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Ms Carolyn Griffiths
Chief Inspector of Accidents
Cullen House
Berkshire Copse Road
Aldershot
Hampshire GU11 2HP

Dear Carolyn

RAIB report: Collision between a train and a lorry and trailer on Llanboidy automatic half barrier level crossing

I write to report¹ on the consideration given and actions taken in relation to the recommendations addressed to ORR contained in the above report which was published on 27 September 2012.

The annex to this letter provides the detail of the consideration and actions where recommendation 1 has been implemented by alternative means, recommendation 2 is subject to non implementation², recommendations 4, 5 and 6 have been implemented³ and recommendation 3 is in progress.

We expect to update you on recommendation 3 by 31 January 2014. We do not propose to take any further action in respect of recommendations 1, 2, 4, 5 and 6 unless we become aware of an inaccuracy in which case I will write to you again.

We expect to publish this response on our website on 16 August 2013.

Yours sincerely

Chris O'Doherty

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

² In accordance with Regulation 12(2)(b)(iii)

³ In accordance with Regulation 12(2)(b)(i)

Initial Consideration by Network Rail

1. All 6 recommendations in the report were addressed to ORR when the report was published on 27 September 2012. After considering the report and its recommendations we passed the recommendations on as follows:
 - Recommendations 1, 3 and 4 to Network Rail;
 - Recommendations 5 and 6 to Alstom and Angel Trains;
2. Asking those organisations to consider and where appropriate act upon them and advise ORR if their conclusions.
3. Recommendation 2 was directed to ORR. The consideration given and actions taken are presented below.

Recommendation 1

The purpose of this recommendation is to make the crossing, as viewed by a road user, more closely parallel to the rest of the road and hence provide a clear exit if the user is on the crossing when the barriers start to lower.

Network Rail should develop an alternative arrangement for Llanboidy level crossing to reduce the apparent misalignment of the road over the crossing relative to the approaches and to bring the road markings and positioning of equipment including road traffic signals into compliance with current traffic signs regulations. Having developed a suitable design, Network Rail should propose to the ORR a revision of the Llanboidy level crossing order accordingly

Actions taken or being taken to address the recommendation

3. In a response received on 11 December 2012 Network Rail explained:

Consideration has been given to developing an alternative arrangement for Llanboidy level crossing.

A post incident review of the layout of the level crossing has been undertaken and it was considered that the only aspect of the level crossing that is contrary to any regulations (Department of Transport's Railway Construction and Operation Requirements – Level Crossings) is the position of the wig-wag and lights to the edge of the carriageway. Therefore, adjustments will be made to the wig-wag/light unit backboard in order to bring its position in line with these regulations. Endorsement will be sought from the ORR, although it is not anticipated that this will require a revision of the legal level crossing order. The timescale estimated to complete this work is 31 December 2012.

The centreline of the road over the crossing was calculated as being aligned at an angle of only 6 degrees; this appears to be marginal and is clearly unrelated to the violation made by the lorry driver who ignored the safety instructions as well as violating other traffic regulations. The road markings were renewed post event, as a matter of routine, in line with the level crossing order and ground plan. There are no other modifications to the crossing layout or design that are considered to be reasonably practicable in reducing risk; however this will be reviewed with the ORR.

The Operations Risk Advisor (ORA) for Wales has been in consultation with Charles Twitchett from the ORR in Wales, and arrangement has been made for a site visit to consider what, if any, further changes would be reasonable to implement, following the minor modification to the wig wag on the down side, which has now been completed. The ORA for Wales has agreed to confirm the actions of Network Rail to ORR in Wales – explaining what Network Rail have done and what future activities are planned.

4. ORR visited Llanboidy AHB on 22 January 2013 and made the following observations to Network Rail:

- Further adjustment of the ZN road traffic signal was required to achieve the clearance required to minimise the likelihood of damage from passing vehicles. ORR estimated this to be approximately a further 200mm back from the carriageway
- The centre of the carriageway markings at the crossing and on the approaches did not comply with the current (1992) level crossing order. ORR explained these should be remarked, along with the relevant footway markings according to the ground plan
- The cattle cum trespass guards should be checked to ensure that the 2.6 m width is achieved throughout the width of the crossing.
- The crossing surface was in poor condition. Significant remedial work was required to ensure that the surface remained in a good and even condition as specified in the order
- The YN road traffic sign was partially obscured by the boundary fence line. To improve the visibility for road users the traffic light should be raised slightly and/or the fence line at the change of gradient should be lowered.

5. Network Rail provided further information on 19 March 2013 (including photographic evidence) confirming completion of the work, this included renewing road markings to achieve compliance with the ground plan (and reduce the apparent misalignment between crossing and road approaches) and adjusting the positioning of the road traffic lights. This work did not need a new/revised Level Crossing Order.

ORR decision

6. Having considered the responses and the additional documentation provided by 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 so far as is reasonably practicable.

ORR does not intend to take any further action in respect of this recommendation unless we become aware any of the information above becomes inaccurate in which case we will write to RAIB again.

Status – Implemented by alternative means

Recommendation 2

The purpose of this recommendation is to give guidance on how to deal with crossings where site constraints force the road over the crossing to not be parallel with its approaches and to ask crossing designers to consider the escape route beyond the crossing rather than just the gap at the barrier line (chapter 2, paragraph 245 of the ORR guide).

ORR should revise Railway Safety Publication 7 ‘Level crossings: A guide for managers, designers and operators’ to provide:

- guidance on how to assess the misalignment between the centreline of the road over the crossing and the road approaches and how to mitigate its effects; and
- guidance supplementing the existing requirement for a 3 m minimum gap between barrier tip and road edge to ensure consideration of the actual vehicle exit path taking into account the largest vehicle permitted to use the crossing without telephoning the signaller.

Actions taken or being taken to address the recommendation

7. On 10 June 2013, ORR inspectors met with RAIB inspectors to discuss Llanboidy RAIB recommendation 2. Producing specific guidance on road misalignment and mitigations does not fit with ORR’s position that site specific risk assessment is key. Rather, such a development may further drive a tick box mentality, already observed in some cases.

9. ORR is however willing to publish goal setting advice in any future guidance (most likely once the Law Commission has finally reported) that

- road misalignment should be considered by those undertaking site specific level crossing risk assessment and
- where misalignment appears to the assessor to be an issue, joint assessment must be undertaken in conjunction with the Highways Authority, who are the experts in such matters and likely to have the tools to properly assess the level crossing within the context of the highway ‘approaches’.

RAIB stated that this would be acceptable.

10. ORR stated that it was reluctant at this time to supplement the existing requirement for a 3 m minimum gap between barrier tip and road edge to ensure consideration of the actual vehicle exit path, taking into account the largest vehicle permitted to use the crossing without telephoning the signaller. This is because ORR would not wish to see any shortening of half barriers leading to potential deterioration in road driver behaviours (weaving around barriers).

11. ORR indicated however that it would reflect on whether the 3m specification should be replaced with goal-setting guidance at the next publication of RSP7. RAIB have indicated that they are content.

Status: Non – implementation

Recommendation 3

The purpose of this recommendation is to ensure that the effect of misalignment of the road is taken account of in the Network Rail level crossing risk management process.

Network Rail should revise its risk management process for level crossings to take account of risks arising from the misalignment of the road over the crossing relative to the rest of the road.

Actions taken or being taken to address the recommendation

12. In a response received on 11 December 2012 Network Rail explained:

The effect of misalignment of the road is taken into account in the level crossing risk management process. The process involves the following aspects of the crossing:

- *Long straight roads/curved approach*
- *Road approach speeds*
- *Junctions in the vicinity of the level crossing*
- *Features on the approach – distraction*
- *Gradient/ surface*
- *Signage*
- *Flood water*

The Level Crossing Data Collection Form is currently used by Mobile Operations Managers (MOMs) and Operations Risk Control Coordinators (ORCCs) to gather data for the risk assessments; this form is also used to provide any additional details about the level crossing approach that have been identified.

March 2013 will see the national roll-out of Level Crossing Managers complete. The Level Crossing Manager's role is to gather the data for the risk assessment and perform risk assessments. They will also perform the asset inspection and a number of other activities around improved stakeholder engagement. MOMs and ORCCs will

no longer collect data for risk assessment or perform risk assessments once all the LCMs are operationally live

13. ORR did not consider that the above response addressed risks arising from misalignment of the road over the crossing. We asked Network Rail for clarification and received the response below on 8 March 2013.

The National Level Crossing Team is currently developing guidance for risk assessors to aid them when carrying out site visits / data collection. This guidance will specifically include factors relating to road alignment / layout and its effect on driver behaviour and also how to escalate these issues with highways authorities. It is anticipated that this guidance will be available by 31 December 2013.

Background information relating to level crossing risk management process:

When a crossing is being renewed or enhanced all elements of risk are considered as part of option selection and a new ground plan is developed. This incorporates road layout and alignment of approaches with the site specific design of the level crossing. Therefore the renewal / enhancement offers the best opportunity to review the crossing layout and optimise the approach alignment. During the lifetime of the level crossing it is subject to regular risk assessments which utilise the All Level Crossing Risk Model (ALCRM).

As part of this process risk assessors must consider the environment and approaches to a level crossing. ALCRM requires specific data inputs to model risk and this includes specific questions about the approach roads as per our original response.

ALCRM models a number of factors relating to approach roads including; road speed, layout, proximity to junctions, long and straight roads etc. Although there is not a specific algorithm relating solely to alignment of approaches, it is implicit within the process that the risk assessor considers the alignment. ALCRM is a very complex tool but like all risk models it should not be expected to account for every single element of risk within its calculations.

The risk assessment questions within ALCRM have been designed in a structured way to lead the risk assessor through a logical process to understand the traverse of the crossing as the user would experience it, thus understanding the impact or likelihood of a user driving onto the wrong side of the road while traversing the crossing. Misaligned crossings should be discussed at Road Rail Partnership Groups (RRPGs) with a view to carrying out joint risk assessments with highways authorities as appropriately.

ORR decision

14. Having considered the responses and the additional information provided by 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 monitor the development of the Network Rail guidance and confirm that it has been completed to the timescale of 31 December 2013.

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

Recommendation 4

The purpose of this recommendation is to prevent parked staff vehicles causing traffic to block back onto a level crossing, in particular vehicles of maximum legal dimensions.

Network Rail should provide guidance to its staff and contractors on where to park their vehicles when working on or around level crossings where there is potential for such vehicles to block the access and egress from the crossing.

Actions taken or being taken to address the recommendation

15. In a response received on 11 December 2012 Network Rail explained:

Industry wide guidance on where to park vehicles when working on or around level crossings will be produced and issued throughout the industry for cascading and onward briefing to staff and contractors. This guidance will specifically cover actions to take where there is a potential for such parked vehicles to block the access and egress from level crossings. The guidance will be issued throughout the industry and will cover; Investment Projects, Asset Management, Operational Services (both operational and maintenance teams), contractors, train operators and British Transport Police.

In addressing this recommendation, the National Level Crossing Team will work with Emma Osborn, Business Manager of NDS, to add guidance to the 'Vehicle near railway lines' section of the drivers' Handbook. They will also work with Claire Bartlett Assurance Manager of NDS and Peter Ellis, Principle Policy Development, Asset Management to prevent staff and contractors from parking vehicles causing traffic to block back onto level crossing.

Timescales will be provided once the following are understood:

- *handbook audit process and timescales*
- *how best to cascade the guidance so the full benefit of the recommendation is realised*

ORR further asked Network Rail to provide its implementation plan. The information below, plus the Drivers Handbook 2.17 and guidance titled 'Parking near level crossings', were provided by Network Rail to ORR on 8 March 2013.

1. *National Level Crossing Team to develop improved guidance on where to park vehicles when working on or around level crossings. COMPLETE.*

2. *'Parking near level crossings' guidance to be submitted for inclusion in the Network Rail Drivers Handbook. COMPLETE –*

3. *National Level Crossing Team to create a briefing pack for staff. Currently under review, expected to be completed and approved by 15 March 2013.*

4. *Staff briefing pack to be submitted for inclusion in the following staff safety briefings:*

Operations Safety Brief – June 2013

Maintenance Safety Brief – March 2013

Infrastructure Projects Safety Brief - TBD (not critical to implementation of the recommendation)

ORR decision

16. Having considered the responses and the additional documentation provided by 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.

17. ORR has included assurance activity on parking at or near level crossings in its 2013/14 inspection plan and will be monitoring the application of the Network Rail guidance. If in doing so, we become aware of an inaccuracy we will write to RAIB again.

Status: Implemented

Recommendation 5

The purpose of this recommendation is to find a means of mitigating the risk to the driver from detachment of the cab GRP structure during a collision.

Angel Trains should investigate and, where appropriate implement, means of mitigating the risk to cab occupants from detachment of the cab GRP panels in class 175 units during a collision.

Actions taken or being taken to address the recommendation

18. In its response dated 21 December 2012 Angel Trains stated

As outlined in the RAIB report the cab structure was fully compliant with the Railway Group Standards (GM/RT2100 issue 2) at the time the Class 175 was accepted into service.

Angel Trains has conducted a high level review to assess the feasibility of reducing the risk of the driver's survival space being compromised. The review has highlighted that an effective way to mitigate a future detachment in a similar circumstance to that witnessed during the Llanboidy Crossing incident would be:-

- *Fitment of a strengthening bar across the back of the side part of the cab GRP panel.*
- *Fitment of secondary retention to the cab GRP panel.*

To validate whether implementing the outlined modifications are reasonably practicable a Cost Benefit Analysis (CBA) has been carried out using the RSSB guidelines (see appended report). For this investigation, the benefit figure is evaluated from the fatalities and weighted injuries (FWI) that would be saved over the remaining life of a vehicle should the vehicles be modified.

The following pessimistic assumptions have been used in building the CBA:-

- *1 incident resulting in loss of driver's survival space occurs every 12 years for the Class 175 fleet for the remainder of its life (noting that only 1 incident has occurred to date in 12 years of operation that has led to the driver's position being compromised).*
- *1 major injury will occur as a result of each incident (noting that no drivers have actually been injured as the result of Class 175 collisions to-date).*

The outcome of the CBA has concluded that the implementation of outlined modifications should be regarded as not justified on the basis of the safety benefits over the remaining fleet life of the Class 175 fleet.

We are in process of discussion with the Train operator Arriva Trains Wales and anticipate that they will be in agreement with this conclusion.

ORR decision

19. ORR challenged the conclusions of the Cost Benefit Analysis and concluded it has no reason to disagree with the findings. Having considered the response from Angel and the cost benefit analysis ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005 Angel Trains has investigated the detachment of the GRP panel and methods to mitigate the risk, Angel Trains have not found a reasonably practicable way to mitigate the risk. They have:

- taken the recommendation into consideration; and
- Taken action to implement it so far as is reasonably practicable.

20. ORR does not intend to take any further action in respect of this recommendation unless we become aware any of the information above becomes inaccurate in which case we will write to RAIB again

Status – Implemented

Recommendation 6

The purpose of this recommendation is to reassess the risks associated with coupler bump stop mounting and retention arrangement.

Alstom and Angel Trains should assess the safety risks of the existing design of the coupler lateral bump stop mounting. Where it is reasonably practicable to reduce the risk of a bump stop detaching and derailing the train, then these improvements should be implemented

Actions taken or being taken to address the recommendation

21. On 17 December 2012 Alstom provided the following response

The mounting arrangement of the bump stop assembly has been reviewed by our engineering department with a view to reducing the possibility of the bump stop becoming detached during a severe collision. It is concluded that a significant improvement can be made by changing the current grade of fasteners from grade 8.8 for the bolt and grade 8 for the associated nut to grades 12.9 and 12 respectively. This fixing change together with an associated increase in tightening torque of these fixings would increase the clamping load on the bump stop assembly by approximately 36% relative to the existing grade 8.8 / 8 fixings. The proposed new installation is fully compliant with the load cases specified by GM/RT2100 issue 3. The review has also concluded that the proposed change in clamping load will have no adverse effect on the ability of the auto coupler to retract in the event of a severe collision and therefore the designed crashworthiness performance of the trainset remains unaffected. It is considered that that this change could be introduced to the fleet by spring 2013.

22. On 21 December 2012 Angel Trains confirmed it had been liaising with Alstom.

Angel Trains in conjunction with Alstom has reviewed the design of the coupler bump stop mounting arrangements. The review of the arrangement has validated that the coupler bump stop mounting arrangement still remains compliant to the Railway Group Standard in force at the time of acceptance of the Class 175 fleet into service (GM/RT2100 Issue 2); the RGS requirements are unchanged in the latest issue (5) of the standard.

The review of the arrangement concluded that an effective improvement would be to change the coupler bump stop mounting fasteners from Grade 8.8 bolts and grade 8 nuts to grade 12.9 bolts and grade 12 nuts. This would improve the clamping load of the arrangement by a margin of 36%.

Based on the conclusions of the review Alstom Transport and Angel Trains consider this modification reasonably practicable and intend to implement the fixing design improvement. Alstom Transport has been in contact with the supply base with regards to lead times of the improved fasteners. It is envisaged that a fleet modification will be drafted and implemented during 2013. The change in bolt arrangement has been discussed with the train operator Arriva Trains Wales who are in agreement with this course of action.

23. On 23 July 2013 Angel Trains confirmed it had completed the coupler bump stop modification on all Class 175 units providing a list of all modified vehicle numbers.

ORR decision

24. Having considered the responses provided by Alstom and Angel Trains and received confirmation that the coupler bum stop modification has been completed 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 so far as is reasonably practicable.

We do not propose to take any further action in respect of this recommendation unless we become aware of an inaccuracy in which case we will write to RAIB again

Status: Implemented