

# RAIB Bulletin 02/2012

## Derailment at Clarborough tunnel, near Retford, Nottinghamshire, 27 April 2012

### Description of the accident

- 1 At approximately 11:55 hrs on Friday 27 April 2012, train 2R15, the 11:25 hrs service from Lincoln to Adwick, operated by Northern Rail, ran into a landslip (figure 1). This occurred as the train exited Clarborough tunnel, near Retford, Nottinghamshire on the Gainsborough to Sheffield line. The train, a class 142 diesel multiple unit, derailed (figure 2). There were 17 passengers and two crew on board; the driver and one passenger were taken to hospital with minor injuries. The train suffered damage to its coupler and underframe equipment; several bodyside panels also came loose during the impact.



Figure 1: The landslip outside Clarborough Tunnel



Figure 2: The derailed train 2R15

## Sequence of events – the train

- 2 Train 2R15 left Gainsborough Lea Road station at 11:51 hrs. The journey was uneventful until, when within Clarborough tunnel and travelling at 59 mph (95 km/h), the driver spotted an obstruction on the track ahead. The driver shut off power and applied the emergency brake. The train struck a large mound of earth and also hit a track-side cabinet and tree root ball that had been pushed onto the track by the landslip. The train's speed had reduced to 45 mph (72 km/h) by the time of the impact. The leading axle derailed to the cess (left in accordance with the direction of travel) and the train travelled a further 100 metres before coming to rest.
- 3 The degree of lateral derailment was limited by the axle box engaging with the right-hand rail and preventing the train deviating further towards the cess (figure 3).



Figure 3: Detail of the axlebox on derailed train 2R15 engaging with the rail

## Sequence of events – the slope and drainage

- 4 The most recent earthworks examination of the cutting at the location of the landslip states that the slope is up to 13 metres high and is at an angle of 50°, although locally steeper; some parts of the slope are vertical. The slope consists of a mix of rock and soil (clay above bedrock). There was no sign of any recent works, other than the clearance of vegetation. Above the slope is a large water catchment area, which rises gradually in an arc from the south through to the east; the railway runs in an east-west orientation at this location (figure 4). Drainage from this catchment area is reliant on a crest drain running along the edge of a field outside of Network Rail's boundary.
- 5 The slope was examined by Network Rail on 27 January 2010 and was classed as 'Marginal'<sup>1</sup>, in accordance with Network Rail's company procedures, and was therefore subject to an examination every five years by examining engineers from Network Rail or its examination contractor. The examination report identified the existence of the crest drain, but because the examining engineer could not access it no examination took place on this occasion. However, the Network Rail drainage engineer undertook a walk through of the crest drain in August 2011 in connection with drainage improvement works; this did not reveal any observable problems with the drain.

<sup>1</sup> The mid-risk categorisation (between poor and serviceable) of an embankment, cutting or natural slope in accordance with NR/SP/CIV/065, Examination of Earthworks.



Figure 4: The catchment area above the slope (courtesy of Google Earth)

- 6 There had been a significant amount of rain over the weeks prior to the accident and very heavy rainfall during the days immediately prior. Inspection of the crest drain shortly after the incident revealed that the section that runs immediately above the slope was ineffective. There was a local low point in the drain immediately above the site of the landslip where water had collected; the drain 'down-stream' of this was dry.
- 7 The water collecting at this low point had saturated the ground and filtered through the bank causing the soil at the top of the bank to be washed down onto the track. Several hours after the landslip occurred, water was still flowing through the ground and could be seen emerging on the cutting face to form distinct streams flowing down the face to track level.

### RAIB investigation

- 8 The cause of the landslip and subsequent derailment was the poor condition of the crest drain, on neighbouring land, and its ineffectiveness in dealing with water flow from the surrounding catchment area following the recent wet weather.
- 9 The RAIB has made recommendations relating to the management of drainage flows from neighbouring land and off-track drainage following previous investigations.

- 10 The following recommendation was made in the report of the RAIB's investigation into Network Rail's Management of Existing Earthworks (25/2008):

*Network Rail should provide clear policy, information and guidance to staff, particularly those in the maintenance organisation, with regard to neighbours and problems related to the management of infrastructure risk.*

- 11 In response to this recommendation, Network Rail advised the ORR of its arrangements in respect of management of the interface between Network Rail and its neighbours and the ORR accepted the response and closed the recommendation.

- 12 The following recommendation was made in the report into the derailment at Oubeck North, near Lancaster on 4 November 2005 (19/2006):

*Network Rail should identify priority cutting slopes prone to earthflow failure due to drainage flows from neighbouring property. These should be prioritised according to their likelihood of failure (eg on the basis of catchment area, slope angle and history of previous failures) and the consequence on the safe operation of trains.*

*For priority cuttings, Network Rail should ensure that it understands all associated drainage arrangements, that they are adequate and that their functionality is maintained. Alternatively it should isolate its land from the effects of such drainage flows (eg by implementing engineered collector drains).*

- 13 This recommendation was rejected by Network Rail, but the RAIB restated the key requirements in the following recommendation made in the report into the derailment near Gillingham tunnel, Dorset on 28 November 2009 (19/2010):

*Network Rail should instigate a process to:*

- *Identify all locations where unsatisfactory operation of off-track drainage is a significant risk to railway safety. Identifying these locations should be assisted by use of information being collected as part of Network Rail's on-going drainage asset surveys, knowledge already required for adverse weather planning and data being obtained from on-going studies to identify locations where ground topography concentrates water flows.*
- *For all such locations establish a programme to:*
  - o *Determine for each location the site specific parameters which are sufficient to ensure satisfactory off-track drainage performance. These parameters should include ditch sizes and the extent to which roots may remain in place. The parameters shall be verified by a drainage professional.*
  - o *Maintain off-track drainage to comply with these parameters.*

- 14 With respect to the requirement to identify applicable neighbouring and off-track drainage, Network Rail implemented a national survey of all railway drainage. This was planned for completion in June 2012; the intention being that it would form the basis for a drainage management plan describing the required inspection, maintenance, refurbishment and renewals for each drainage system. Network Rail reported that the progress on the survey in the London North Eastern route indicates that it will be completed in September 2012 for this route.

- 15 To assist in prioritising drainage and slope remediation at the most vulnerable locations, Network Rail has also developed a Washout and Earthflow Risk Modelling database.
- 16 To facilitate a broad understanding of the relevant parameters for managing effective drainage, Network Rail has issued a new company standard for drainage, NR/L3/CIV/005. This defines Network Rail's requirements and provides recommendations for design, installation, inspection and maintenance of drainage systems as well as guidance on identifying and managing the associated risks.
- 17 With respect to actual maintenance of neighbouring and off-track drainage, Network Rail embarked on an initiative to identify and prioritise crest drains requiring attention in 2010. The London North Eastern route has completed work on five crest drains with another nine programmed for work due to be completed by the end of 2014.
- 18 The crest drain at the location of the earthworks failure had not been considered for improvement works under the crest drain initiative because it had neither been identified as a high priority, nor had there been any reports of problems with it. Also, the drainage survey had not been completed for this location.

## Learning points

- 19 The RAIB has decided not to conduct a full investigation as it does not believe that an investigation would lead to the identification of any further recommendations. However, this incident reinforces the lessons highlighted from previous investigations as described below.

### Crest drain management

- 20 This accident reiterates the importance of correctly identifying and managing the risk from drainage of land outside of the railway's boundary.
- 21 Where the risk is not being effectively managed by the railway's neighbour, the infrastructure manager will need to:

- identify drainage that is critical to the stability of the slope; and
- assess the adequacy of existing drainage;

such that suitable arrangements can be established with neighbours to cover:

- the inspection and maintenance of drainage; and
- the identification and implementation of any necessary improvements.

Where such arrangements cannot be established infrastructure managers need to consider implementing measures on their own land to manage the risk.

This occurrence may indicate the need for Network Rail to review the prioritisation and planned timescales for implementing such actions.

## Minimising the degree of derailment

- 22 The RAIB has observed in several previous derailments that features of the bogie, underframe equipment and running gear have, following a derailment, engaged with the running rails and limited the degree of lateral deviation. The RAIB has made recommendations to RSSB<sup>2,3,4</sup> to consider the practicability of including design elements to limit the degree of deviation. However, RSSB concluded that it is inappropriate to recommend changes to the relevant standards, and the ORR accepted this position. The basis for RSSB's conclusion is not fully detailed in the related RSSB report.
- 23 The RAIB observes that in this derailment a feature of the running gear has again provided this function. The RAIB believes there is a case for the industry to revisit its previous study and to carry out a more detailed assessment.

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<sup>2</sup> The company is registered as 'Rail Safety and Standards Board', but trades as 'RSSB'.

<sup>3</sup> Report 22/2006. Derailment near Moy, Inverness-shire on 26 November 2005. Recommendation 10.

<sup>4</sup> Report 18/2008. Collision of a train with a demolished footbridge, Barrow upon Soar, 1 February 2008. Recommendation 3.

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