



Rail Accident Investigation Branch

Rail Accident Report



**Trailer runaway near Hope, Derbyshire
28 May 2017**

Report 03/2018
February 2018

This investigation was carried out in accordance with:

- the Railway Safety Directive 2004/49/EC;
- the Railways and Transport Safety Act 2003; and
- the Railways (Accident Investigation and Reporting) Regulations 2005.

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Preface

The purpose of a Rail Accident Investigation Branch (RAIB) investigation is to improve railway safety by preventing future railway accidents or by mitigating their consequences. It is not the purpose of such an investigation to establish blame or liability. Accordingly, it is inappropriate that RAIB reports should be used to assign fault or blame, or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The RAIB's findings are based on its own evaluation of the evidence that was available at the time of the investigation and are intended to explain what happened, and why, in a fair and unbiased manner.

Where the RAIB has described a factor as being linked to cause and the term is unqualified, this means that the RAIB has satisfied itself that the evidence supports both the presence of the factor and its direct relevance to the causation of the accident. However, where the RAIB is less confident about the existence of a factor, or its role in the causation of the accident, the RAIB will qualify its findings by use of the words 'probable' or 'possible', as appropriate. Where there is more than one potential explanation the RAIB may describe one factor as being 'more' or 'less' likely than the other.

In some cases factors are described as 'underlying'. Such factors are also relevant to the causation of the accident but are associated with the underlying management arrangements or organisational issues (such as working culture). Where necessary, the words 'probable' or 'possible' can also be used to qualify 'underlying factor'.

Use of the word 'probable' means that, although it is considered highly likely that the factor applied, some small element of uncertainty remains. Use of the word 'possible' means that, although there is some evidence that supports this factor, there remains a more significant degree of uncertainty.

An 'observation' is a safety issue discovered as part of the investigation that is not considered to be causal or underlying to the event being investigated, but does deserve scrutiny because of a perceived potential for safety learning.

The above terms are intended to assist readers' interpretation of the report, and to provide suitable explanations where uncertainty remains. The report should therefore be interpreted as the view of the RAIB, expressed with the sole purpose of improving railway safety.

The RAIB's investigation (including its scope, methods, conclusions and recommendations) is independent of any inquest or fatal accident inquiry, and all other investigations, including those carried out by the safety authority, police or railway industry.

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Summary

At around 06:30 hrs on Sunday 28 May 2017, a trailer, being propelled by a small rail tractor between Edale and Bamford, became detached and ran away for a distance of around 1 mile (1.6 km). It came to a stop at a set of points at Earles Sidings, near Hope. There were no injuries that required medical attention, and there was no significant damage to the infrastructure, the trailer or the tractor.

The tractor and trailer became separated because the towbar pin fell out. A lynch pin that secured the towbar pin had almost certainly been inserted in the wrong orientation. This would have resulted in it falling out, allowing the towbar pin to fall out and the towbar to become uncoupled.

The subsequent runaway occurred because the brakes on the trailer had been manually disabled by the staff present, to overcome them being stuck in the applied position. It is likely that this was because the hydraulic brake hose between the tractor and the trailer had either been not connected or incorrectly connected at the start of the shift.

The RAIB has made three recommendations to Network Rail as a result of this investigation. One relates to providing staff with guidance on what actions to take if a trailer becomes immobilised when being used. The second relates to management of staff competence at the depot involved in the incident. The third relates to learning lessons from multiple non-compliances during use of the plant.

The RAIB has also identified two learning points, relating to the precautions required when isolating trailer brakes and to the requirements to carry out a full set of brake tests prior to use.

Introduction

Key definitions

- 1 Metric units are used in this report, except when it is normal railway practice to give speeds and locations in imperial units. Where appropriate the equivalent metric value is also given.
- 2 The report contains abbreviations and technical terms (shown in *italics* the first time they appear in the report). These are explained in appendices A and B. Sources of evidence used in the investigation are listed in Appendix C.

The incident

Summary of the incident

- 3 On Sunday 28 May 2017, a trailer was being propelled between Edale and Bamford by a small rail-mounted tractor, known by its brand name 'gator' (the term used throughout the rest of the report). At around 06:30 hrs, the trailer became detached and ran away for a distance of around 1 mile (1.6 km). It came to a stop at a set of points at Earles Sidings, near Hope. The gator's *machine operator* followed in the gator to warn anyone on the track of the approach of the trailer.
- 4 The *towbar pin* and its associated *linch pin*, which secured the trailer to the gator, had come out and the hydraulic hose connecting the trailer's brake system to the gator was disconnected. The operation of the trailer's brakes had also been mechanically disabled as a result of problems earlier in the shift, during which the brakes had been stuck in the applied position.
- 5 There were no injuries that required medical attention, and there was no significant damage to the infrastructure or to the trailer or gator.

Context

Location

- 6 The incident occurred on the Hope Valley line between Manchester and Sheffield (figure 1). The equipment had been put on the track at Grindleford sidings, at 159 miles 6 chains¹, before setting off to undertake work at Cowburn tunnel, at 172 miles 44 chains (figure 2). The runaway occurred on the return journey at approximately 166 miles 0 chains, with the trailer coming to a stand at a *crossover* at Earles Sidings, at 165 miles 4 chains.
- 7 The railway at this location comprises two non-electrified tracks. The speed limit for trains travelling in both directions varies between 70 mph (113 km/h) and 90 mph (145 km/h) between Grindleford and Cowburn tunnel. However, the gator is limited to a top speed of 20 mph (32 km/h) on plain line.
- 8 The signalling system on the section of line where the incident occurred is controlled from signal boxes at Grindleford, Earles Sidings and Edale.
- 9 *Road-rail access points* (RRAPs) are available at Grindleford sidings, on both the up and down lines² at Bamford and on the down line at Edale.

Organisations involved

- 10 Network Rail owns and manages the infrastructure as part of its London North Western route, and employed the staff involved in the operation of the gator and trailer.

¹ The mileage is measured from London St Pancras station (via Toton); one chain is equal to 22 yards (approximately 20 metres).

² The up line is normally used by trains travelling towards Sheffield, while the down line is normally used by trains travelling towards Manchester.

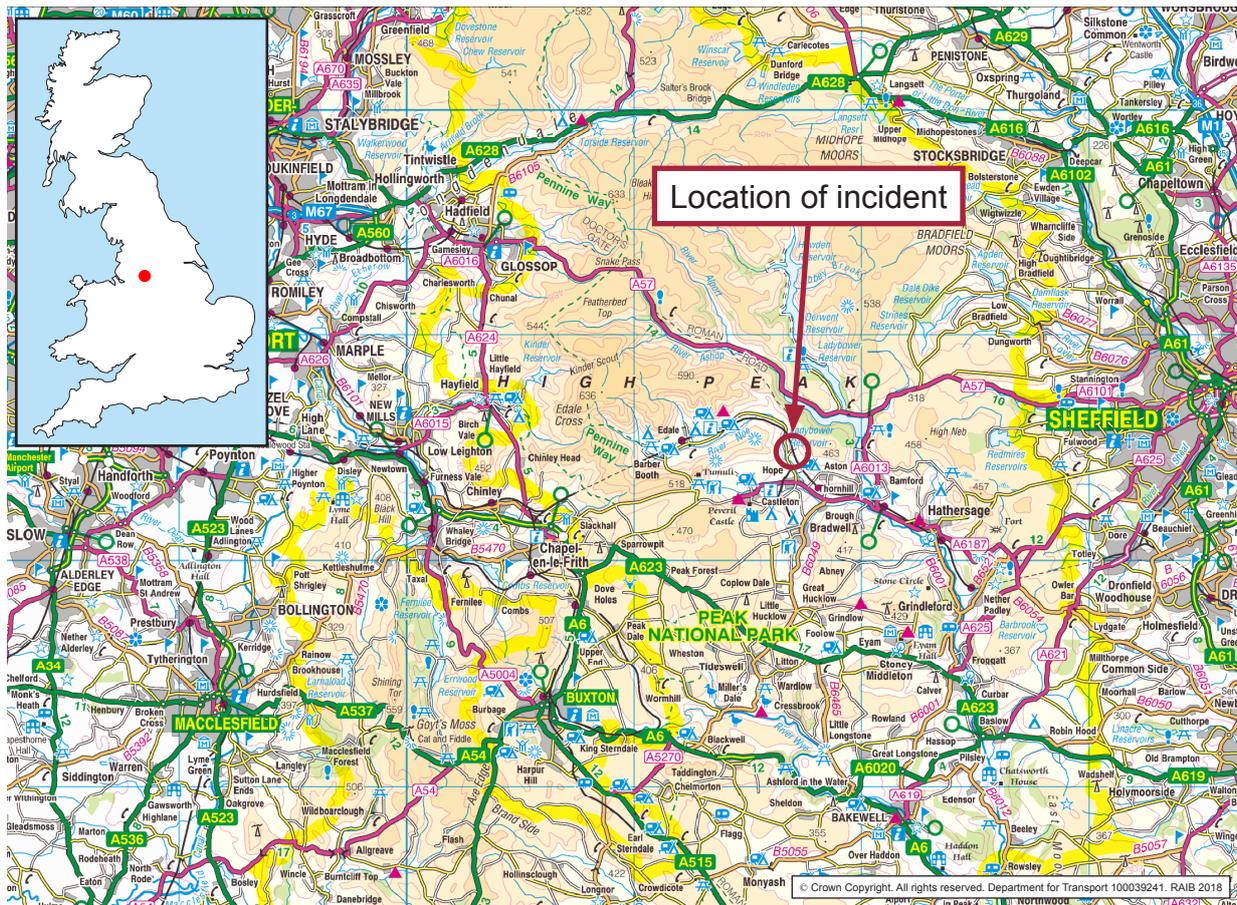


Figure 1: Extract from Ordnance Survey map showing location of incident

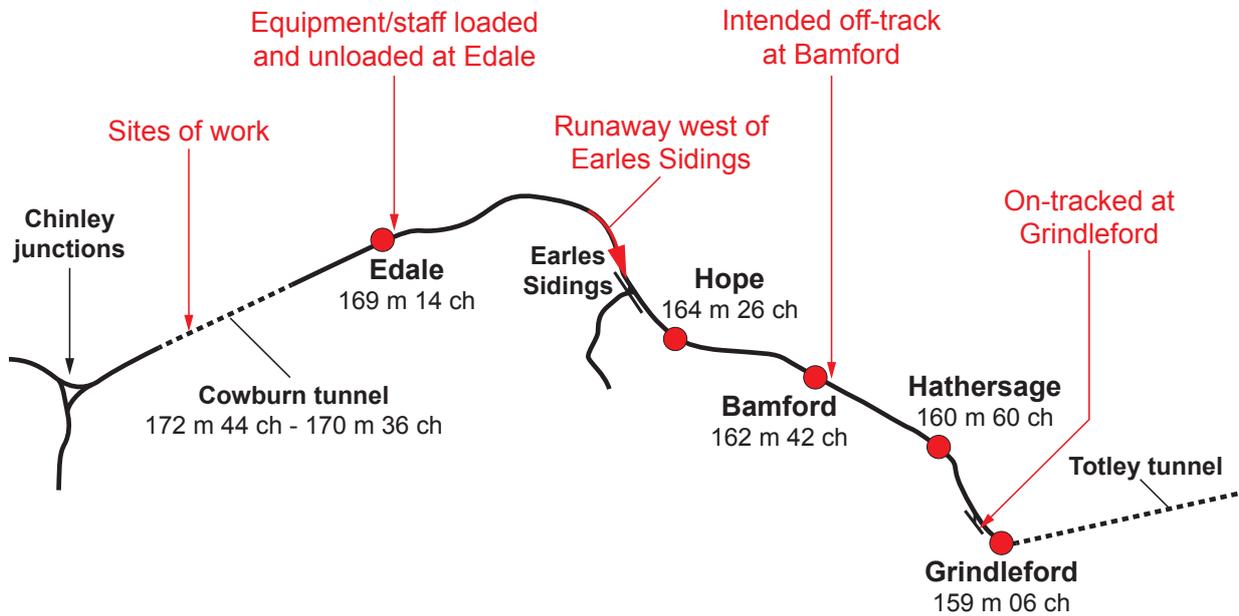


Figure 2: Locations of key events during the morning of the runaway incident

- 11 Vital Rail employed the other track workers that were present when the trailer was being used during the work in Cowburn tunnel. However, these workers did not take an active part in the operation of the gator and trailer.
- 12 AMCO Rail employed the staff who placed the trailer on the track at Grindleford sidings.
- 13 Permaquip Ltd manufactured the personnel carrier trailer and carried out the road-rail conversion of the gator.
- 14 Network Rail, Vital Rail, AMCO and Permaquip all freely co-operated with the investigation.

Equipment involved

- 15 The trailer that ran away was a Permaquip Personnel Carrier (figure 3). This is a four-wheeled trailer designed to carry six seated persons. Two of the four rail wheels, on one side of the trailer, are braked. These brakes are spring applied and are released by hydraulic oil pressure applied by a hose connection from the vehicle being used to tow the trailer. There is also a manual release for each of the braked wheels (figure 4), which is operated by attaching and pulling a handle at each end of the trailer.



Figure 3: Personnel carrier trailer



Figure 4: Manual brake release

- 16 The tractor unit was a Permaquip Gator 6x4 (figure 5). This was a six-wheeled all-terrain vehicle that had been converted for use on the UK rail network by Permaquip. When on the track, the rail wheels are lowered to provide guidance. The rear four road wheels remain in contact with the rail and provide traction and braking. The front two road wheels are lifted clear of the rail, and the rail wheels take the weight.



Figure 5: Gator with personnel carrier trailer

Staff involved

- 17 The machine operator, who drove the gator, had worked on the railway for 28 years, primarily on track inspection at Chinley and Buxton depots. He had been a track inspection team leader at Chinley for 10 years. He held a number of safety related competencies, including machine operator and *machine controller*.

- 18 The track worker, who put the gator onto the track, had worked on the railway at Chinley depot for 17 years. He held a number of safety related competencies, but these did not include machine operator.
- 19 The supervisor, who oversaw the work in Cowburn tunnel, had also worked on the railway at Chinley depot for 17 years. He had worked as a *section manager* for five years, but had given up that role due to work pressures, and reverted back to his supervisor role.
- 20 The section manager had worked in that role at Chinley depot for one year. He had worked in a number of other roles at other railway locations, including Chinley, prior to that for eight years.
- 21 Network Rail stated that there were no safety related incidents on the records for any of the above staff.

External circumstances

- 22 It was dark when the gator was *on-tracked*, at Grindleford sidings, and there was no site lighting. Staff used vehicle lights and head torches to see what they were doing. It is possible that this affected their ability to inspect the towbar and hydraulic hose connections (paragraphs 26 and 27).
- 23 It was raining intermittently when the machine operator was travelling on the gator from Grindleford to Edale. This is unlikely to have significantly affected the level of adhesion that was available between the gator's rubber tyres and the railhead. However, it is likely that it affected the machine operator's perception of why the gator was performing sluggishly (paragraph 76).

The sequence of events

Events preceding the incident

- 24 The staff involved started their shift at approximately 22:00 hrs at Network Rail's Chinley depot (part of the Manchester *Delivery Unit*). The plan for the work that night was to undertake track repairs in Topley tunnel followed by the repair of several track faults in Cowburn tunnel. The workgroup was to access Cowburn tunnel using the gator and personnel carrier trailer that were stored at Grindleford sidings, after loading the staff and materials at Edale. A *possession* had been set up to cover the entire line from the east end of Topley tunnel to Chinley.
- 25 The track worker arrived at Grindleford sidings shortly after midnight after he had arranged for personnel from AMCO Rail to lift the personnel carrier trailer onto the track. They did this by lifting it from below, using the forks on a *telehandler*. This was done as a favour because Network Rail did not have any lifting equipment available. The lift was not in accordance with the manufacturer's instructions, as the trailer was intended to be lifted by chains from above.
- 26 At around 00:20 hrs, the track worker drove the gator on to the track in Grindleford sidings and lowered the rail wheels. He then moved the gator adjacent to the trailer, and connected the towbar between the rear of the gator and the trailer. The track worker stated that he believed that he had correctly connected the trailer's hydraulic brake hose to the gator. The track worker did not undertake any functional checks on the gator or trailer. He left the engine running, ready for the machine operator to collect the vehicles later, and proceeded to the work in Topley tunnel.
- 27 At approximately 03:00 hrs the machine operator arrived at Grindleford sidings to collect the gator and trailer, after having done some work west of Chinley. He checked the lights were on and visually checked the coupling. He also checked that the hydraulic brake system indicating lamp was lit, showing that there was pressure in the system (paragraph 41). He undertook tests to confirm that the gator and trailer combination stopped when he applied the brakes in the siding. The machine operator stated that he believed that the hydraulic hose was connected between the gator and trailer at this time.
- 28 The machine operator then obtained permission from the Grindleford signaller to leave the siding, reverse over the crossover onto the up (northernmost) line, and to proceed west towards Edale. After he had set off, with the gator towing the trailer, the machine operator observed that it was raining intermittently and that the gator felt sluggish.
- 29 On arrival at Edale, at about 04:00 hrs, the machine operator met the supervisor and the track worker, as well as the three contractors from Vital Rail, who had all come from the work in Topley tunnel. He reported to the supervisor that the gator was feeling sluggish. The staff loaded the equipment required for the work in Cowburn tunnel onto the gator and trailer, and everyone got on board.

- 30 They travelled into Cowburn tunnel, and reached the first work site at the western end shortly after 04:30 hrs. They met the section manager there, who was acting as *engineering supervisor* for the possession. The machine operator reported to the section manager that the gator was sluggish, and that he had concerns about being able to get the gator and trailer back to Grindleford in time for the planned end of the possession at 07:15 hrs. At that point, the section manager instructed the staff that the gator and trailer would be taken off track at Bamford to save time.
- 31 They started to travel back through the tunnel towards Edale, stopping several times to carry out work on the way. Repair of the last track fault was abandoned due to a lack of time. As the gator pushed the trailer through the tunnel, the supervisor and track worker observed that the trailer wheels were dragging, suggesting the brakes were stuck on. They attempted to use the manual handles to hold off the brakes while they sat on the trailer, as it was being pushed by the gator. However, they reported that this was difficult, and they instead used a webbing strap from the gator to tie the handles down, thus holding the brakes off.
- 32 The staff and tools were pushed out of the tunnel on the trailer with the brakes strapped off, and they were off-loaded at Edale. The machine operator continued alone on the gator towards Bamford, with the trailer brakes still strapped off. The supervisor drove to Buxton to deal with another possession there. The track worker and the contractors drove towards Bamford to assist with the intended off-tracking of the gator and trailer.
- 33 After a short distance, the machine operator stopped the gator to take a telephone call from the supervisor, who was checking whether he had left some equipment on the trailer. The machine operator stated that, during this stop, he was concerned that the trailer brakes were fully strapped off, and so he loosened the straps. He then continued towards Bamford.

Events during the incident

- 34 A little later, near the 166 mile post, the machine operator received a second phone call, this time from the section manager. He stopped the gator and told the section manager his location. He then turned round and saw that the trailer had become detached from the gator and was slowly rolling downhill towards Bamford.
- 35 The machine operator started to run after the trailer, but then got back in the gator (with the towbar still attached to it) and started to follow the trailer along the track. He soon caught up with it and continued to closely follow it towards Earles Sidings. During this time he called the track worker to get him to try to derail the trailer at a suitable location near Hope station.
- 36 At the crossover just after Earles Sidings signal box, at 165 miles 4 chains, the trailer stopped suddenly, causing the gator to also stop suddenly because the two were running very close together at the time. Witness evidence indicated that the machine operator was jarred by the sudden stop, but did not require medical assistance.

Events following the incident

- 37 The machine operator got off the gator and removed the strap that had been securing the trailer brakes in the released position. He also called the track worker to let him know that the trailer had stopped at Earles Sidings.

- 38 After the track worker had arrived by road, the machine operator manually pulled the trailer away from the gator to allow the towbar to be reconnected. The section manager then arrived, and he liaised with the signaller to allow the machine operator and track worker to move the gator and trailer away from the main lines and into the sidings.

Key facts and analysis

Background information

Braking system

- 39 The self-contained braking system on the gator is similar to that on a normal road vehicle. It consists of a footbrake and a handbrake, both of which apply braking to the rubber-tyred wheels. The amount of pressure applied using the footbrake varies the amount of braking applied to those wheels. This provides braking in both road and rail modes.
- 40 When the personnel carrier trailer is coupled to the gator, the braking on the trailer is spring applied and hydraulically released. A hydraulic pump on the gator pressurises oil in a sealed system, which is used to operate brake cylinders on the trailer which compress the springs, retracting the brake shoes and releasing the brakes (figure 6). This system is binary, in that the system is either fully pressurised, to release the brakes on the trailer, or depressurised, in which case the brakes are spring applied. RAIB testing was unable to identify a condition where partial braking could be present.

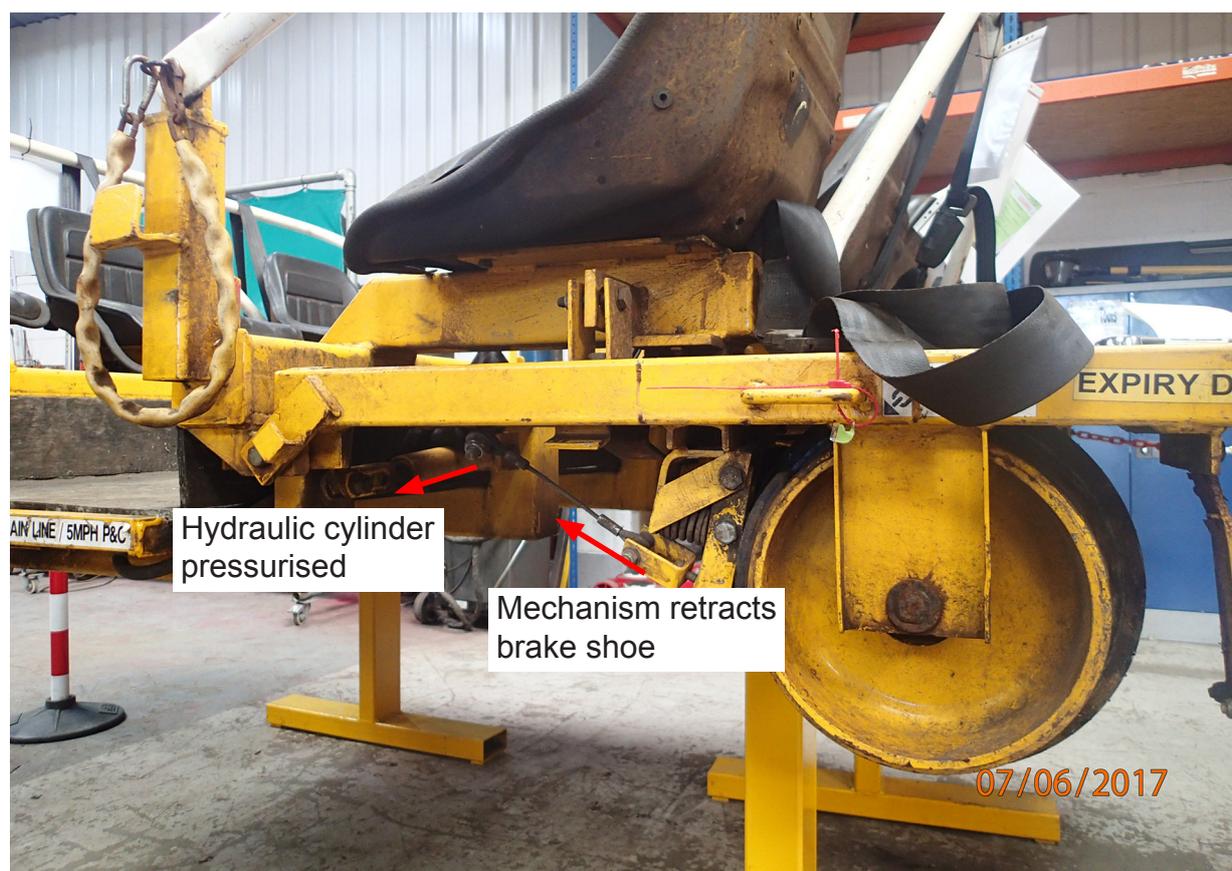


Figure 6: Trailer brakes

- 41 The hydraulic pump is switched on by the operator, using a switch on the gator's dashboard. When service pressure is reached (normally in a second or two) a pressure switch stops the pump, a light is lit on the dashboard, labelled 'trailer brakes off', and the trailer brakes are fully released (figure 7).

- 42 When the operator applies either the footbrake or the handbrake on the gator, a *solenoid valve* releases the pressure in the hydraulic system and the trailer brakes are fully applied. The light on the dashboard is also extinguished. Releasing the gator brakes allows the hydraulic pump to recharge the pressure, thus releasing the trailer brakes and re-illuminating the light.
- 43 A hose connects the hydraulic system on the gator to the brake release cylinders on the trailer. The hose is permanently coupled to the trailer and attaches to the gator using a sealed bayonet coupling (figure 8). This coupling snaps into place and requires a locking collar to be manually retracted to allow it to be released. The hydraulic connection between the gator and the trailer is not made until the coupling is snapped into place. When this is done, the coupling is secured and a valve in the coupling is opened to allow pressure to be transmitted.



Figure 7: Hydraulic brake system control and indication



Figure 8: Hydraulic hose coupling

- 44 If the trailer's hose is not connected, the hydraulic system on the gator can still be switched on and pressurised because the valve in the coupling remains closed. The pressurised indication lamp on the dashboard is also illuminated (figure 7). The hydraulic system also acts to release and recharge pressure as the gator brakes are applied and released. However, in this situation the pressure is not transmitted to the trailer and therefore it has no effect on the trailer brakes.

Maintenance

- 45 The gator and trailer were subject to a routine maintenance regime, as prescribed in their *Engineering Acceptance Certificates*. This specified annual, six-monthly and three-monthly (gator only) maintenance activities, which were all undertaken, on behalf of Network Rail, by a contractor. The records for these activities were all up to date and did not indicate any significant problems with either the gator or the trailer.

- 46 This regime also specified daily, weekly and monthly (gator only) maintenance activities. Most of these activities consisted of inspections, with the daily maintenance intended to be carried out by the user prior to use. These were not part of the work allocated to the maintenance contractor. Network Rail was not able to provide any records relating to completion of this maintenance and could not identify who was responsible for undertaking it.
- 47 A record of some pre-use checks was identified on the 'machine controller checklist'. This is a generic checklist that the machine controller is required to complete prior to use of any plant or vehicle, and includes such activities as a brake test. However, this is not intended to be a maintenance check, and does not constitute part of the specified maintenance regime. The machine controller checklist completed on that night did not identify any problems with the machine.
- 48 Staff reported that there had been a long term issue with flat batteries on the gator when trying to start it. However, it is likely that this was related to the infrequent use of the gator and its storage outside. A portable starter pack had been provided to boost start the gator and this was brought to site from the depot when the gator was to be used. These problems had been part of the reason for operator complaints about the suitability for use of the gator over a number of years.
- 49 After the runaway, the rear of the gator was found to have damage consistent with an end-on impact to the towbar (figure 9). No evidence was found to explain how this damage had occurred. The gator was able to operate correctly after the runaway, with this damage in place, and so it is possible that the damage was present prior to the incident.

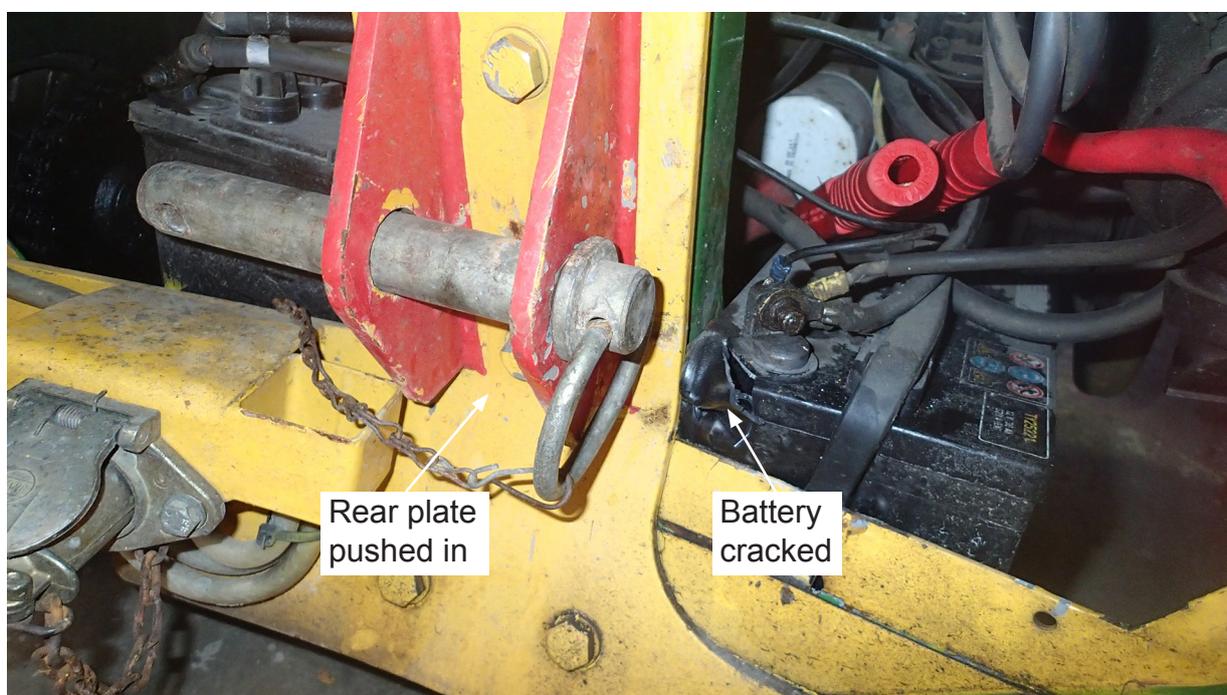


Figure 9: Rear end damage to the gator

- 50 None of the maintenance records or the testing indicated any problem with the operation of the gator, or of its braking systems, other than the difficulty of starting due to flat batteries.

Identification of the immediate cause

- 51 The trailer ran away on the gradient because it became uncoupled from the gator while the trailer brakes were disabled.**
- 52 When the machine operator stopped the gator to take the second call from the section manager the trailer continued moving (paragraph 34). The track gradient between Cowburn tunnel and Hope station is predominantly 1 in 100 downhill, with short shallower sections at stations and east of Earles Sidings. The trailer was on the downhill end of the gator at the time of the phone call.

Identification of causal factors

- 53 The runaway occurred due to a combination of the following causal factors:
- The trailer became physically separated from the gator (paragraph 54); and
 - The operation of the brakes on the trailer had been disabled by the staff to allow its recovery (paragraph 71).

Each of these factors is now considered in turn.

Mechanical coupling of the trailer to the gator

- 54 The trailer became physically separated from the gator.**
- 55 The primary physical connection between the gator and the trailer was the towbar. However, although not designed for the purpose, it is likely that the hydraulic brake system hose would also hold the two together on the track gradient concerned. Both of these must have been separated when the trailer started moving away from the gator.
- 56 This causal factor arose due to a combination of the following:
- the coupling pin at the trailer end of the towbar had fallen out (paragraph 57); and
 - the hydraulic hose between the gator and the trailer was not correctly connected at the time that the towbar coupling pin fell out (paragraph 64).

Each of these factors is now considered in turn.

Towbar

- 57 The coupling pin at the trailer end of the towbar had fallen out.**
- 58 The towbar consists of a horizontal steel bar which is connected between coupling points on the gator and on the trailer. Each end of the towbar has three vertical fins, which interleave with two vertical fins that are mounted on the vehicle's coupling point (figure 10). A towbar pin is inserted horizontally through holes in the five vertical fins, securing the towbar to the vehicle (figure 11).
- 59 Near the end of the towbar pin, there is a hole to allow fitment of a linch pin (figure 11) that is intended to prevent the horizontal towbar pin from vibrating out of the coupling. The linch pin consists of a metal pin with a ring in the end that snaps securely into position. The ring is intended to be snapped over the end of the towbar pin and rest hard against one side of the linch pin. In that position, the ring prevents the linch pin from falling out, in any orientation, which in turn prevents the towbar pin from falling out.

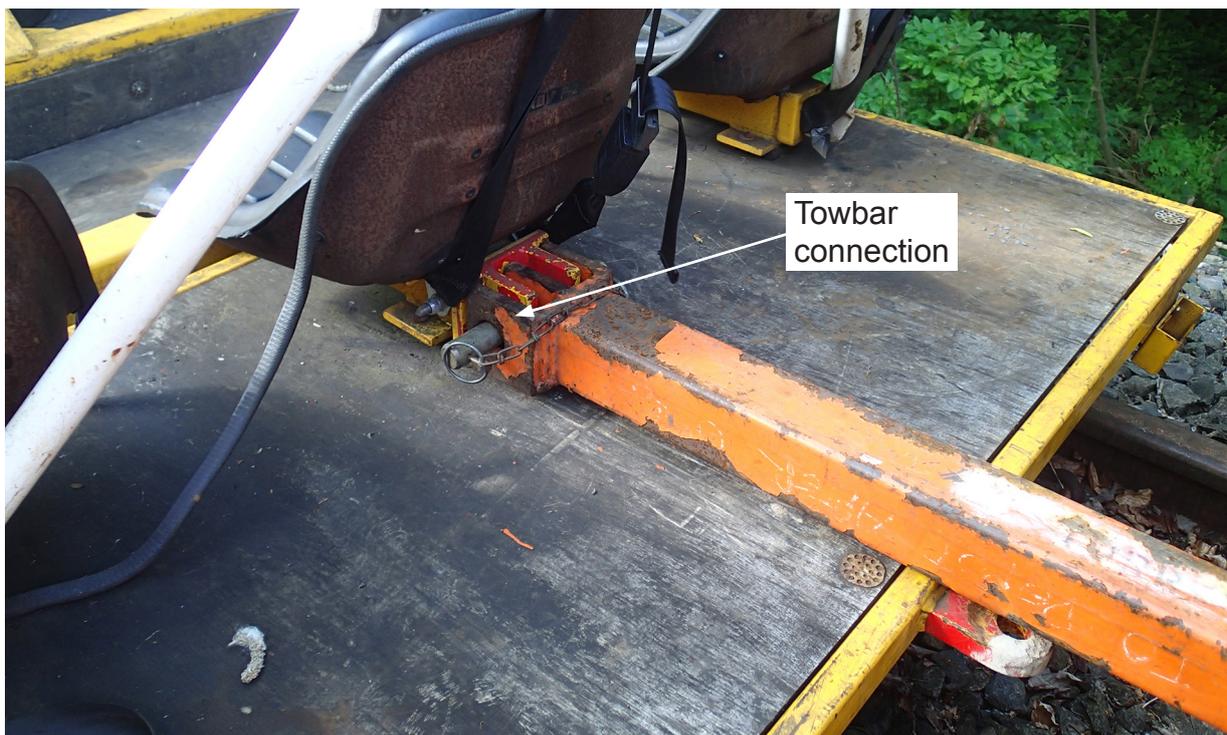


Figure 10: Towbar connected to trailer



Figure 11: Towbar pin

60 The RAIB identified that it was possible to snap the ring on the linch pin in two orientations. The ring snaps into position against the linch pin in only one of these orientations. In the other orientation, the ring remains at an angle to the linch pin, potentially allowing it to fall out, while still looking as if it has been snapped in place correctly (figure 12). If the linch pin has fallen out, the horizontal orientation of the towbar means there is nothing preventing the towbar pin falling out under vibration and the towbar becoming detached.



Figure 12: Linch pin in correct and incorrect orientations

- 61 After the runaway, the towbar pin was found on the rear deck of the trailer, adjacent to the coupling. The linch pin was attached to it by a chain but was not inserted in the hole in the towbar pin. This is consistent with the towbar pin having vibrated its way out.
- 62 Witness evidence suggests that the linch pin was in place after the gator and trailer had been coupled. On the basis that there is no evidence to contradict this, or indicating that the linch pin had been deliberately removed by anyone during the shift, the RAIB has concluded that it is almost certain that the linch pin was not installed correctly. The linch pin could have fallen out at any time after the trailer was coupled, but the towbar pin probably vibrated out after the machine operator stopped to take the first call from the supervisor, as the trailer did not run away at this time (paragraph 33).
- 63 Neither the machine operator nor the track worker who coupled the trailer to the gator was aware that there was an incorrect orientation for the snap ring on the linch pin. There was also no mention in the user manuals for the gator and the personnel carrier trailer that there was an incorrect way of fitting the linch pin. Network Rail stated that operator training on the gator and trailer was based around the information in the user manual, and so it is unlikely that awareness of there being an incorrect orientation for the linch pin would have been communicated to any staff during training.

Hydraulic hose

- 64 **The hydraulic hose between the gator and the trailer was not correctly connected at the time that the towbar coupling pin fell out.**
- 65 When the trailer came to a stop at Earles Sidings, the bayonet fitting at the end of the trailer's hydraulic brake hose was not connected to the gator. The fixed coupling at the trailer end of the hose had snapped and the hose was found on the track close to where the trailer came to a stop. The outer surfaces of the hydraulic hose bayonet coupling were covered in scratches and marks consistent with it having been dragged along the track, although it is possible that some of these were present prior to the incident (figure 13).



Figure 13: Hydraulic hose coupling

- 66 Witness evidence indicated that the trailer stopped suddenly as it reached the set of trailing points at Earles Sidings. Because the gradient at that location was still significantly downhill, an external force must have been applied to cause the trailer to stop.
- 67 The most likely explanation for this external force is that the hydraulic brake hose was trailing on the ground behind the trailer and caught in the trackwork at the trailing points. The resulting snatch force on the fixed coupling at the trailer end of the hose would have resulted in the trailer slowing or stopping and the fixed coupling probably breaking. This would also explain why the hose was found detached from, but close to, the trailer after the incident.

- 68 The RAIB considered the possibility that the hose was connected to the gator and broke at the trailer fixed coupling as the trailer started to run away. However, this is not credible because witness evidence indicates that the hydraulic system was active, and this would have resulted in the pump discharging the hydraulic oil through the broken pipe. After the incident, the hydraulic system was full of oil.
- 69 The RAIB also considered the possibility that the hose was connected to the gator prior to the runaway and that the bayonet coupling parted as the trailer started to run away. However, the hose is designed so that the fixed coupling at the trailer forms a weak link and will break in the event of excessive force being applied along the hose. The RAIB was unable to replicate any condition where the coupling was connected allowing hydraulic pressure to reach the trailer, yet able to be disconnected by pulling on the hose.
- 70 There was no evidence to suggest that anyone had acted to disconnect the hydraulic hose prior to the runaway. The RAIB concluded that it was most likely that the hydraulic hose was either not connected at all or not latched in position (and hence not allowing hydraulic pressure to pass) when the trailer was connected up to the gator. The circumstances around this are discussed in more detail from paragraph 75 onwards.

Brakes on the trailer

71 The operation of the brakes on the trailer had been disabled by the staff to allow its recovery.

- 72 The Network Rail staff first recognised that the brakes on the trailer were stuck on when they were travelling eastwards in Cowburn tunnel (paragraph 31). Because of the time pressure to get the gator and trailer back to the RRAP at Bamford, the track worker and supervisor decided to try to use the manual brake release handles to manually hold the trailer brakes off, while the gator pushed it out of the tunnel. They did this without seeking authority from their line manager (the section manager), as Network Rail stated they should have done. However, Network Rail has not identified any documented procedure that required them to do so.
- 73 The track worker and supervisor attempted to hold the brake handles over while riding on the trailer. They found this difficult to maintain and instead used a webbing strap which had been stored in the rear of the gator, to tie the brake release handles down. This was contrary to the operating manual for the trailer, which said that mechanical means should not be used to hold off the brakes. This action released the trailer brakes and allowed it to be moved freely. The gator then pushed the trailer out of the tunnel. At Edale, staff and equipment were unloaded, but the webbing strap was left in place for the machine operator to make the rest of the journey to Bamford, alone (paragraph 32). The trailer brakes were still disabled, with no mechanism available to apply them in the event of a breakaway from the gator.
- 74 The machine operator was conscious of the absence of trailer brakes, and reported that he attempted to apply some braking by loosening off the strap when he stopped to answer the first telephone call (paragraph 33). However, RAIB testing demonstrated that when the brake release handles are operated, there is a large range of movement over which the brakes are in the released state. This means that a partial loosening of the strap would have almost certainly left the brakes still fully released.

Connection of the brake hose

- 75 **The brakes were stuck on, probably because the hydraulic brake hose between the gator and the trailer was not correctly connected when they were on-tracked.**
- 76 When the machine operator set off from Grindleford, after checking that the brakes were applying when requested, he stated that he felt the gator was sluggish. However, at the time he considered that this could be because of poor adhesion due to the rain that was falling at the time. He did not consider that there was any problem with the brakes on the gator or the trailer. It was only when the machine operator was driving the gator back towards the eastern portal of Cowburn tunnel (paragraph 31) that the track workers reportedly saw sparks, drawing their attention to the trailer brakes being on.
- 77 RAIB testing of the gator and trailer showed that the gator was easily able to pull or push the trailer when the hydraulic braking hose was not connected, and thus the trailer brakes were applied. This was the case when the trailer was both empty and loaded with personnel. However, with the trailer brakes applied, the gator driver needed to apply more power than when the brakes were released to achieve the same performance.
- 78 The continuous application of the trailer brakes from when the machine operator set off from Grindleford explains the sluggishness throughout the shift and why the brakes were found to be on in the tunnel.
- 79 The machine operator was not a regular user of the gator, but typically operated it approximately twice a year. His training on the gator had included an outline of how to connect up the brakes, but did not include a detailed understanding of how the braking system worked, or how to troubleshoot it.
- 80 The track worker stated that he believed that he connected the hydraulic hose between the trailer and the gator, and the machine operator stated that he believed that he saw that the hydraulic brake hose was coupled to the gator when he checked the machine at Grindleford sidings (paragraphs 26 and 27). The machine operator saw the dashboard lamp was illuminated to indicate that the brake system was pressurised correctly, and heard the pump start and stop as the brakes were cycled, and thought this indicated that the brakes were operating. This may have been reinforced by the dashboard lamp being marked 'trailer brakes off'. However, as described in paragraph 44, the hydraulic brake system acts like this even if the gator is not connected to a trailer.
- 81 The brake tests that the machine operator carried out when he arrived at Grindleford sidings (paragraph 27) only confirmed that the gator and trailer combination stopped when the brakes were applied. This was carried out by driving forwards and backwards and checking that the brake pedal stopped the vehicle. There was no check that the trailer brakes were released when the brake pedal was not depressed. The machine operator could not see the trailer wheels from the driving position, and so could not check that they were freely rotating when the vehicle was moving.

- 82 Checking that the brakes were releasing correctly is specified as a pre-use check in the user manual for the personnel carrier trailer. The *M&EE Networking Group* document COP0014 ('Code of Practice for Trailers and Attachments with RRVs and RMMMs') also specifies that a test that brakes are releasing correctly is undertaken every time a trailer is coupled to an RRV.

Identification of underlying factors

Competence Management

- 83 The records of the safety critical competencies held by the machine operator did not align with the assessments that he had undertaken and the experience that he had accrued. This is a possible underlying factor.**
- 84 The machine operator was recorded in Network Rail's competence management system as holding the necessary competencies that he required to act as both machine operator and machine controller for the gator and trailer.
- 85 Network Rail requires all such staff to undergo an Annual Capability Conversation (ACC). This records the activities that an individual has undertaken during the year and reviews these against the competencies that they hold. The ACC records of the work activities that the machine operator had undertaken did not align with the actual work that he had done for the most recent year.
- 86 As an example, the ACC record stated that the machine operator had acted as machine controller forty times in the year 2016-2017, whereas he had only done so about four times. The machine operator did not recall having had an ACC for that year, despite there being a record of it having taken place. In addition, although the signature on the ACC was of the machine operator's name, the signature was not his. Separate records of supervision for some activities also included signatures that were not written by the machine operator. If the records had been accurate, it is possible that the machine operator's suitability for driving the gator could have been called into question.
- 87 Network Rail has reported that the assessment records had been completed without the process of involving the relevant staff being followed. It also reported that it has since investigated this issue as part of its disciplinary process.
- 88 Although this issue affected a number of staff's competence records, the only one involved in the runaway incident was the machine operator.

Observations

Non-compliances with operational processes

- 89 Although not causal to the runaway on 28 May 2017, the RAIB observes that there were a number of non-compliances with procedures relating to use of the gator and trailer.**
- 90 There were a number of non-compliances with Network Rail and industry standards and codes of practice on the night of the runaway incident, although these did not contribute to the circumstances of the runaway. These non-compliances are described in the following paragraphs.

- 91 The trailer was lifted on to the track at Grindleford sidings using the forks of a telehandler (paragraph 25). This was contrary to the user manual that specified that it should be lifted using chains from above.
- 92 The track worker who on-tracked the gator and coupled it up to the trailer (paragraph 26) did not hold the machine operator or machine controller competencies required by Network Rail standards to carry out this task.
- 93 When the gator and trailer were on-tracked, the trailer was coupled to the rear of the gator. The user manual for the trailer states that it must be coupled to the front of the gator so that the gator driver can see the trailer and its occupants as he is driving, and so be able to quickly stop in an emergency.
- 94 No light board was fitted to the trailer, again in contravention of the user manual. The light board provides white lights at the front, if the trailer is being pushed by the gator, and red lights at the rear, if the trailer is being pulled. The light board is connected to the gator by a cable that also includes a breakaway alarm function. This sounds an audible alarm on the gator dashboard if the cable breaks or is unplugged, indicating that the trailer has separated from the gator. This light board was not at site when the trailer was on-tracked and coupled to the gator.
- 95 The trailer is also intended to have an emergency stop button fitted. This is mounted on a small box which attaches to the trailer, and is connected to the gator by a cable. This allows the passengers on the trailer to press the button in an emergency, thus applying the gator and trailer brakes. This emergency stop box was not at site when the trailer was on-tracked and coupled to the gator.
- 96 Rail industry standard RIS-1700-PLT (Safe Use of Plant for Infrastructure Work) requires that a copy of the engineering acceptance certificate is kept with any item of on-track plant. COP0014 also states that this should be available to the machine operator and that the trailer should not be used if it is not available. The certificate for the trailer was not available at site on the night of the incident.

Summary of conclusions

Immediate cause

97 The trailer ran away on the gradient because it became uncoupled from the gator while the trailer brakes were disabled (paragraph 51).

Causal factors

98 The causal factors were:

- a. The trailer became physically separated from the gator (paragraph 54). This causal factor arose due to a combination of the following:
 - i. the coupling pin at the trailer end of the towbar had fallen out (paragraph 57); and
 - ii. the hydraulic hose between the gator and the trailer was not correctly connected at the time that the towbar coupling pin fell out (paragraph 64).
- b. The operation of the brakes on the trailer had been disabled by the staff to allow its recovery (paragraph 71, **Recommendation 1, Learning point 1**). This causal factor arose because of the following:
 - i. The brakes were stuck on, probably because the hydraulic brake hose between the gator and the trailer was not correctly connected when they were on-tracked (paragraph 75, **Learning point 2**).

Underlying factor

99 A possible underlying factor was that the records of the safety critical competencies held by the machine operator did not align with the assessments that he had undertaken and the experience that he had accrued (paragraph 83, **Recommendation 2**)

Additional observation

100 Although not causal to the runaway on 28 May 2017, the RAIB observes that there were a number of non-compliances with procedures relating to use of the gator and trailer (paragraph 89, **Recommendation 3**).

Previous RAIB recommendations relevant to this investigation

- 101 The RAIB has made a number of recommendations resulting from previous investigations relating to the testing of the brakes on trolleys and trailers. However, all of these relate to testing positive application of the brakes. In this incident, the issue of concern was checking that the brakes were releasing on a trailer, where there was a procedure that was not fully implemented. As a result, none of the previous recommendations are directly relevant to this incident.

Actions reported as already taken or in progress relevant to this report

Actions reported that address factors which otherwise would have resulted in a RAIB recommendation

- 102 Network Rail has issued a safety bulletin describing the circumstances of the towbar separation and the importance of fitting the linch pin in the correct orientation. This was distributed to users in Network Rail and to its contractors.
- 103 Permaquip has updated the user and maintenance manuals for plant that it supplies that uses this design of towbar. The changes include clarification that there is a correct and an incorrect way of securing the linch pin, showing photographs of both conditions. The maintenance regime has also been amended to include an inspection of the linch pin condition.

Other reported actions

- 104 Network Rail has reviewed the competence records of the staff at Chinley depot and updated their training and associated records in line with its requirements and standards.

Recommendations and learning points

Recommendations

105 The following recommendations are made³:

- 1 *The intent of this recommendation is to prevent ad hoc measures being taken when it is necessary to recover rail mounted trolleys and trailers.*

Network Rail should provide clear instructions and training to users of rail mounted trolleys and trailers on its infrastructure, on the procedures to be followed in the event of failures, such as of braking systems, that require them to be recovered (paragraph 98b).

- 2 *The intent of this recommendation is to confirm that the competence management of staff with safety critical roles is being effectively implemented.*

Network Rail should investigate the arrangements for the management of safety critical competencies at its Manchester Delivery Unit to understand the circumstances that led to the mismatch between the competence records of individuals, the assessments they had undertaken and their actual experience. Network Rail should consider whether these circumstances could exist elsewhere and take appropriate actions against a time-bound plan (paragraph 99).

- 3 *The intent of this recommendation is for Network Rail to improve levels of compliance with standards and codes of practice.*

Network Rail should take steps to understand the factors at its Manchester Delivery Unit that led to the non-compliances identified in this report, and implement the measures required to improve compliance with the relevant standards and codes of practice. Network Rail should also consider whether the lessons learnt are relevant with respect to other activities at its Manchester Delivery Unit and elsewhere (paragraph 100).

³ Those identified in the recommendations have a general and ongoing obligation to comply with health and safety legislation, and need to take these recommendations into account in ensuring the safety of their employees and others.

Additionally, for the purposes of regulation 12(1) of the Railways (Accident Investigation and Reporting) Regulations 2005, these recommendations are addressed to the Office of Rail and Road to enable it to carry out its duties under regulation 12(2) to:

- (a) ensure that recommendations are duly considered and where appropriate acted upon; and
- (b) report back to RAIB details of any implementation measures, or the reasons why no implementation measures are being taken.

Copies of both the regulations and the accompanying guidance notes (paragraphs 200 to 203) can be found on RAIB's website www.gov.uk/raib.

Learning points

106 The RAIB has identified the following key learning points⁴:

- 1 It is important that users of rail mounted trailers and trolleys do not disable the operation of brakes, unless alternative mitigation to prevent a runaway condition has been put in place.
- 2 It is important that users of rail mounted trailers and trolleys carry out the full set of prescribed brake tests, including testing that brakes are releasing correctly, as well as applying correctly, prior to use.

⁴ 'Learning points' are intended to disseminate safety learning that is not covered by a recommendation. They are included in a report when the RAIB wishes to reinforce the importance of compliance with existing safety arrangements (where the RAIB has not identified management issues that justify a recommendation) and the consequences of failing to do so. They also record good practice and actions already taken by industry bodies that may have a wider application.

Appendices

Appendix A - Glossary of abbreviations and acronyms

ACC	Annual Capability Conversation
RAIB	Rail Accident Investigation Branch
RMMM	Rail Mounted Maintenance Machine
RRAP	Road-Rail Access Point
RRV	Road-Rail Vehicle

Appendix B - Glossary of terms

All definitions marked with an asterisk, thus (*), have been taken from Ellis's British Railway Engineering Encyclopaedia © Iain Ellis. www.iainellis.com.

Crossover	A route between two parallel tracks that allows a train to cross from one track to the other.
Delivery Unit	Part of Network Rail's organisation that is responsible for the maintenance of assets in a defined geographical area.
Engineering acceptance certificate	A certificate issued by a Vehicle Acceptance Body that certifies that a vehicle complies with all relevant mandatory requirements in Railway Group standards.*
Engineering supervisor	The person nominated to manage the safe execution of works within an engineering worksite. This includes authorising movements of trains into and within the worksite and managing staff access to the site.*
Linch pin	A metal pin or clip inserted into a hole at one end of an axle or pivot intended to prevent the axle or pin working loose.
M&EE Networking Group	An industry working group concerned with the operation of plant on railways in Great Britain.
Machine controller	A person trained and authorised to control and supervise an item of on-track plant other than a rail crane.*
Machine operator	A person trained and authorised to operate an item of on-track plant or machinery.*
On-track	The process whereby an RRV transfers from road to rail.
Possession	A period of time during which one or more tracks are blocked to trains to permit work to be safely carried out on or near the line.*
Road-rail access point	A location on the railway designed to allow an RRV to be driven onto the line and to change from road mode to rail mode.
Road-rail vehicle	A vehicle that can travel under its own power on the road and also, by virtue of a rail guidance system, on railway track.
Section manager	The person responsible for the day to day maintenance of the track within a Maintenance Delivery Unit.
Solenoid valve	An electromechanically operated valve.
Telehandler	A piece of plant fitted with a telescopic boom that can be used for lifting, stacking or digging operations according to the type of attachment fitted to the boom.
Towbar pin	A cylindrical metal pin used to couple a towbar to a vehicle or trailer. The pin is inserted into corresponding holes in the towbar and the vehicle or trailer, and forms a semi-permanent link between the two.

Appendix C - Investigation details

The RAIB used the following sources of evidence in this investigation:

- information provided by witnesses;
- site photographs and measurements;
- testing of the gator and trailer braking system;
- maintenance records for the equipment involved;
- manufacturer's documentation;
- competence management records;
- operational records;
- weather reports and observations at the site; and
- a review of previous RAIB investigations that had relevance to this incident.

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