on 22 June 2012 advised that:

Two changes have been made to date with respect to rock slope examinations. These are related to the rock volume and the consequent algorithm score and a revision to NR/L3/CIV/065 which addresses mixed ground i.e. soil and rock.

A Network Rail rock slope examination development group has also been established and a consultant has been commissioned to further develop RSHI as outlined in the presentation.

31. Network Rail provided a presentation that provides an update on its responses to recommendation 5.

32. Extracts from presentation:

33. *Rock Volume failure range in RSHI parameter library was modified in 2011 to increase RSHI score for observed size of block failure on a rock slope or at toe of slope (see table):*

<i>Original Range (m³)</i>	<i>New Range (m³)</i>	<i>Score</i>
<i>< 1</i>	<i>< 0.1</i>	<i>1</i>
<i>1 - 3</i>	<i>0.1 - 1</i>	<i>4</i>

3 – 6	1 - 3	9
6 – 10	3 - 6	16
10 – 50	6 – 10	20
> 50	> 10	25

Network Rail Standard NR/L3/CIV/065 Examination of Earthwork has been changed (publication 2nd June'12) to better specify examination of mixed rock and soil geology slopes such as at Falls of Cruachan.

Both an SSHI and RSHI examination shall be determined for rock and soil slopes.

Solutions

- *Change to RSHI rock volume will increase RSHI score for sites with rock blocks in cess*
- *The revision to the 065 Standard will clarify the requirement to carry out a rock slope examination for all mixed geology slopes (soil and rock slopes) which have rock outcrops*
- *Starting with last year examination season (2011/12), Examiners have been instructed to do an RSHI exam for all slopes with rock present*

ORR Decision

34. 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
- taken action to implement it

ORR is considering Network Rail's responses and will update RAIB in September 2012

Status: *Implemented*

Recommendation 6

The intention of this recommendation is to reduce the risk of lighting diffusers and other saloon interior panels becoming displaced and causing injuries to persons on board trains in the event of an accident.

First ScotRail should assess the risk of lighting diffusers and other saloon panels in the interiors of trains that it operates becoming displaced in the event of an accident such that they may cause injuries to those on board. Any necessary remedial measures to reduce the risk should be implemented (paragraph 139d).

This recommendation may also apply to other train operating companies.

Details of steps taken or being taken to implement the recommendation

35. First ScotRail Ltd in its initial response on 30 September 2011 advised that:
First ScotRail has undertaken a risk assessment of lighting diffusers and interior panels becoming displaced in the event of an accident, which detail the control measures it has taken or plans to take.

36. First ScotRail provided ORR with a copy of its risk assessment: Reference No. FSR/RA/505 'Risk of Lighting Diffusers and Saloon Panels Becoming Displaced in the Event of an Accident'.

Class 156 Conclusion: *Cable ties are now fitted across the fleet which has increased the security to an acceptable level. The VMI also includes a check of lighting diffuser security.*

VMI should be updated to include security checks of saloon panels.

Class 158 Conclusion: *VMI jobs need to be updated to include security checks of lighting diffusers and saloon panels*

Saloon ceiling panels do not require any action.

Class 170 Conclusion: *Although no counter measures are required it would be good practice to update the VMI jobs to include security checks of lighting diffusers and saloon panels.*

Saloon ceiling panels do not require any action.

Class 314 Conclusion: *Although no counter measures are required to decrease the risk it is good practice to to update the VMI jobs to include security checks of light fitting covers and saloon panels.*

Saloon ceiling panels do not require any action.

Class 318 Conclusion: *Although no counter measures are required, as good practice the VMI jobs need to be updated to include security checks of lighting diffusers and saloon panels.*

Cable ties should also be fitted to budget locks to increase security of the diffuser as these are a similar to the 156.

Saloon ceiling panels do not require any action.

Class 320 Conclusion: *Although no counter measures are required, as good practice the VMI jobs need to be updated to include security checks of lighting diffusers and saloon panels.*

Cable ties should also be fitted to budget locks to increase security of the diffuser as these are a similar to the 156 and 318.

Saloon ceiling panels do not require any action.

Class 334 Conclusion: Although the hazard rating cannot be reduced, as good practice the VMI jobs need to be updated to include security checks of lighting diffusers and saloon panels.

Saloon ceiling panels do not require any action.

Class 380 Conclusion: Although the hazard rating is acceptable it is still good practice to update the VMI jobs to include security checks of lighting diffusers and saloon panels.

Saloon ceiling panels do not require any action.

MK II Sleeper LHCS: Although the hazard rating is acceptable VMI jobs need to be updated to include security checks of lighting diffusers and saloon panels.

Saloon ceiling panels do not require any action.

MK III Sleeper LHCS: Although the hazard rating is acceptable VMI jobs need to be updated to include security checks of lighting diffusers and saloon panels.

Saloon ceiling panels do not require any action.

Summary: In general the fleets have a risk rating of either tolerable or acceptable. The VMI for all fleets has to be updated to include a security check of saloon panels and light diffusers. Cable ties will also be fitted to fleets where possible.

37. First ScotRail Ltd in its response on 5 December 2011 provided ORR with its programme to update the Vehicle Maintenance Instructions:

Class	Actions	Comments / Status
156	VMI to update to include security check of saloon panels.	VMI has been updated and issued.
158	VMI to update to include security check of saloon panels including diffusers.	VMI has been updated and scheduled for issue August 2012..
170	VMI to update to include security check of saloon panels including diffusers.	VMI has been updated and scheduled for issue August 2012.
314	VMI to update to include security check of saloon panels including diffusers.	VMI has been updated and issued.

318	<i>VMI to update to include security check of saloon panels including diffusers.</i>	<i>VMI has been updated and issued.</i>
320	<i>VMI to update to include security check of saloon panels including diffusers</i>	<i>VMI has been updated and scheduled for issue July 2012</i>
334	<i>VMI to update to include security check of saloon panels including diffusers.</i>	<i>VMI has been updated and scheduled for issue July 2012.</i>
380	<i>VMI to update to include security check of saloon panels including diffusers.</i>	<i>VMI has been updated and scheduled for issue August 2012.</i>
<i>MKII LHCS</i>	<i>VMI to update to include security check of saloon panels including diffusers.</i>	<i>VMI has been updated and scheduled for issue July 2012.</i>
<i>MK III LHCS</i>	<i>VMI to update to include security check of saloon panels including diffusers.</i>	<i>VMI has been and scheduled for issue July 2012.</i>

ORR Decision

38. After reviewing information received from Network Rail, ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, First ScotRail has:

- taken the recommendation into consideration; and
- taken action to implement it.

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

Status: *Implemented*