RAIB

Rail Accident Investigation Branch

Rail Accident Report

Runaway of a road-rail vehicle at Bradford Interchange
8 June 2018

Report 01/2019
March 2019

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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This report is published by the Rail Accident Investigation Branch, Department for Transport.

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 words such as '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, words such as '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.

Information about casualties is based on figures provided to the RAIB from various sources. Considerations of personal privacy may mean that not all of the actual effects of the event are recorded in the report. The RAIB recognises that sudden unexpected events can have both short and long term consequences for the physical and/or mental health of people who were involved, both directly and indirectly, in what happened.

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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Runaway of a road-rail vehicle at Bradford Interchange, 8 June 2018

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Summary

At about 01:40 hrs on Friday 8 June 2018, a road-rail vehicle (RRV) ran away while being on-tracked at a road-rail access point south of Bradford Interchange station. The RRV ran downhill for approximately 340 metres, before coming to a stop as the track levelled out in the station. The RRV's machine operator and machine controller were able to run along with it and warned a member of track maintenance staff, who was able to move clear in time.

The RRV ran away because its rail wheels were, incorrectly, partially deployed and because the rail wheel braking system had not been correctly maintained.

Partial deployment of the rail wheels was a result of the machine operator not following the standard industry procedure for on- and off-tracking. He had routinely been on- and off-tracking in this manner and this had not been detected by his employer, Readypower.

The braking system on the rail wheels had not been correctly maintained because fitters were not following the original equipment manufacturer's instructions and Readypower had not detected this.

An underlying factor was that the industry's competence management system for machine operators focuses on the renewal of qualifications, rather than demonstrating ongoing competence.

The RAIB has made three recommendations. The first one seeks to improve the industry's competence management system for all machine operators who work on Network Rail's infrastructure. The second, addressed to Readypower, is intended to improve the management of competence of its staff. The last recommendation aims to improve the quality of the maintenance instructions and training provided to Readypower's fitters.

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. These are explained in appendix A.

The incident

Summary of the incident

3 At about 01:40 hrs on Friday 8 June 2018, a road-rail vehicle (RRV) ran away as it was being on-tracked at a road-rail access point (RRAP) south of Bradford Interchange station (figure 1). The RRV ran downhill for approximately 340 metres before coming to a stop as the track levelled out in the station. A group of maintenance workers was operating at the station, including a worker on the track on which the runaway took place. This worker was warned of the approaching runaway and was able to move clear in time.

4 The RRV was a Genie Z60/34 Mobile Elevating Work Platform (MEWP), which was owned and operated by Readypower Rail Services Ltd (referred to as Readypower in the rest of this report) (figure 2). It weighed 17.5 tonnes. There were two members of Readypower's staff with the MEWP at the time of the on-tracking operation, a machine operator and a machine controller. Unable to stop the runaway, they both were able to keep up with the silent and unlit machine as it ran towards the station, and they warned others of its approach.

5 There was no damage to the infrastructure or equipment and nobody was injured during the incident. The incident took place at a time when the area was under possession[1] for maintenance activities. As a result, there were no passenger train services in the vicinity.

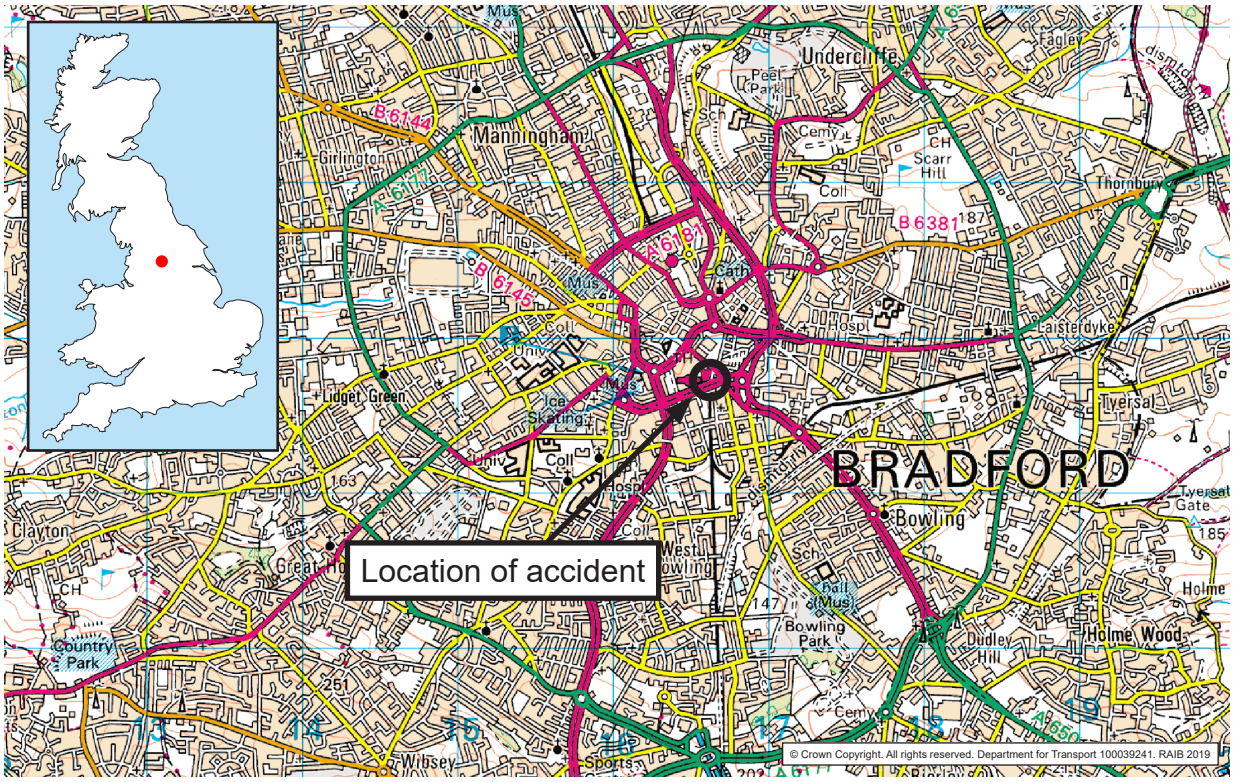


Figure 1: Location of incident

[1] A possession is a period of time during which one or more lines are blocked to trains to allow engineering work to be safely undertaken.

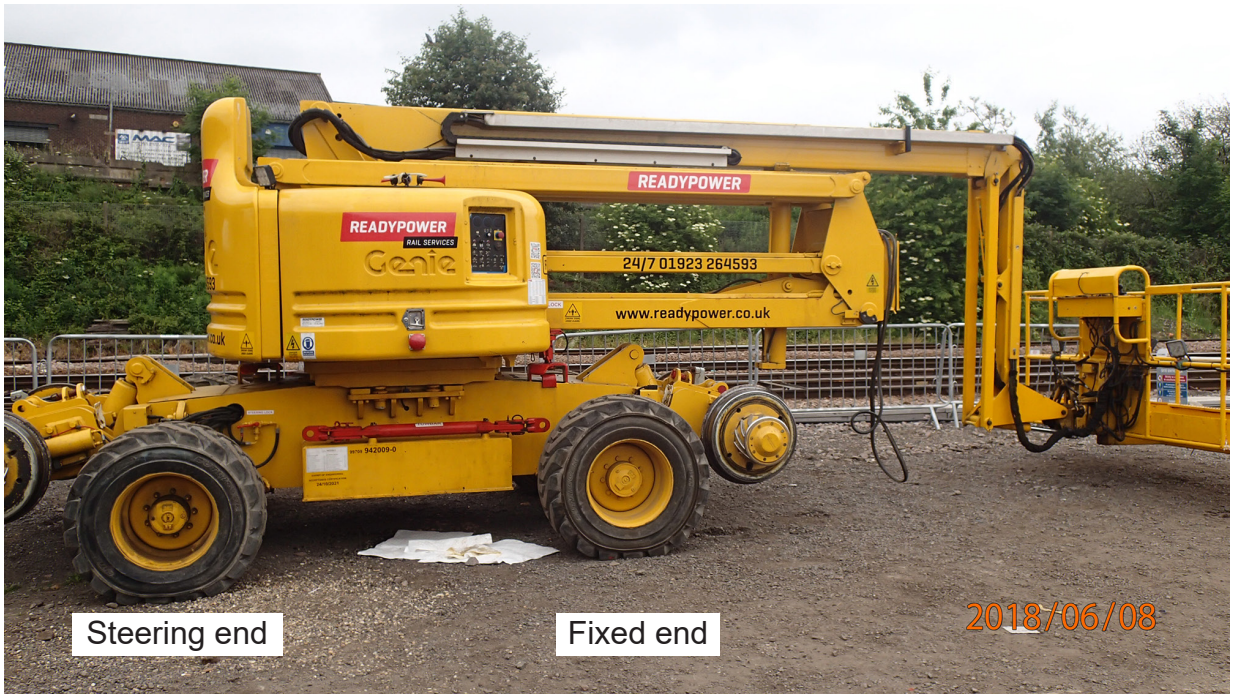


Figure 2: The RRV involved in the incident

Context

Location

6 Bradford Interchange station is located on Network Rail's London North Eastern route, 40 miles 27 chains from a zero datum at Manchester Victoria station. The MEWP was being on-tracked onto the W -line at Britannia Street RRAP, which is located at 40 miles 7 chains (figure 3). The gradient at the RRAP is 1 in 46.

Organisations involved

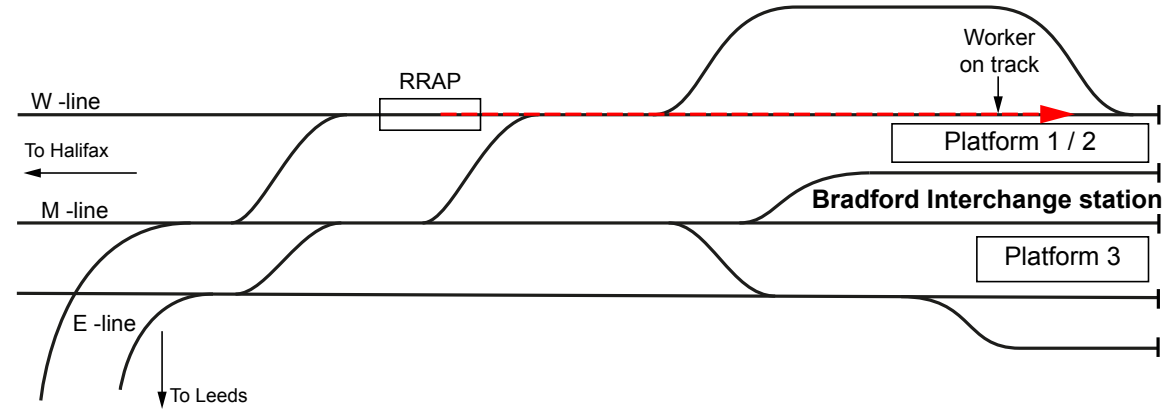
7 Network Rail owns and maintains the railway infrastructure where the incident occurred.

8 Amey CEFA was responsible for the track possession and provided the engineering supervisor, controllers of site safety and person in charge of the possession (PICOP).

9 Readypower owned and maintained the MEWP involved in the runaway and employed the machine controller and machine operator. As the provider of the on-track plant, Readypower was also responsible for the provision of a Plant Operations Scheme Representative (POS Rep). In this instance, the machine controller also had the role of POS Rep. This is allowed by Network Rail's standards. The role of a POS Rep is described in Network Rail standard NR/L2/RMVP/0200/module P521. As a POS Rep, the machine controller was responsible for the safe delivery of all plant operations involving the MEWP.

10 Allan J Hargreaves Plant Engineers Ltd (referred to as Hargreaves in the rest of this report) modified the MEWP with its own design of the Direct Rail Wheel Braking system (DRWB) in October 2014.

11 Network Rail, Amey CEFA, Readypower and Hargreaves freely co-operated with the investigation.



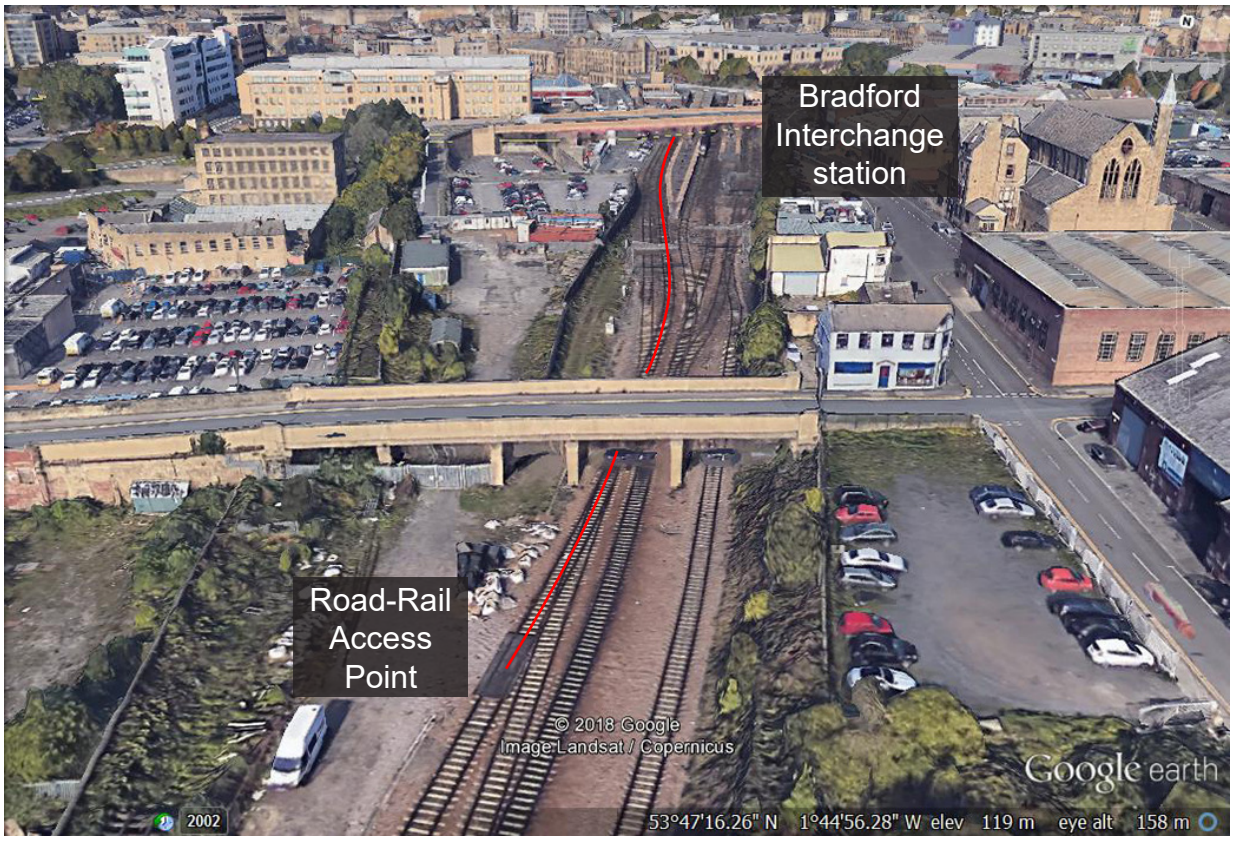


Figure 3: Track layout and aerial view

Rail equipment involved

12 The machine involved in the incident was MEWP vehicle number 99709 942009-0 (referred to as FR1326 by Readypower). This was a road-based MEWP, manufactured in the United States in 2006, which had been converted in 2007 for use on the UK rail network.

13 The MEWP is known as a high-ride type 9b RRV. Machines of this type have rail wheels that are driven and braked by friction forces transmitted through the tyres of the road wheels onto hubs fitted at the end of the rail axles (figure 4). Since 2014, this RRV type has also been fitted with brakes on its rail wheels (the Direct Rail Wheel Braking system). This is a supplementary braking system which acts directly on the rail wheels using brake callipers pushing pads onto discs that are fitted to the rail axles. The DRWB system works in parallel with the braking achieved through the road wheels. However, it is the only effective braking system when the road wheels are not touching the ground and are not in full contact with the rail wheel hubs (figure 5). The DRWB system was retrofitted to all type 9b machines following previous runaway incidents. The project to do this was led and financed by Network Rail between 2011 and 2014.

Figure 4: Hubs at the end of the rail axles

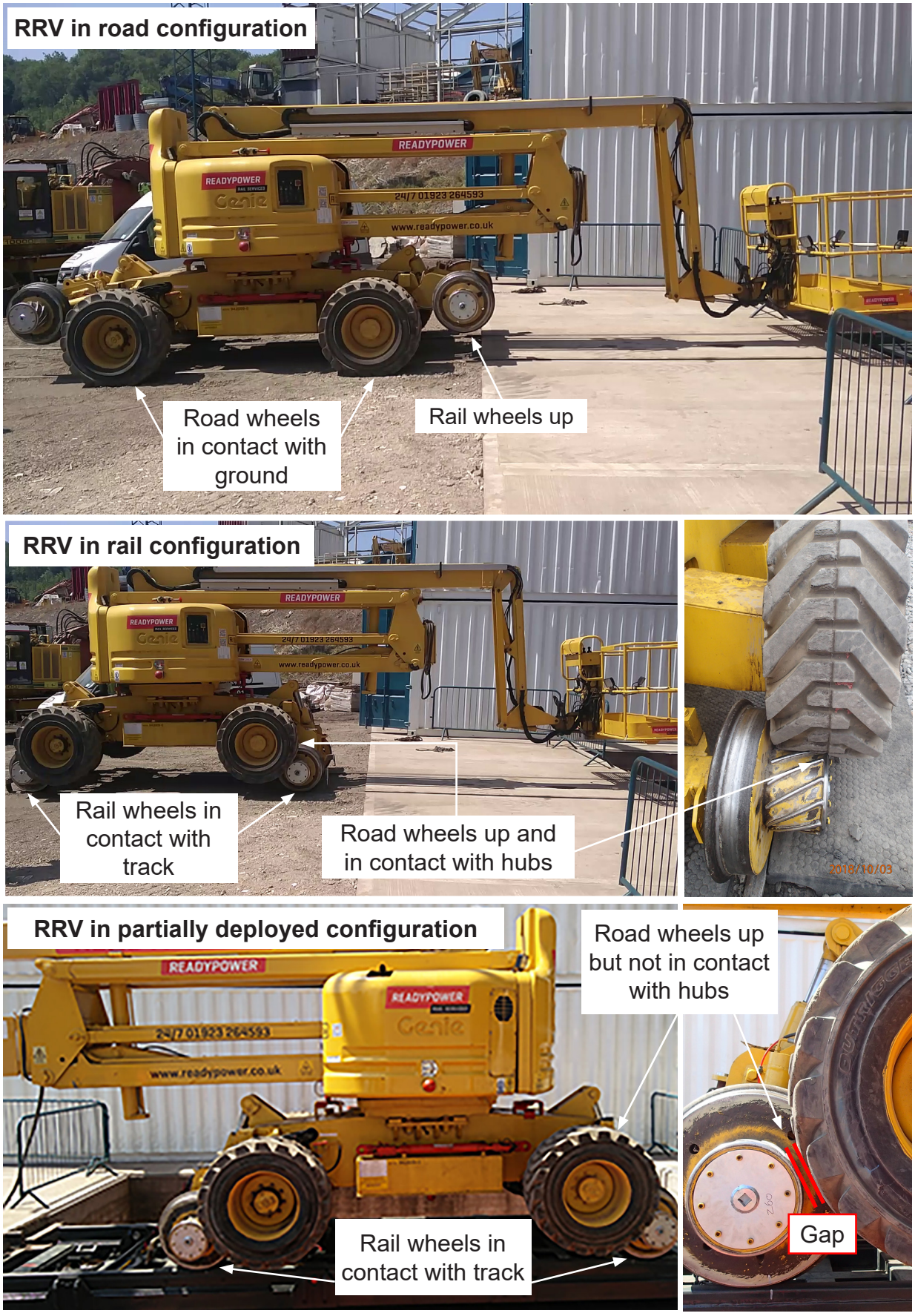


Figure 5: RRV in various deployment configurations

14 During the implementation of the DRWB project, the number of machines to be converted led Network Rail to place contracts with several companies for the design and installation of a DRWB system. Hargreaves was one of the companies that was selected and it installed its own design of the DRWB system onto many RRVs, including the MEWP involved in this incident.

15 The machine has two pairs of road wheels, one steerable and the other fixed (figure 2). When it is being on-tracked, the MEWP is operated using a remote-control pendant (figure 6), which is attached to the vehicle by a cable and stored in a housing at the fixed end. When the MEWP is being driven along the track or on the ground, it is operated from a control panel in the operator's basket (figure 7). The machine also has a control panel attached to the body of the MEWP (figure 8).

Figure 6: Remote-control pendant

Figure 7: Control panel in the operator's basket

Figure 8: Control panel attached to the body of the MEWP

Staff involved

16 The machine operator joined Readypower in October 2017 and had been working solely for the company since January 2018. He had held the Network Rail machine operator qualification since September 2016. Since January 2018, he had operated and on- and off-tracked the three types of MEWPs owned by Readypower (Genie Z60, Manitou ART17 and RR EVO14) many times. There were no performance incidents on his employment record. He had never worked at Bradford Interchange station before.

17 The machine controller had held the Network Rail machine controller qualification since March 2018, but he had been working on the railway since March 2014 and held many other safety-related qualifications. There were no performance incidents on his employment record. The machine controller was required to ensure that the RRV did not expose those working in the vicinity to additional risks. This required him to be present during on-tracking, and to assist the machine operator if requested. Machine controllers are not given detailed training on how individual RRVs are operated and their role does not include detailed supervision of the machine operator's actions. The machine controller was familiar with the location as he had worked at the same place the night before. He had worked with the machine operator before.

External circumstances

18 It was a dry, mild night with a temperature of 10°C recorded at a nearby weather station in Bradford at the time of the incident. It was dark, but ample artificial light was provided at the RRAP by temporary flood lights (figure 9).

Figure 9: Britannia Street RRAP on night of the incident (courtesy of Network Rail)

The sequence of events

Events preceding the incident

19 On the night of Thursday 7 June 2018, at around 23:00 hrs, the machine operator arrived at the railway access point off Britannia Street. He gained access to the railway and located the machine he was to operate during his shift. In accordance with Readypower's procedures, he undertook pre-departure checks on the machine.

20 The machine controller arrived shortly afterwards and saw the machine operator complete the pre-departure checks. Knowing that the track possession was not planned to start before 00:55 hrs on Friday 8 June, they both went back to their cars to wait.

21 The Amey CEFA engineering supervisor and three controllers of site safety had also arrived on site at around the same time. The engineering supervisor discussed the planned work with each controller of site safety. This planned work included a structure examination for which the MEWP was going to be used. The intent was for one of the controllers of site safety to carry out the structure examination from the MEWP basket, with the MEWP being controlled by the machine operator.

22 At 01:21 hrs, the engineering supervisor was granted access to the various work sites by the PICOP. He then gave permission to the three controllers of site safety to start work. Two controllers of site safety went to the station to brief their teams while the third stayed at the RRAP. Just after 01:30 hrs, having established a radio link between the two of them, the machine controller and machine operator started the process of moving the machine to the RRAP. The controller of site safety was waiting nearby for this process to be completed before climbing into the basket.

Events during the incident

23 Under guidance from the machine controller, the machine operator started the machine, climbed into the basket and drove the MEWP onto the RRAP. He then left the basket to start the on-tracking sequence using the pendant controls. He elected at that point to leave the pendant in its housing. In order to align the machine, he was standing by the uphill end, adjacent to the fixed pair of road wheels in line with the cess[2] rail. The machine controller had positioned himself in line with the steering end in the six-foot[3] (figure 10).

24 With the fixed end aligned with the track, the machine operator started to deploy the rail wheels at that end. He stopped once the rail wheels had engaged with the rails and the road wheels were off the ground. At that point, the road wheels at the fixed end were not yet in contact with the hubs.

[2] The cess is the space alongside the lines.

[3] The six-foot is the space between two adjacent lines on a two-track railway.

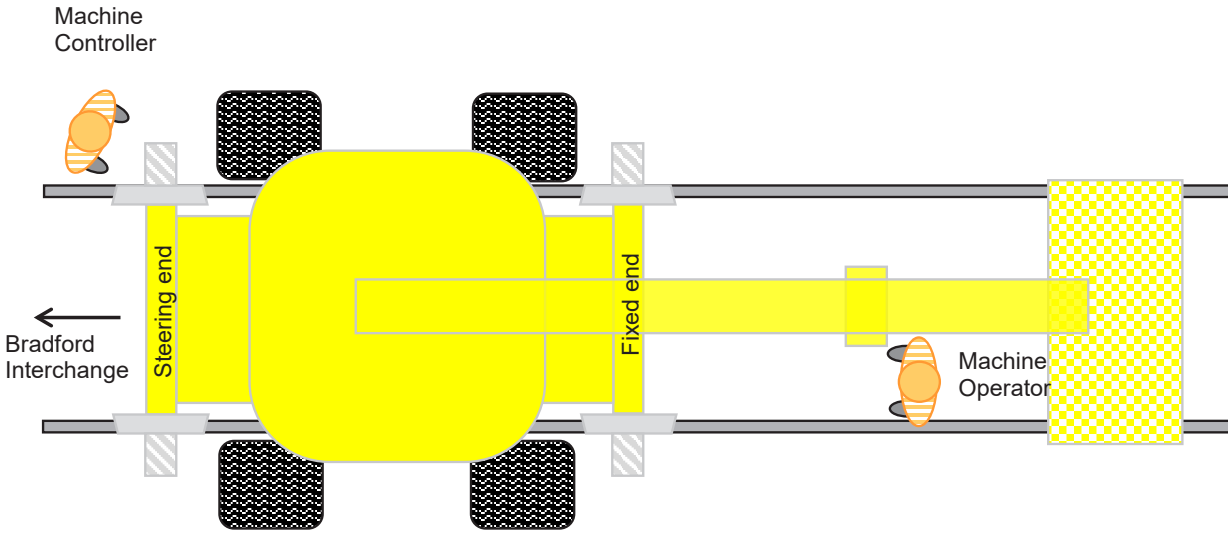


Figure 10: Position of machine operator and machine controller at time of runaway

25 He then proceeded to align the steering end of the machine guided by the machine controller. Once the steering end was aligned, he started to deploy the rail wheels at that end. He again stopped once the rail wheels had engaged with the rails and the road wheels at the steering end were off the ground. At that point, none of the road wheels were in contact with either the ground or the rail wheel hubs. His intention was to complete the deployment of the fixed end axle and then the steering end axle.

26 However, before he was able to continue with his intended actions, the MEWP started rolling away from him towards Bradford Interchange station.

27 At this point, the machine operator realised that the MEWP engine had stopped, preventing any further deployment of the rail axles. This may have been as a result of the machine controller having already pressed an emergency stop button on the side of the machine (witness evidence is inconclusive as to the exact timing of the use of the emergency stop button). In an attempt to stop the runaway, the machine operator jumped in the basket where he tried unsuccessfully to restart the machine (the engine cannot be restarted with the emergency stop button depressed). The machine controller ran to the opposite side of the machine where the control panel attached to the MEWP body is located. He tried to reach a master key at the top of this control panel but the key snapped as he tried to operate it.

28 Finding that he was unable to restart the engine, the machine operator jumped from the basket onto the track and, together with the machine controller, started running alongside the machine to warn others of the runaway. With the engine off, the machine was silent and with the emergency button pressed, it was also unlit. Witnesses described the machine increasing its speed from walking pace to a ‘fast jog’ as it ran away towards platform 1 of Bradford Interchange station.

29 Staff on the platform heard the commotion and quickly realised that there was a member of staff on the track alongside platform 1 in the path of the approaching machine. They warned him and helped him onto the platform approximately 5 to 8 seconds before the machine reached them. As the gradient levelled out and due to the action of the machine operator who pushed the basket against the platform, the machine came to a stop approximately 40 metres from the buffer stops located at the end of platform 1. The time was then 01:38 hrs (figure 11).

Figure 11: Incident MEWP at platform 1 immediately after the incident (courtesy Northern Rail)

Events following the incident

30 The machine controller reported the incident to Readypower's on-call personnel and requested the attendance of a fitter. With the help of the machine controller, the machine operator placed a railway sleeper across the track to ensure that the machine could not move any further. The engineering supervisor was in the vicinity of the runaway and he rang the PICOP to advise him of the incident. At 02:01 hrs, the PICOP reported the incident to Network Rail's route control.

31 At 02:05 hrs, the machine operator restarted the engine and at 02:11 hrs, the deployment of both rail axles was completed to bring the road wheels into full contact with the rail hubs. At 02:17 hrs, under instruction from the engineering supervisor, the machine departed platform 1 to return to the RRAP. By 02:38 hrs, the machine had been off-tracked and returned to the compound where it had previously been stored. The Readypower fitter arrived just before 03:00 hrs and proceeded to check the machine. Other than an oil leak, he could not find any fault with the machine and was able to fully deploy its rail wheels in the compound.

Key facts and analysis

Background information

32 The MEWP involved in the incident had been certified in October 2014 for use on gradients of up to 1 in 25, in accordance with Rail Industry Standard RIS-1530-PLT[4] issue 5. This certification remains valid for use of the RRV on Network Rail infrastructure until October 2021, after which the RRV would need to be reassessed against the latest version of standard RIS-1530-PLT. The October 2014 certificate had been issued following installation of the DRWB on the machine[5].

33 On 8 May 2016, the incident MEWP had been involved in another runaway incident at Brentwood, Essex. During that incident, a machine operator experienced difficulties gaining forward movement from the machine before transiting over a set of points (the brakes would not release). In an attempt to fix the fault and with the help of a fitter from another plant operator, he raised and lowered the rail wheels several times. On the last attempt and with the rail wheels partially deployed at both ends, the machine started to run away. The MEWP ran along the track for several hundred yards until it collided with a rail trailer which was being towed by an RRV excavator. Nobody was injured as a result of this incident.

34 Following the incident at Brentwood, the MEWP was taken out of service and examined. The detailed examination revealed that an override valve in the hydraulic circuit feeding the brakes had been left open after maintenance which, in the sequence of events that day, led to the rail wheel brakes being inadvertently released. Following this incident, the fitters responsible for the inspection and maintenance of this type of MEWP were instructed to check the position of this override valve at every maintenance intervention.

35 Following the incident at Brentwood, the MEWP remained out of service for 18 months, initially quarantined and then unused. Before re-entering service, the machine underwent Readypower's 12-monthly inspection, which involves a full suite of testing, including brake testing. Having successfully passed these tests, the machine re-entered service on 21 October 2017 in West Drayton, in the western suburbs of London.

36 Having re-entered service, the machine was again subject to Readypower's maintenance regime which includes weekly inspections, 6-monthly inspections and 12-monthly inspections. These inspections are carried out by Readypower's fitters. The last weekly inspection before the incident at Bradford Interchange took place on 4 June 2018 (4 days before the incident) and the last 6-monthly inspection took place on 5 April 2018 (2 months before the incident). The last 6-monthly inspection followed another period when the machine had not been in use, between Christmas 2017 and April 2018.

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[4] Rail Industry Standard for Technical Requirements for On-Track Plant and their Associated Equipment and Trolleys, now at issue 6.

[5] When it was converted in 2007 for use on the UK rail network, this machine was fitted with a type of rail wheel braking system. This braking system was removed and replaced with the DRWB system referred to throughout this report in 2014. RAIB report 15/2014 describes the system that used to be fitted to the Genie Z60 MEWPs.

Identification of the immediate cause

37 The MEWP ran away on a gradient because only the rail wheel brakes were acting to prevent movement and these were unable to do so.

38 Following the incident at Bradford Interchange, the MEWP was taken to a testing site at EP Industries (Derbyshire) where the ability of its rail wheel brakes to hold the machine on gradients was explored (figure 12). In particular, the machine was placed with its rail wheels partially deployed, so that it was being held by its rail wheel brakes only, as it had been on the night. The machine was also tested with its rail wheels in a fully deployed configuration to establish whether it was able to meet the 1 in 25 gradient requirement in RIS-1530-PLT. Table 1 and table 2 show the results of the testing.

Figure 12: Incident MEWP during testing

Incident condition: Rail wheels partially deployed (Road wheels not in contact with ground or rail wheel hubs)		
Test	**Angle**	**Gradient**
1	0.9º	1 in 64*
2	1.1º	1 in 52*
3	0.9º	1 in 64*

* Test stopped because the machine started moving

Table 1: Test results on incident MEWP

Incident condition: Rail wheels fully deployed (Road wheels in full contact with rail wheel hubs)		
Test	**Angle**	**Gradient**
1	2.3º	1 in 25**
2	2.7º	1 in 21**

** Test stopped before any machine movement

Table 2: Test results on incident MEWP

39 These tests demonstrated that the machine with its rail wheels in a partially deployed configuration would not have remained stationary on the gradient at the Britannia Street RRAP (1 in 46). Hence, in a partially deployed configuration, the MEWP was not able to meet the 1 in 25 gradient requirement in RIS-1530-PLT. In a fully deployed configuration, the MEWP was able to meet the 1 in 25 gradient requirement.

Identification of causal factors

40 The incident occurred due to a combination of the following causal factors:

a. The MEWP was placed in a configuration where only its rail wheel brakes were acting to prevent movement (paragraph 41).

b. The MEWP direct rail wheel braking system was unable to provide enough brake force to prevent a runaway on a 1 in 46 gradient (paragraph 63).

c. The crew was unable to recover the developing situation (paragraph 98).

Each of these factors is now considered in turn.

The on-tracking process

41 **The MEWP was placed in a configuration where only its rail wheel brakes were acting to prevent movement.**

42 Witness evidence confirms that the machine operator placed the machine with both sets of rail wheels partially deployed during the on-tracking sequence. The CCTV footage at the station shows the machine operator completing the deployment of the rail wheels, after the runaway.

43 This causal factor arose due to a combination of the following:

a. The machine operator did not follow the correct on-tracking procedure (paragraph 44).

b. Readypower had not previously identified that the machine operator was routinely not following the correct on-tracking procedure (paragraph 50).

Each of these factors is now considered in turn.

The on- and off-tracking procedure

44 **The machine operator did not follow the correct on-tracking procedure.**

45 During on-tracking of a high-ride RRV, the weight is transferred from the road wheels to the rail wheels. During this transition, there is a phase when a pair of road wheels is neither in contact with the ground nor in contact with the rail wheel hubs. Any braking provided by the road wheels is not effective during this transition phase. It is essential to avoid this situation occurring simultaneously at both ends of the machine as this results in the risk of a runaway.

46 Before 2009, the risk of runaway was generally managed by machine operators having to comply with procedures. The risks associated with partial deployment of both rail axles were explained to machine operators during training and they were taught to follow an on- and off-tracking procedure to mitigate these risks; they should complete the deployment of the first rail axle before they started deploying the second one. This way, there was always a set of braked road wheels in contact with either the ground or the rail wheel hubs.

47 Between 2009 and the introduction of the DRWB systems in 2014, the requirements in RIS-1530-PLT changed, such that sole reliance on a procedure was no longer acceptable. During that period, the industry generally mitigated the risk of runaways by fitting RRVs with electro-mechanical interlocks to prevent the second rail axle from being deployed before the first rail axle had been fully deployed. This type of interlock effectively forced the machine operator to follow the correct on- and off-tracking procedure.

48 Since the introduction of the DRWB systems in 2014, interlocks of this type are no longer fitted to RRVs and the risk of runaway is mitigated by the presence of the DRWB system. As part of their training, machine operators are still warned about the risks of a runaway and taught not to start deploying the second rail axle until the first one is fully deployed. But there is now no interlock preventing a machine operator from deploying the rail wheels the way it was done on the night (figure 13).

49 The machine operator involved in the incident at Bradford Interchange had been trained in September 2016 on a Genie Z60. He demonstrated during his assessments that he understood the importance of following the on- and off-tracking procedure. He confirmed post-incident that he knew how to deploy a machine following the on- and off-tracking procedure (figure 14). He also stated that he deployed the rail wheels on the night in the same way as he had been routinely deploying the rail wheels on other machines. He was aware that the MEWP was fitted with a DRWB system which should have prevented a runaway situation and he stated that this may have affected his perception of the risk.

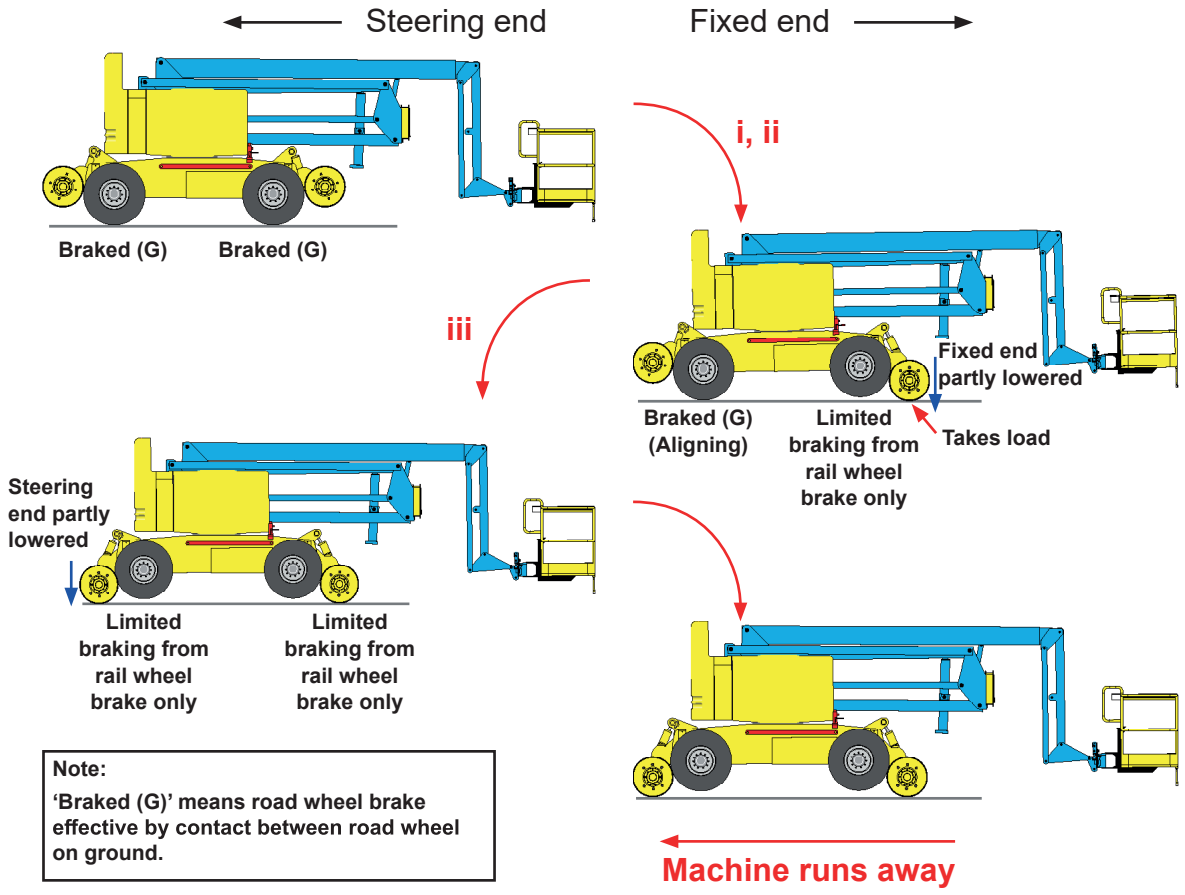


Figure 13: On-tracking sequence on the night

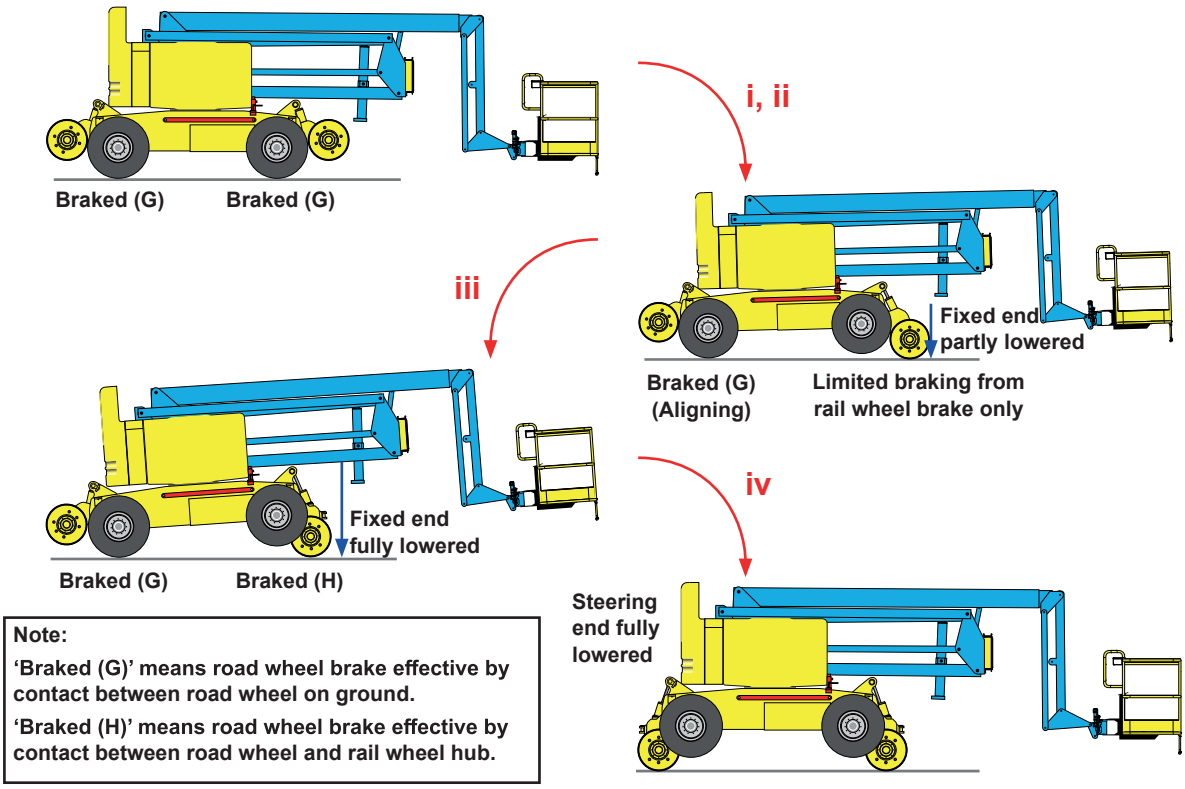


Figure 14: On-tracking in accordance with trained procedure

Readypower's management of the machine operator

50 Readypower had not previously identified that the machine operator was routinely not following the on-tracking procedure.

51 This causal factor arose due to one or both of the following:

a. Readypower did not follow its own recruitment process (paragraph 52).

b. Once in employment with Readypower, the ongoing competence of the machine operator was not checked (paragraph 57).

Each of these factors is now considered in turn.

Readypower's recruitment process

52 Readypower did not follow its own recruitment process.

53 Following initial training in September 2016, the machine operator started working for a plant hire company based in Sheffield. From September 2016 to October 2017, he worked on various projects in Newport and Slough operating various types of MEWPs including Genie Z60. As his work through this company started to dwindle, he approached Readypower seeking employment on a zero-hours contract.

54 Readypower's recruitment process was described in its HRM-P-01 procedure. It required that any machine operator seeking employment with Readypower started with a theoretical and practical assessment of their plant skills. In practical terms, the applicant was invited to one of Readypower's sites to demonstrate that they knew how to safely operate an RRV. This assessment included on- and off-tracking of the RRV. HRM-P-01 stated that this assessment should be carried out by Readypower's training manager who stated that he would expect every machine operator to on- and off-track a high-ride machine in the correct sequence.

55 A contracts manager within Readypower had previously worked with the machine operator. He recommended him for employment and the machine operator was provided with a zero-hours contract without being subject to the practical assessment stipulated in HRM-P-01. Had it followed its own recruitment process, it is possible that Readypower would have detected that the machine operator did not routinely on-track high-ride RRVs correctly.

56 The machine operator was given a company induction on 25 October 2017. On 30 October 2017 he received familiarisation on the MEWPs operated by Readypower. Familiarisation is the opportunity for Readypower to show its new recruits the type of machines that they will operate and their controls. In the case of this machine operator, the familiarisation exercise was undertaken by the contracts manager. There is conflicting evidence regarding how this exercise was conducted. However, this familiarisation exercise was not expected to cover the on- and off-tracking sequence. Following this familiarisation exercise, the machine operator was provided with an authority to work card which enabled him to start working for Readypower. His first shift with Readypower took place on 15 January 2018 at Matlock Bath, Derbyshire, using a Genie Z60 machine.

Readypower's management of ongoing competence

57 **Once in employment with Readypower, the ongoing competence of the machine operator was not checked.**

58 From 15 January 2018 to 8 June 2018, the machine operator worked 75 shifts for Readypower. As he had joined them as an experienced machine operator, he was not subjected to any mentoring programme. Such a programme would be expected to ensure that he was chaperoned by another experienced machine operator during his first few shifts.

59 There was no evidence that, at any time during the 75 shifts covering a period of 6 months, his performance was monitored to confirm that he was operating in accordance with the correct processes. The machine operator's line manager was a depot manager who was office-based and did not carry out performance monitoring of the machine operators on site. The depot manager reported to the head of operations who spent some time on operational sites, but was not there to, and did not, specifically monitor the performance of the machine operators.

60 Readypower had a process of site safety tours defined in its monitoring procedure QM-P-01. The site safety tours mainly focused on ensuring that the correct tools and equipment were available on site. They also required the person carrying out the tour to check that the machine operators had the correct qualifications in the Sentinel scheme (paragraph 102) to operate certain types of equipment. This only ensured that there was evidence that they had received the relevant training earlier in their career, not that they continued to operate the equipment correctly.

61 The machine controller on the night of the incident was also acting as the POS Rep. In his role as a POS Rep, the machine controller had a form to remind him of the duties of a POS Rep. This included monitoring the plant activities undertaken by the machine operator. However, the monitoring seemed to focus more on the delivery of the activities in accordance with the work plan rather on monitoring the performance of the machine operator delivering the plan.

62 In common with other plant operators, Readypower's competence management system for machine operators focused on the renewal of qualifications, rather than demonstrating ongoing competence (paragraph 101).

The Direct Rail Wheel Braking system

63 **The MEWP direct rail wheel braking system was unable to provide enough brake force to prevent a runaway on a 1 in 46 gradient.**

64 Following the incident at Bradford Interchange and with the assistance of Readypower, the RAIB examined and tested the braking systems on the MEWP. Paragraphs 38 and 39 describe the initial tests on a sloping test rig. Additionally, the DRWB system was tested using the torque[6] testing method (figure 15). This method enables the resisting torque provided by the DRWB system to be directly and individually measured on each rail wheel. The braking achieved solely through the road wheels was tested using a separate pull-test (figure 16). The pull-test provides the overall braking resistance achieved by the road wheels contacting the hubs. Table 3 shows the results of the torque tests. Table 4 shows the results of the pull-tests (see also paragraph 92).

Wheel	Torque[7]
Steering end nearside[8]	232 Nm
Steering end offside	115 Nm
Fixed end nearside	162 Nm
Fixed end offside	105 Nm
Total resisting torque	614 Nm

Table 3: Brake torque test results

Condition	Pull-force
As found #1	1750 kgf to 1950 kgf
As found #2	1850 kgf to 2000 kgf

Table 4: Pull-test results

[6] Torque is a twist or rotating force measured in Newton-metres (Nm). The brake force can be calculated by dividing the torque by the wheel radius.

[7] The torques were measured in the clockwise and anticlockwise directions. The results presented here is an average combining both directions.

[8] Nearside and offside are defined assuming that the front of the MEWP is at the steering end.

Figure 15: Torque testing of DRWB system

Figure 16: Pull-test when road wheels acting only (DRWB callipers removed)

65 According to Hargreaves maintenance instruction AJH077[9] issue 7, each rail wheel braking torque should have been a minimum of 950 Nm. The results of the torque tests show that the DRWB system was providing significantly less than the required torque. When converted to a brake force, the total resisting torque equates to a brake force of 220 kgf. The gradient at the RRAP (1 in 46) created a 380 kgf downhill force on the 17.5 tonne MEWP, which exceeded the brake force of 220 kgf. These tests further confirm (beyond the tests reported in paragraphs 38 and 39) that the MEWP rail wheel braking system was unable to provide enough brake force to prevent movement on a 1 in 46 gradient.

[9] AJH077 issue 7 – 'MEWP Direct Rail Wheel Braking system operation and maintenance'.

66 This causal factor arose due to a combination of the following:

a. The brake pads were worn (paragraph 67).

b. The brake callipers had not been adjusted to compensate for brake pad wear (paragraph 71).

Each of these factors is now considered in turn.

Hargreaves DRWB system

67 **The brake pads were worn.**

68 Figure 17 shows the DRWB system fitted to the incident MEWP and figure 18 shows a cross-section of the calliper. The Hargreaves design uses a single acting calliper installed on a floating mount to accommodate a fixed brake disc. This design is replicated at every wheel. The clamping load (applying the brake) is provided by a spring made of Belleville washers[10] in compression. In order to release the brakes, hydraulic pressure is provided to the calliper to further compress the spring. The calliper is fail-safe as a loss of hydraulic pressure results in the brakes being applied.

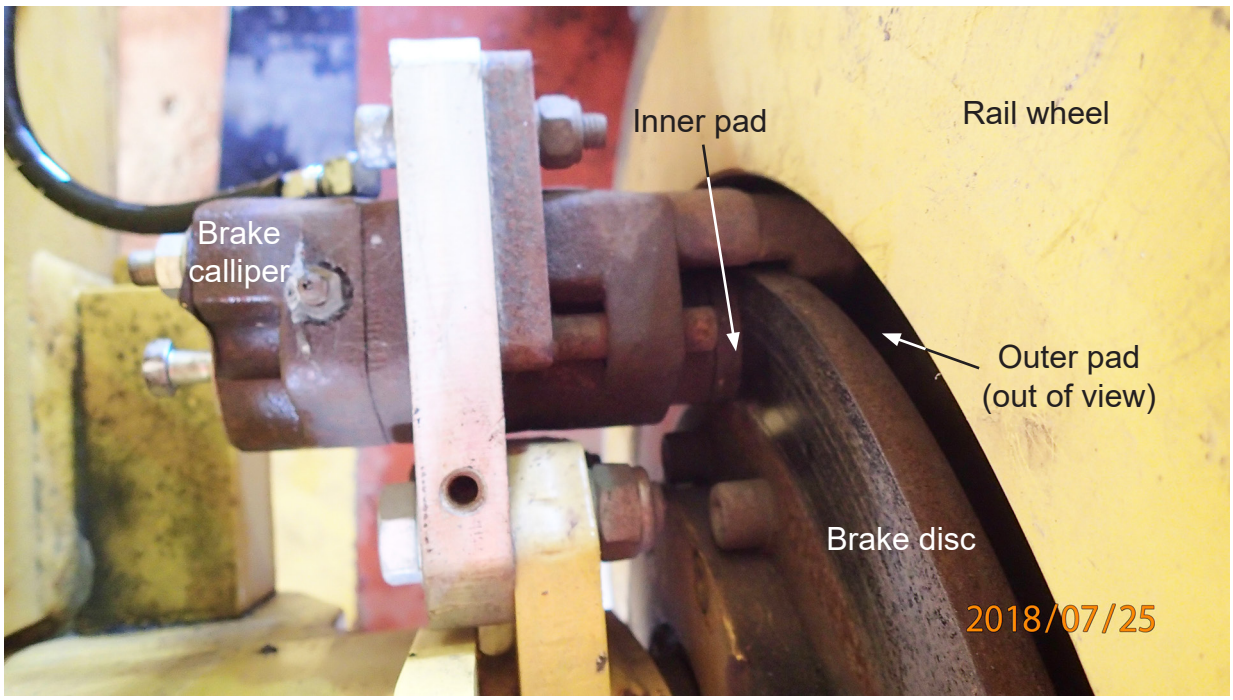


Figure 17: Hargreaves DRWB arrangement

[10] Conical washers assembled in a specific sequence.

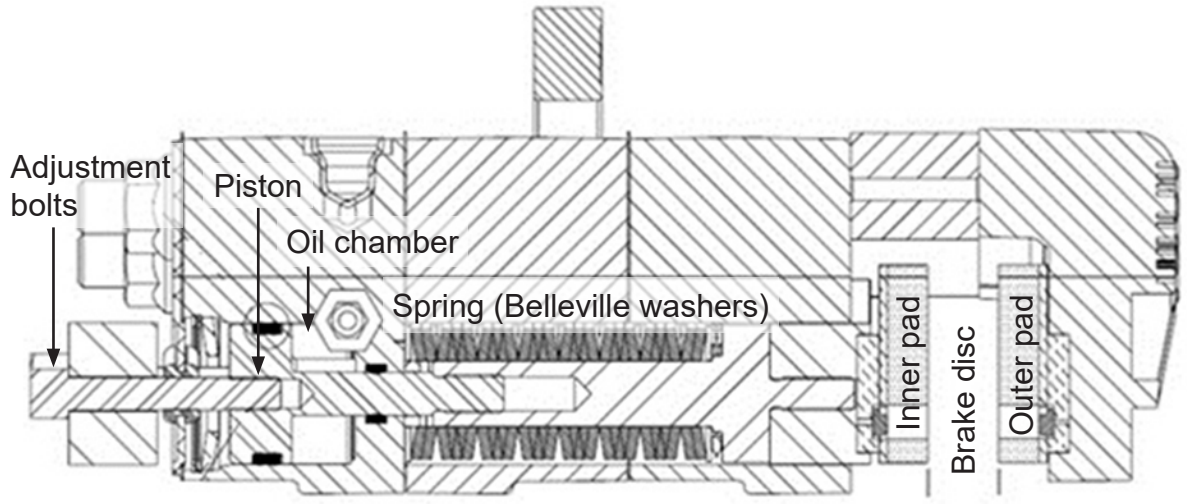


Figure 18: Calliper cross-section

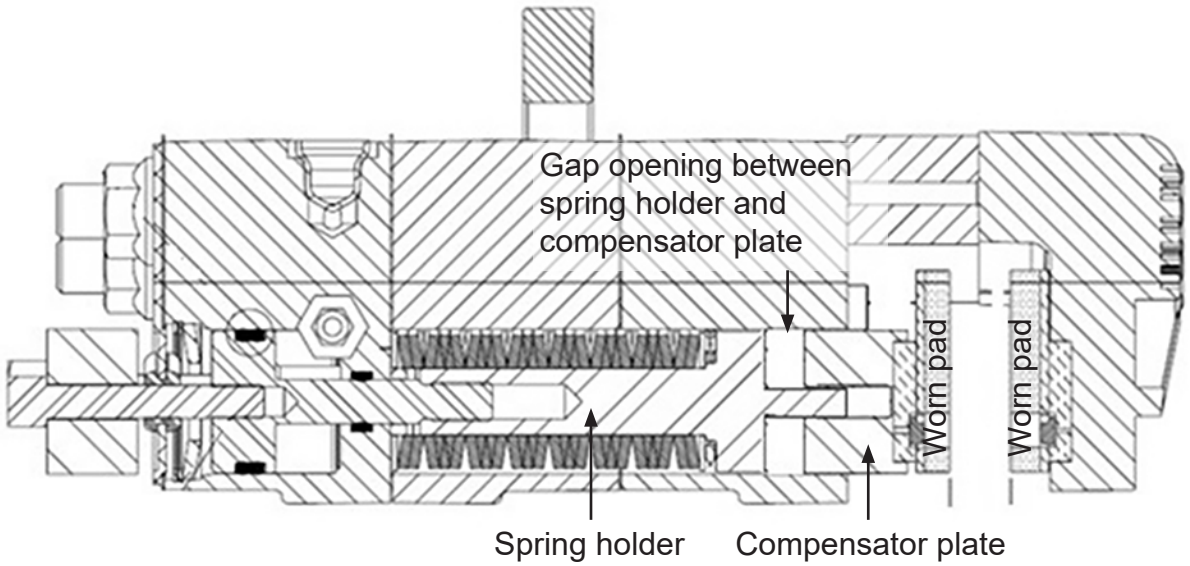


Figure 19: Calliper with worn pads, that has been adjusted

69 When the brakes are applied to slow a vehicle, the brake discs are clamped between the pads (inner and outer) and the pads wear as a result. This is a normal condition. As the pads wear, the load in the spring reduces which lowers the clamping load. In order to compensate for wear, the calliper needs to be manually adjusted by operating the adjustment bolts which results in a gap opening between the spring holder and the compensator plate (figure 19). This has the effect of compressing the spring which reinstates the required clamping load. If this operation is not carried out and the pads are allowed to wear, the clamping load will continue to decrease. According to the calliper manufacturer's datasheet, a combined wear of 11.7 mm on the pads, if unadjusted, will lead to all the clamping load being lost.

70 A detailed examination of the callipers fitted to the incident MEWP showed that the pads had worn to the extent that the callipers needed adjustment (combined pad wear ranging from 5 to 10 mm, across all four callipers). However, the examination also revealed that none of them had been adjusted.

Maintenance of Hargreaves DRWB

71 **The brake callipers had not been adjusted to compensate for brake pad wear.**

72 Hargreaves maintenance instruction AJH077 issue 7 defines the activities required to determine whether or not the callipers need adjustment. The intent is for the brakes to be released in order to measure the gap between the pads and disc. If the total gap is greater than 4 mm, the calliper needs adjusting.

73 The gaps at the four rail wheels on the incident MEWP were measured to be between 7.1 mm and 10.6 mm post-incident. This is consistent with the amount of wear measured on the pads, the low brake torque measured and a lack of adjustment.

74 The Hargreaves instruction for checking whether adjustment was needed was to be carried out every three months. However, Readypower operated an inspection and maintenance regime based on weekly, 6-monthly and 12-monthly interventions. In order to be on the safe side, Readypower instructed its fitters to carry out all 3-monthly activities on a weekly basis. Hence, Readypower's fitters should have been checking the need for brake calliper adjustment every week. Witness evidence indicated that this was not taking place, and that the fitters were not following Hargreaves' instructions.

75 The brake callipers had not been adjusted to compensate for wear because:

a. The fitters were not following Hargreaves' instructions probably because of the poor design of Readypower's inspection form, and possibly because of a lack of associated training (paragraph 76).

Other possible reasons were:

b. The work of the fitters was not supervised or audited (paragraph 81).

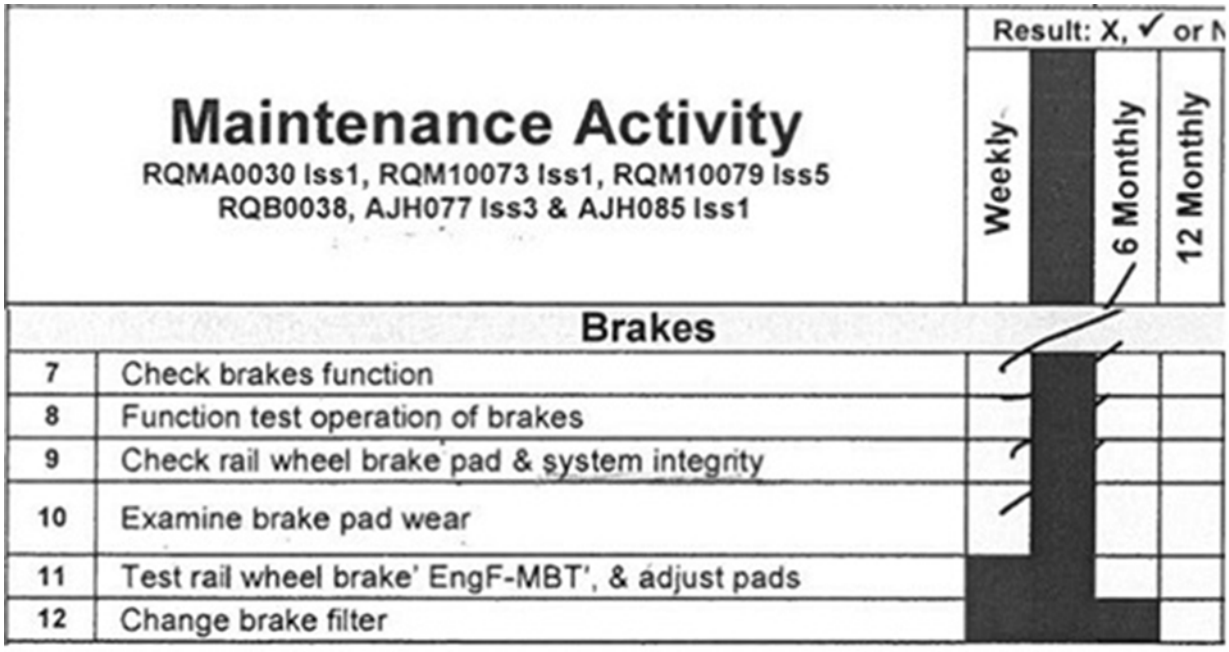
c. The tests carried out during the 12-month inspection in October 2017 may have failed to reveal the poor performance of the DRWB system (paragraph 89).

d. Readypower was not using the latest version of Hargreaves' instruction AJH077 (paragraph 94).

Each of these factors is now considered in turn.

76 **The fitters were not following Hargreaves' instructions probably because of the poor design of Readypower's inspection form and possibly because of a lack of associated training.**

77 As well as a copy of the relevant original equipment manufacturer (OEM) maintenance instructions (including AJH077), Readypower provided its fitters with a form titled 'Genie Z60 inspection form' to complete when carrying out an inspection. The part of the form that is relevant to the braking system is reproduced in figure 20. There is no separate Readypower maintenance document supporting the form.



Maintenance Activity RQMA0030 Iss1, RQM10073 Iss1, RQM10079 Iss5 RQB0038, AJH077 Iss3 & AJH085 Iss1		Result: X, ✓ or N Weekly	6 Monthly	12 Monthly
Brakes				
7	Check brakes function			
8	Function test operation of brakes			
9	Check rail wheel brake pad & system integrity			
10	Examine brake pad wear			
11	Test rail wheel brake' EngF-MBT', & adjust pads			
12	Change brake filter			

Figure 20: Extract from Readypower's inspection form relevant to braking system

78 Readypower owned and maintained four Genie Z60 with the Hargreaves DRWB system and fourteen Genie Z60 with another DRWB installer's system. These two DRWB systems are of a different design and hence use different maintenance instructions. However, there is only one Readypower inspection form to cover both types of conversion which explains why the form makes reference to some Hargreaves instructions (AJHxxx) and some other instructions (RQMxxx). Hargreaves instruction AJH077 issue 3 is quoted on the inspection form, whereas issue 7 was current at the time of the incident (it had been published by Hargreaves on its website in September 2017).

79 Because the inspection form tries to capture the requirements from two different sets of maintenance instructions, each with its own titles for individual maintenance activities, the link between the maintenance activities on the inspection form (eg: 'Check brakes function') and the DRWB installers' maintenance instructions is loose. Over time, this has blurred the link between the activities as undertaken by the fitters and the activities as described in the DRWB installers' instructions. In practice, the fitters have been assessing the health of the braking systems based on a visual examination of the inner pad thickness, a functional brake test proving that the DRWB releases as vehicle movement is commanded from the basket and a running brake test proving that the machine brakes when commanded. The latter only proves that there is some brake force developed by either the DRWB system or the road wheels engaged on the rail wheel hubs. It does not demonstrate the performance of the DRWB alone. Readypower management was not aware that fitters were not closely following OEM instructions and were therefore not checking whether the callipers needed adjustment.

80 When the DRWB systems were introduced on the Genie Z60 in 2014, the fitters received an email from Readypower providing them with the new Readypower inspection form to complete and with the new OEM maintenance instructions to follow. With the expectation that fitters would have all the necessary documentation, no training was provided to ensure that fitters understood more about the DRWB system and how to maintain it effectively (paragraph 108).

81 **The work of the fitters on site was not supervised or audited.**

82 Readypower employed 30 to 35 fitters, some as full-time employees and others on zero-hours contracts. Readypower assessed the competence of its fitters against the relevant Rail Plant Association[11] assessment modules on a 2-year cycle. The fitters reported to the fleet engineering and performance manager who was responsible for the quality of their work. However, fitters mostly carried out their weekly inspections on site, rather than at Readypower facilities. When on site, their work was never checked by anyone else.

83 Readypower had a monitoring and compliance audit programme in place which covered depot inspection, site safety tours and POS Site monitoring, but did not capture the work of fitters.

84 Had the fitters been supervised or audited, it is probable that Readypower's management would have identified that the fitters were not following the OEM instructions and taken actions to enforce compliance.

85 Although Network Rail and others carried out various compliance monitoring and assurance activities, no issues were identified with Readypower's monitoring and supervision of maintenance staff. As the organisation which owns and operates the railway infrastructure, Network Rail is responsible for ensuring that all work on the infrastructure is delivered in a safe manner. The assurance process used by Network Rail to mitigate the risks associated with using external contractors and their equipment is based on:

- the qualification scheme for all suppliers of services and equipment known as RISQS[12] (Railway Industry Supplier Qualification Scheme); and
- the on-track Plant Operations Scheme (POS).

86 Under both schemes, confirmation that a supplier continues to operate within the requirements of the scheme is confirmed by annual audits. A single audit is carried out under RISQS and Network Rail carries out three different audits under the POS scheme: a management system audit, a technical audit and an on-site audit. Network Rail standard NR/L2/RMVP/0200 module P521 requires POS providers to have a competence management system for assuring the competence and fitness of their employees involved in the operation, maintenance and supervision of OTP operations, and this requirement is covered by the POS technical audit.

[11] https://www.cpa.uk.net/rpa.

[12] RISQS is managed by RSSB (Rail Safety and Standards Board).

87 As a supplier to Network Rail, Readypower had been subjected to both RISQS and POS audits. The last RISQS audit before the incident had been conducted in April 2018. The last POS technical audit before the incident had been conducted in January 2017. Both audits looked to confirm that the competence of the maintenance staff was actively managed. The audit reports highlighted that Readypower used the Rail Plant Association assessment modules to assess the competence of its maintenance staff and that this is '*deemed good practice*'. Neither of these two audits raised any questions regarding the monitoring or supervision of maintenance staff on an ongoing basis. Audits, by nature, cannot be guaranteed to cover all aspects of an organisation's operations.

88 In October 2018, Network Rail conducted its next POS technical audit of Readypower during which a non-compliance report was raised on the management of the competence of the maintenance staff. In its response to this non-compliance report, Readypower indicated that it was considering appointing a member of staff to supervise and monitor its maintenance staff (paragraph 130e).

89 **The tests carried out during the 12-month inspection in October 2017 may have failed to reveal the poor performance of the DRWB system.**

90 Before returning the incident MEWP to service, Readypower applied its 12-month inspection regime to the machine in October 2017 (paragraph 35). This involved a full suite of testing, including brake testing, which it passed successfully.

91 The brake tests consisted of an on-track dynamic brake test and a pull-test. Both of these tests were carried out with the rail wheels fully deployed so both road wheel and rail wheel braking systems were operating in parallel. The brake force developed would therefore have been a combination of that developed by the two systems. During the dynamic brake test the distance to stop from a given speed was measured and checked to be less than distance requirements given in RIS-1530-PLT. When pull-tested, the target pull-force of 2,000 kgf (according to AJH077 issue 7) was achieved.

92 Post-incident pull-tests on the incident MEWP showed that the road wheel brakes on their own provided somewhere between 1,750 and 2,000 kgf of brake force (table 4). A DRWB system which provided only 220 kgf of additional brake force (paragraph 65), would combine with the braking through the road wheels and achieve the target of 2,000 kgf. Therefore, a successful pull-test on the machine with fully deployed rail wheels may fail to reveal sub-standard performance of the DRWB system.

93 This is only a possible factor because the callipers may have been changed after the test. Physical evidence suggests that the callipers that were fitted on the MEWP at the time of the incident were not the same callipers as the ones that had been fitted to the machine in 2014, although Readypower has no records as to when this happened. Witness evidence indicated that it was highly likely that the incident MEWP had been used as a donor vehicle during the long periods it was out of service; one after the Brentwood incident (18 months) and another from Christmas 2017 to April 2018 (3 months) (paragraph 36). If a brake calliper swap took place during the latter period, then the testing undertaken during the 12-month inspection is irrelevant to the incident.

94 **Readypower was not using the latest version of Hargreaves' instruction AJH077.**

95 The version of AJH077 which was current at the time of the incident was issue 7, dated September 2017. Readypower's inspection form used by the fitters made reference to issue 3 of AJH077. The Engineering Acceptance Certificate for the machine issued in 2014 showed that it had been assessed to issue 4 of AJH077, which was the valid issue at the time.

96 According to RIS-1710-PLT[13] issue 1, revision of a maintenance instruction does not necessitate reissue of the Engineering Acceptance Certificate, provided that the revised instruction has been reviewed by an independent third party (usually a Plant Assessment Body) (paragraph 116). Once published, the organisation proposing the change to the instruction should advise all owners of the applicable RRV type that an updated maintenance instruction has been prepared and should be used for future reference. When the RRV is subsequently re-certificated for other reasons, the reference on the certificate to the maintenance instruction should be updated.

97 AJH077 issue 7 was the update to the instruction which saw the introduction of torque testing on the DRWB system as a mandatory test to be carried out on a 12-monthly basis. Hargreaves placed a copy of AJH077 issue 7 on its website in the expectation that all plant operators would be accessing its website to make themselves aware of the update. Had Readypower been aware that AJH077 issue 7 had been issued, it is probable that it would have torque tested the incident MEWP in October 2017 when it received its 12-monthly inspection. If the callipers at the time were the same as the ones on the machine during the incident it is likely that this testing would have highlighted the poor performance of the DRWB system[14].

Recovery

98 **The crew was unable to recover the developing situation.**

99 As the MEWP started to roll away, the machine operator and machine controller stated that they started to panic. The engine had stopped either because of an engine fault or because the emergency stop button had been pressed, and it needed to be restarted before the deployment of one of the rail axles could be completed. However, having elected to leave the pendant in its housing, the machine operator was now unable to press the 'engine start' button which was located at the top of the pendant, out of reach[15] (figure 21). He was also unaware that the emergency stop button had been pressed; it needed to be reset before the engine could be restarted.

[13] Rail Industry Standard for Engineering Certification of Railborne Plant.

[14] The MEWP had only operated for 250 hours from October 2017 to June 2018 which, assuming a pessimistic wear rate of 0.0027 mm/hr provided by Hargreaves, would have equated to 0.7 mm of pad wear.

[15] The buttons to raise and lower the rail axles are at the bottom of the pendant.

Figure 21: Operator pressing the rail axle deployment button at bottom of pendant

100 The training received by the machine operator to become a MEWP operator covered the theory of the actions to take in the event of a runaway. There was however no practical exercise as this was understandably considered too dangerous. The machine controller was not expected to interact with the machine in the event of a runaway and his training reflected this.

Identification of underlying factors

The management of ongoing competence in the industry

101 **The competence management system for machine operators across the railway industry focuses on the renewal of qualifications, rather than demonstrating ongoing competence.**

102 Readypower manages the ongoing competence of its machine operators in accordance with the Sentinel scheme, managed by Network Rail. The scheme defines many qualifications with associated training courses delivered by external training providers. Once a training course has been passed, the applicant is awarded the relevant qualification and this is recorded on their Sentinel card. This enables someone to be declared 'competent' for this activity. Most qualifications have a validity of four or five years.

103 The machine operator had passed his training course 'Machine Operator – Self-propelled MEWP' in September 2016. This was endorsed on his Sentinel card and hence he was considered 'competent' to operate MEWPs. The next time his qualification would be reviewed would have been four years later in accordance with the Sentinel scheme rules.

104 Network Rail's standard NR/L2/RMVP/0200/module P500 defines the competence requirements for machine operators who work on Network Rail's infrastructure and refers to another Network Rail standard, NR/L2/CTM/025. This standard, dated 2008, refers to log books which are no longer used by plant operators. The review of these log books was intended to form the basis for annual competence conversations with machine operators. Other than that, there is no requirement in any of these standards to manage the ongoing competence of machine operators on a regular basis.

105 The M&EE[16] group formed of representatives from various organisations involved in plant operations issued, through RSSB, a code of practice for the management of competence of plant operators (COP0001). The latest version of COP0001 dated July 2016 defines the elements of competence that need to be managed and this includes the procedure for on- and off-tracking. However, this code of practice does not define how organisations should ensure that the competence of machine operators should be managed on an ongoing basis.

The DRWB project

106 **Network Rail and Readypower's implementation of the Direct Rail Wheel Braking project did not cover all of the necessary elements; this was a possible underlying factor.**

107 The DRWB project was led and financed by Network Rail. The contract placed at the time between Network Rail and the companies undertaking the design and installation of the DRWB systems contained no provision for:

a. companies undertaking the design and installation of the DRWB systems to be provided with the proprietary information required to fully understand the machines that they were modifying (paragraph 115); or

b. training to be provided to plant operators' fitters to familiarise themselves with the new braking system that they needed to maintain.

108 Had training been provided to fitters to familiarise them with the new braking system, either through provision in the contract between Network Rail and the DRWB installers or by the plant operators themselves, this incident might have been avoided (paragraph 80).

109 The introduction of the DRWB systems on the fleet of RRVs operated by Readypower did not trigger its change management process, described in its procedure QM-P-04. The change management process is based on the assessment of the risks following the introduction of a change. Had a risk assessment been carried out, it is possible that it would have identified the need for fitters to be trained on the new braking systems.

Observations

AJH077 maintenance instruction

110 **There was an error in maintenance instruction AJH077 regarding the adjustment of the brake callipers.**

111 The first step in maintenance instruction AJH077 to check whether the callipers needed adjusting required the machine to be in its road configuration and an override on a three-way valve in the hydraulic circuit to be operated. The objective of this step was to release the direct rail wheel brakes in order to measure the gap between the pads and the disc.

[16] Mechanical and Electrical Engineering.

112 Examination of the MEWP post-incident revealed that the operation of the override valve did not release the brakes when the machine was in its road configuration. This was because there was another valve in series with the three-way valve in the hydraulic circuitry detecting the position of the rail axles (figure 22). This second valve (a four-way valve) was only activated if it detected that the rail axles had been fully deployed at both ends. With the machine in its road configuration so its rail axles were off the ground, this four-way valve was not activated and did not allow hydraulic fluid to flow in the brake circuitry. As a result, operating the override on the three-way valve only had no effect. For the brakes to be released, the override on the four-way valve also needed to be operated (or the rail wheels fully deployed).

113 This error in maintenance instruction AJH077 was not causal to this incident as witness evidence indicated that Readypower fitters knew how to release the brakes, which was the purpose of the first step in the process. In accordance with Hargreaves' quality management system, AJH077 was checked by a competent person but he too did not identify the error in the maintenance instruction, possibly because this part of the instruction could not be validated by testing as the callipers did not need adjustment.

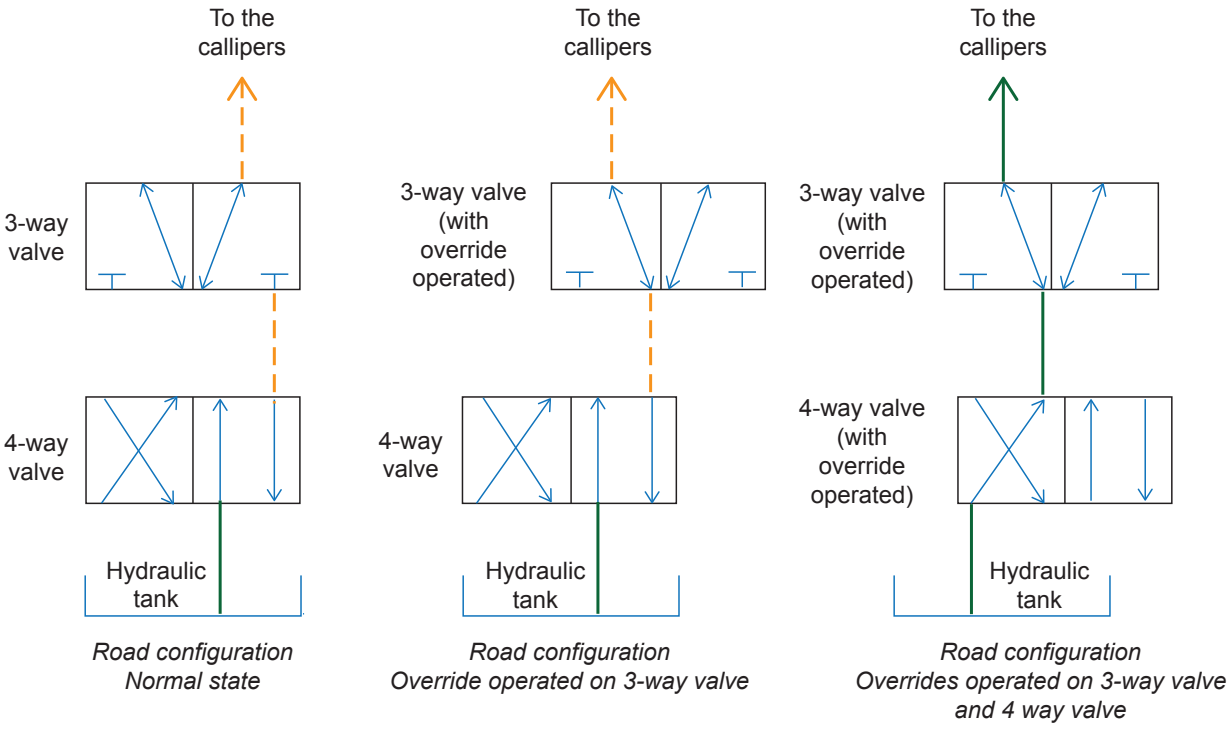


Figure 22: Hydraulic circuit for DRWB system (simplified)

114 The three-way valve was part of the Hargreaves DRWB design but the four-way valve was not. It was part of the original design of rail wheel brakes that had been fitted to the Genie Z60 by the manufacturer (see footnote 5). When designing its DRWB system, Hargreaves retained some parts of the old braking system including the four-way valve.

115 However, the precise working of the four-way valve may not have been known by Hargreaves at the time. At the start of the DRWB project, Hargreaves was not provided with any proprietary information to better inform its understanding of the machines that it was working on. The company had been provided with the machines and had to work without supporting design information.

116 **The changes introduced in maintenance instruction AJH077 at issue 7 relevant to the Genie Z60 MEWPs were not reviewed by a third party.**

117 RIS-1710-PLT stipulates that all changes to maintenance instructions should be reviewed by a third party (paragraph 96). Although issue 7 of AJH077 was reviewed by a third party in September 2017 as part of the certification of the other MEWP to which it applied, Hargreaves was unable to provide any evidence that the changes that were relevant to the Genie Z60 had been reviewed.

Previous occurrences of a similar character

118 The RAIB has investigated several runaway incidents including:

a. runaway of a road-rail vehicle at Glen Garry, RAIB report 05/2009

b. road-rail vehicle runaway incidents at Brentwood, Essex, and at Birmingham Snow Hill, RAIB report 11/2009

c. runaway and collision of a road-rail vehicle near Raigmore, Inverness, RAIB report 10/2011

d. collision of a road-rail vehicle with a buffer stop at Bradford Interchange station, RAIB report 09/2013

e. runaway of a road-rail vehicle and the resulting collision in Queen Street High Level Tunnel, RAIB report 15/2014

119 In addition, the RAIB conducted a class investigation into runaways of RRVs and their trailers (RAIB report 27/2009). These investigations and their recommendations have helped shape the management of the risks of RRV runaways.

Summary of conclusions

Immediate cause

120 The MEWP ran away on a gradient because only the rail wheel brakes were acting to prevent movement and these were unable to do so (paragraph 37).

Causal factors

121 The causal factors were:

a. The MEWP was placed in a configuration where only its rail wheel brakes were acting to prevent movement (paragraph 41). This arose due to a combination of the following:

   i. The machine operator did not follow the correct on-tracking procedure (paragraph 44, paragraphs 130a and 131, no recommendation).

   ii. Readypower had not previously identified that the machine operator was routinely not following the on-tracking procedure (paragraph 50, paragraph 130f). This happened due to one or both of the following:

   - Readypower did not follow its own recruitment process (paragraph 52, **Recommendation 2**).
   - Once in employment with Readypower, the ongoing competence of the machine operator was not checked (paragraph 57, **Recommendation 2**).

b. The MEWP direct rail wheel braking system was unable to provide enough brake force to prevent a runaway on a 1 in 46 gradient (paragraph 63). This arose due to a combination of the following:

   i. The brake pads were worn (paragraph 67, a normal condition).

   ii. The brake callipers had not been adjusted to compensate for brake pad wear (paragraph 71). This happened because:

   - The fitters were not following Hargreaves' instructions probably because of the poor design of Readypower's inspection form and possibly because of a lack of associated training (paragraph 76, paragraph 130d, **Recommendation 3**).

   Other possible reasons were:

   - The work of the fitters on site was not supervised or audited (paragraph 81, paragraph 130e, **Recommendation 2**).
   - The tests carried out during the 12-month inspection in October 2017 may have failed to reveal the poor performance of the DRWB system (paragraph 89, paragraph 131, no recommendation).
   - Readypower was not using the latest version of Hargreaves' instruction AJH077 (paragraph 94, paragraph 130e, **Recommendation 3**, **Learning point 4**).

c. The crew was unable to recover the developing situation (paragraph 98, no recommendation, **Learning point 1**).

Underlying factors

122 The competence management system for machine operators across the industry focuses on the renewal of qualifications, rather than demonstrating ongoing competence (paragraph 101, **Recommendation 1**).

123 A possible underlying factor was that the implementation of the Direct Rail Wheel Braking project by Network Rail and Readypower did not cover all of the necessary elements (paragraph 106, **Learning point 3**).

Additional observations

124 Although not linked to the incident on 8 June 2018, the RAIB observes that:

a. There was an error in maintenance instruction AJH077 regarding the adjustment of the brake callipers (paragraph 110, paragraphs 132 and 133 and **Learning point 2**).

b. The changes introduced in maintenance instruction AJH077 at issue 7 relevant to the Genie Z60 MEWPs were not reviewed by a third party (paragraph 116, paragraph 133 and **Learning point 4**).

Previous RAIB recommendations relevant to this investigation

125 The following recommendations, which were made by the RAIB as a result of its previous investigation of another runaway incident at the same location, have potential relevance to this investigation.

Accident at Bradford Interchange on 25 March 2012, RAIB report 09/2013

Recommendation 2

126 This recommendation reads as follows:

> *The intention of this recommendation is for Quattro Plant Limited to better manage the competence of its personnel and the provision of information to them.*
>
> Quattro should review and improve its existing systems for the management of staff that are engaged in the maintenance, inspection and operation of road-rail vehicles (paragraphs 160a, 160b, 160c and 162b). As a minimum the review should identify the most effective means of:
>
> (…)
>
> d. establishing monitoring systems to check that staff are correctly applying the inspection and maintenance procedures, and are competent to do so, including:
>
> - enhanced surveillance and regular audits; and
> - checks that staff are familiar with, and have access to, documentation that is relevant to the safety critical tasks they are undertaking.

Recommendation 4

127 This recommendation reads as follows:

> *The intention of this recommendation is that Network Rail should review the scope of the compliance monitoring and assurance activities conducted upon, and by, its rail plant suppliers, and ensure that audits are more comprehensive.*
>
> Network Rail should review the processes for audits of engineering safety management systems and the competence of technical staff that it conducts, or requires others to conduct, on rail plant suppliers. The objective of the review is to identify ways of improving the focus on engineering safety management and the quality of the end products. The findings of this review should be implemented and documented in revised management processes. In addition, Network Rail should take steps to improve the extent to which plant suppliers' own audits are directed in a similar manner (paragraph 162c).

128 The Office of Rail and Road (ORR) reported to the RAIB in August 2014 that Quattro and Network Rail had taken actions to address these recommendations and that ORR considered them as 'implemented'. In response to recommendation 4, Network Rail referred to the introduction of the Plant Operations Scheme (POS) and to RISQS (paragraph 85) as evidence of its implementation of the recommendation.

129 While not directed at Readypower, these recommendations address the factor identified during this investigation regarding the management of the competence of the staff involved in the inspection and maintenance of RRVs.

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

130 In response to the incident, Readypower has taken the following actions:

a. On 8 June 2018, it issued a briefing to all its operators reminding them of the correct on- and off-tracking procedure. On the same day and in collaboration with Network Rail, it grounded its fleet of Genie Z60 machines.

b. On 28 June 2018, it issued National Incident Report 3485 alerting other operators of Genie Z60 machines fitted with Hargreaves' DRWB system of the mistake in AJH077.

c. From June 2018 to October 2018, it made its fitters retake the Rail Plant Association assessments (professional qualification for fitters).

d. In August 2018, it re-issued its Genie Z60 inspection form with an explicit link between the activities described on the form and the DRWB installers' instructions.

e. In October 2018, it appointed a member of staff to monitor the activities of fitters and to brief them on changes to maintenance arrangements.

f. In October 2018, it updated its POS Rep checklist to include the need to witness the safe on- and off-tracking of on-track plant.

g. From October to November 2018, it organised refresher training for its fitters at some of the DRWB installers, including Hargreaves.

h. In November 2018, it re-issued its change management procedure to introduce a change management board made of members covering the various areas of its business. This change management board is responsible for reviewing the impact of any proposed changes on its operational risks using risk assessment.

131 On 22 June 2018, Network Rail issued a safety advice to plant operators asking them to re-brief their machine operators in the correct on- and off-tracking procedure for high-ride vehicles and introducing a requirement to torque test all Genie Z60 MEWPs every 3 months.

132 On 28 June 2018, Hargreaves wrote to all its customers using AJH077 to advise them of the mistake relating to the effect of the override valve.

133 On 31 August 2018, Hargreaves distributed AJH077 issue 8, having addressed the error in issue 7. Issue 8 of AJH077 was independently checked by a Plant Acceptance Body.

Recommendations and learning points

Recommendations

134 The following recommendations are made[17]:

1 *The intent of this recommendation is for machine operators to maintain sufficient levels of competence.*

Network Rail should review current standards and guidance related to managing the competence of machine operators working on its infrastructure and, taking into account guidance from the M&EE group's codes of practice, provide a clear framework for the competence management of machine operators (paragraph 122). The review should encompass the following elements:

i. Initial training
ii. Monitoring systems to check staff compliance
iii. Ongoing machine experience
iv. Continuous development
v. Knowledge re-assessment
vi. Response to involvement in incidents

2 *The intent of this recommendation is for Readypower to implement suitable arrangements for ensuring that staff undertake safety critical operations in an acceptable manner.*

Readypower should review and improve its existing arrangements for the management of staff that are engaged in safety critical activities involving road-rail vehicles, including machine operators and those involved in the maintenance and inspection (paragraphs 121a.ii and 121b.ii). This should consider the arrangements for ensuring that staff are sufficiently competent, including, among other elements, recruitment, experience, continuous development and knowledge reassessment. It should also establish adequate monitoring systems to check that staff are correctly applying the operating, inspection and maintenance procedures.

Note: this recommendation may also apply to other plant operators.

[17] 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.raib.gov.uk.

3 *The intent is for Readypower's road-rail vehicles to be maintained adequately.*

Readypower should review and improve its processes for providing staff that are engaged in the maintenance and inspection of road-rail vehicles with clear and accurate instructions, and training on how to maintain all variants of vehicles. This process should include arrangements for ensuring that Readypower maintenance checklists are clearly linked to OEM instructions and staff are made aware of, and suitably trained in, revisions made to the OEM instructions (paragraph 121b.ii).

Learning points

135 The RAIB has identified the following key learning points[18]:

1 Machine operators working with road-rail vehicles that can be controlled using a pendant are reminded of the importance of taking the pendant out of its housing when in use so as to provide themselves with full access to the range of controls provided by the pendant.

2 Authors and checkers of maintenance instructions are reminded that, where it is not practical to validate an instruction by physically implementing it, they should find an alternative way of validating it (for example by checking the instructions against drawings or other design information).

3 Organisations that design and implement changes to road-rail vehicles are reminded of the importance of ensuring that:

i. relevant original design information is sourced; and

ii. the operators of the vehicles are suitably briefed on both the operational and maintenance effects of the changes that are being made to their vehicles.

4 Organisations that modify maintenance instructions to already-certificated road-rail vehicles are reminded that they should:

i. in accordance with the requirements of RIS-1710-PLT issue 1, arrange for the updated instructions to be reviewed by a third party such as a Plant Assessment Body (PAB); and

ii. advise all owners of the road-rail vehicle type that an updated maintenance instruction has been prepared and should be used for future reference.

[18] '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

DRWB	Direct Rail Wheel Braking
MEWP	Mobile Elevating Working Platform
OEM	Original Equipment Manufacturer
ORR	Office of Rail and Road
PAB	Plant Approval Body
PICOP	Person in Charge Of the Possession
POS Rep	Plant Operations Scheme Representative
RAIB	Rail Accident Investigation Branch
RISQS	Railway Industry Supplier Qualification Scheme
RRAP	Road-Rail Access Point
RRV	Road-Rail Vehicle

This report is published by the Rail Accident Investigation Branch,
Department for Transport.

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