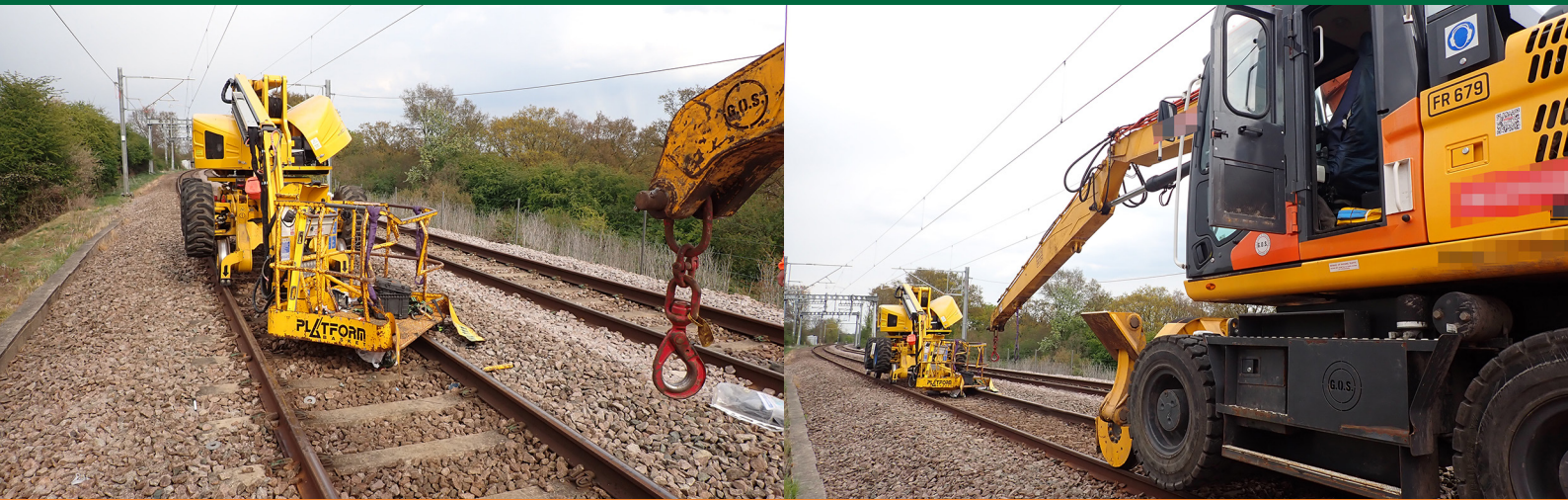




Rail Accident Investigation Branch

Rail Accident Report



Collision between road-rail vehicles near Ramsden Bellhouse, Essex 2 May 2021

Report 09/2022
September 2022

This investigation was carried out in accordance with:

- the Railway Safety Directive 2004/49/EC
- the Railways and Transport Safety Act 2003
- 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.

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

Any information about casualties is based on figures provided to 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. 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.

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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Collision between road-rail vehicles near Ramsden Bellhouse, Essex, 2 May 2021

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Summary

On 2 May 2021, just before 07:00 hrs, two road-rail vehicles (RRVs) collided while travelling on the same track towards Wickford station from a location of work near Ramsden Bellhouse, Essex. The leading vehicle, a mobile elevating work platform (MEWP), was stationary at the time of the collision and was hit from behind at around 7.5 mph (12 km/h) by a road-rail machine, configured as a crane. The MEWP operator suffered life-changing injuries due to the collision.

Around 10 seconds before the collision, the MEWP operator had stopped to stow away a tool which was loose in the personnel basket of his machine. Around the same time, the operator of the crane became dazzled by the rising sun ahead. The crane operator turned to look out of the side window to relieve his eyes but did not apply the brakes of the crane when he did so, resulting in the collision with the MEWP.

Before the collision, the crane operator had allowed the gap between the crane and the MEWP to reduce so that, when the MEWP stopped, it was only about 30 metres. Network Rail standards require operators to maintain a minimum separation distance of 100 metres when travelling in convoy with other vehicles. The shortened separation distance in this case reduced the time that the crane operator had to observe and react to the obstruction ahead.

Fatigue was a possible factor in this accident, as the crane operator had not taken advantage of the opportunity to rest before the nightshift at a hotel provided by his employers. He had also not declared his actual travel time when providing his journey details at the site access control point.

A possible underlying factor was the lack of clarity in the role of machine controllers during travelling movements. This may have contributed to a lack of warning of the impending collision from the crane controller, who was riding in the cab with the crane operator.

A similar collision occurred at Wellingborough on 15 August 2019. The industry's investigation into that accident found that the machine operators involved had been regularly ignoring the need to maintain an adequate separation between vehicles. Although action was taken to modify behaviours, site inspection procedures were not revised to assure compliance and RAIB found that the plan for the work being undertaken on 1 to 2 May 2021 did not explicitly cover the need for suitable distances to be maintained. Not applying learning from this previous accident is also a possible underlying factor.

RAIB has made three recommendations. Two of these are addressed to Network Rail and include the need to clarify the role of a machine controller when they are travelling with their vehicle, as well as the need to continue the development of obstacle detection for road-rail vehicles. A third recommendation is made to SPL Powerlines UK and Readypower Rail Services relating to the application of learning from previous accidents and incidents.

RAIB has also identified four learning points. These alert operators to the need for bringing vehicles to a stand when forward vision is lost, and the importance of judging and observing the correct safe distance between moving vehicles. It is also important that staff are fit and appropriately prepared when reporting for duty and comply with all road-rail vehicle operating instructions.

Introduction

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. Sources of evidence used in the investigation are listed in appendix B.

The accident

Summary of the accident

- 3 On Sunday 2 May 2021, just before 07:00 hrs, two road-rail vehicles (RRVs) collided while travelling on the same track towards Wickford station from a location of work near Ramsden Bellhouse (figure 1). The leading vehicle, a mobile elevating work platform (MEWP), was stationary at the time of the collision. It was hit from behind at around 7.5 mph (12 km/h) by a road-rail machine which was configured as a crane (referred to as the crane within this report). The crane was equipped with a long reach arm that projected approximately nine metres ahead of the driving position.



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

- 4 Two machines were travelling together for around three minutes before the collision on the down Southend line. A third machine travelling slightly ahead of the crane and MEWP was on the up Southend line, but was not involved in the accident. All the machines were being operated by their respective machine operators and each had an additional member of staff onboard, acting as the machine controller. A machine controller is appointed in accordance with Handbook 15 of the railway Rule Book¹ to supervise the use of the on-track plant (see paragraph 47). If the machine is required for lifting operations, the machine controller must undertake the role of a crane controller (and is referred to as such in the rest of the report).

¹ GERT8000 HB15 Issue 5 Duties of the machine controller (MC) and on-track plant operator, Section 3.

- 5 On the crane involved in the accident, the operator was in the driving seat and the crane controller was travelling in a sideways-facing seat, situated behind the operator. On the MEWP involved in the accident, the operator was driving from the elevating basket, which was positioned at the rear of the machine (figure 2). The machine controller for the MEWP was also travelling in this basket. When the collision occurred, the end of the crane's arm initially struck the rear of the basket. This broke the railings which form the basket, some of which trapped the MEWP operator's leg, while the MEWP controller jumped from the basket. The MEWP operator suffered life-changing injuries due to the collision.



Figure 2: The rail mounted crane and elevated platform involved in the collision after being moved apart

Context

Location

- 6 The collision occurred near the village of Ramsden Bellhouse, around halfway between the stations of Billericay and Wickford on the London Liverpool Street to Southend Victoria line. At this location the railway has two tracks equipped with overhead line equipment,² with the up Southend line used by trains heading towards London and the down Southend line by those heading towards Southend. The work was part of an overhead line renewals contract and was protected by the closure of both lines from the London side of Billericay to 3.5 miles (5.6 km) east of Wickford as part of a possession (where the railway is temporarily closed for engineering work to take place).

² An assembly of metal conductor wires, insulating devices and support structures used to bring an electric traction supply current to electric trains.

- 7 The group had been working within a work site (the area within a possession managed by an engineering supervisor³) at a location which was 26 miles 52 chains from London Liverpool Street station, approximately 2.5 miles (4 km) west of Wickford station (figure 3). When the accident occurred, the group was returning to an access point within the work site at Wickford station, where the machines were taken on and off the track. The machines had been travelling for just over three minutes and had covered 500 metres when the collision occurred. At this location, the railway curves to the right in the direction of travel and is on a low embankment running approximately due east.

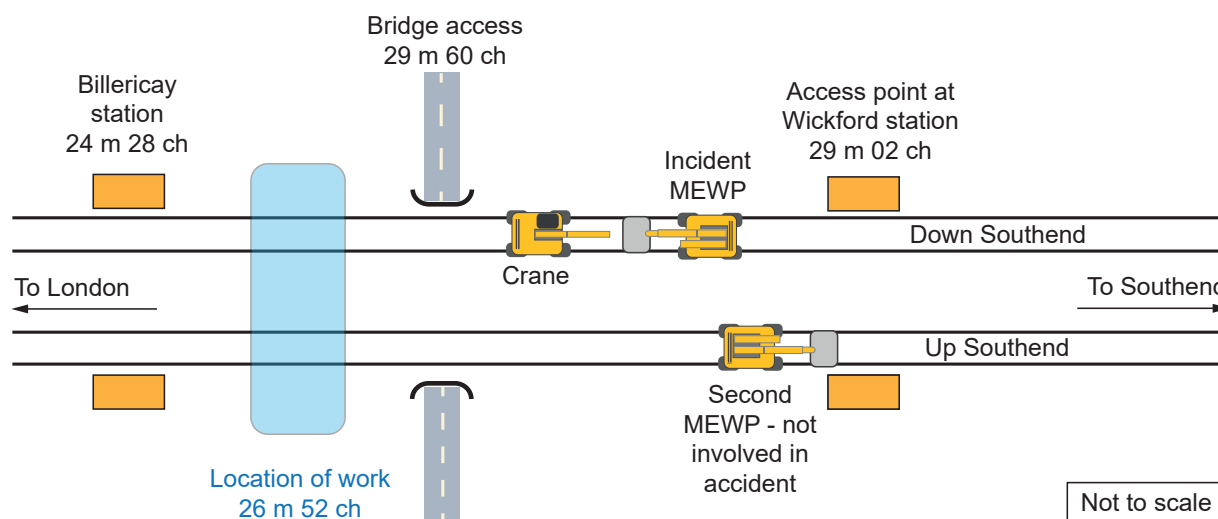


Figure 3: Location of work and relative positions of machines immediately before the collision

Organisations involved

- 8 Network Rail is the owner and maintainer of the infrastructure.
- 9 J. Murphy & Sons Ltd (JMS) was contracted by Network Rail to undertake the overhead line renewals. It acted as Principal Contractor,⁴ provided project management staff and the engineering supervisor and prepared the safe work packs for the other contractors. JMS sub-contracted SPL Powerlines Ltd to undertake work packages including the one undertaken by the group operating from Wickford station, who were involved in the accident.
- 10 SPL Powerlines UK Ltd (SPL) supplied the two MEWPs and employed the MEWP controller, crane controller and the MEWP operators. SPL were also responsible for meeting the requirements of the On-track Plant Operations Scheme (POS) and providing the representative on site for the scheme (POS representative). The POS representative was the single point of contact on site for SPL on matters relating to on-track plant. The POS representative assisted in the planning of on-track plant operations and documenting this within the on-track plant plan (see paragraph 63).
- 11 Readypower Rail Services (RRS) supplied the crane and employed its operator.

³ The person nominated to manage the safe execution of engineering work within a work site. This includes arranging the work site marker boards and authorising movements of trains into, out of and within the work site.

⁴ The principal contractor is defined by the Health and Safety Executive as the contractor with control over the construction phase of a project involving more than one contractor. They are appointed in writing by the client (commercial or domestic) to plan, manage, monitor and co-ordinate health and safety during this phase.

12 All the listed organisations freely co-operated with the investigation.

Rail equipment involved

13 The MEWP involved was a Promax RR14 EVO-2/400 road-rail machine (figure 4).



Figure 4: An example of a MEWP similar to that involved in the collision

14 The crane involved was a Doosan Ultimate 270 road-rail machine equipped with a 5.5 metre 'long reach dipper' arm, rigged for lifting operations (figure 5).



Figure 5: The crane involved in the collision during brake testing

Staff involved

- 15 The crane operator had about 18 months of experience working on the railway and had qualified to operate rail mounted plant six months before the accident. The crane operator was employed as a zero-hours contractor to RRS and worked as a machine driver during the week on non-railway civil engineering worksites.
- 16 The crane controller had nine years railway experience, including four years as a crane controller. He was employed by SPL on a zero-hours contract.
- 17 The MEWP operator had worked for 4.5 years in a railway environment and had qualified to operate MEWPs in 2017. He was a full-time employee of SPL.
- 18 The MEWP machine controller had worked on the mainline railway network for five years and before that had worked for London Underground. He was also employed by SPL on a zero-hours contract.

External circumstances

- 19 The weather at the time was cool and dry, and the sun was rising ahead of the machines as they returned to Wickford. The low rising sun was a factor in the collision (see paragraph 30).

The sequence of events

Events preceding the accident

- 20 Network Rail had contracted JMS to renew overhead line equipment on the London to Southend line. In addition to these renewals, Network Rail and JMS took the opportunity to simultaneously carry out work to stabilise overhead line structures which had shown evidence of slipping down the railway embankment from their designed position.
- 21 JMS contracted SPL to supply machines and workers to complete the structures stabilisation work package, and SPL engaged RRS to supply a suitable machine and operator to carry out the necessary lifting operations. The work was to be undertaken at several locations either side of Wickford station within the limits of the possessions already established for the overhead line renewals. The work was planned to span consecutive day and night shifts over a bank holiday weekend, beginning at 19:00 hrs on Saturday 1 May and ending on the morning of Monday 3 May 2021.
- 22 The crane operator lived in the north-west of England. In the week before the accident, he had worked from Monday to Friday on a construction site unrelated to the railway, and not in the employment of RRS. The day before the accident, Friday 30 April, the crane operator had finished work at lunchtime and then attended a short private appointment in the afternoon. The operator stated that he slept well on the Friday night, having fallen asleep in bed between 21:00 and 22:00 hrs and woken between 06:00 and 07:00 hrs on the Saturday morning.
- 23 RRS had booked a hotel in the local area from Saturday afternoon until Monday morning so that the crane operator could rest between arriving in Essex and starting the night shift covering the night of Saturday 1 May and early morning of Sunday 2 May. However, as his partner was feeling unwell on the Saturday morning, the operator decided to stay at home to look after their children. The crane operator stated that he had napped between 12:30 and 15:30 hrs before leaving home around 16:10 hrs, and that he then travelled directly to the site of work. The operator recalled that it was a three-hour journey and that he arrived at the signing-in point at Wickford station around 19:15 hrs. When completing the site access control paperwork, the crane operator recorded his travel time from the local hotel (which he had not been to) and not as the three-hour journey from his home address.
- 24 The rail industry investigation into the accident found that the engineering supervisor gave a face-to-face briefing to the machine and crane controllers at the access point at Wickford station before work started. In this briefing, the engineering supervisor outlined the limits of the worksite and stated that there were no other on-track activities planned. He gave the controllers permission to manage the movements of their on-track plant as required by the tasks being undertaken, provided the machines remained within the limits of the worksite. Witness evidence was that this initial brief imposed a limit of 5 mph (8 km/h) on all movements of on-track plant within the worksite.

- 25 The night shift for the crane operator consisted of a series of short duration tasks, mostly lasting about 30 minutes and with periods of little or no activity in-between. The operator stated that during this downtime he would sleep or play mobile phone games, and that the last period of downtime before the accident had lasted about 90 minutes. During that particular period of downtime, the crane operator stated that he had probably fallen asleep, because his phone battery had gone flat.
- 26 Shortly before 06:54 hrs on Sunday morning, the crane controller knocked on the door of the cab and told the crane operator that it was time to return to Wickford station. Because of the distance involved, the work group anticipated that the journey would take about an hour on foot, and so the MEWP machine controllers climbed into the baskets of their machines for the journey. Seeing this, the crane operator opened the door to the rear of the crane for the crane controller to climb into the rear seat of his cab. With the crane controller onboard, the crane began the journey to Wickford.

Events during the accident

- 27 The two MEWPs left the site of work ahead of the crane and travelled with one on each of the two tracks, together with other members of the workgroup on foot. The MEWP involved in the accident was travelling on the down Southend line, directly ahead of the crane. This MEWP was being driven with the basket at the rear of the machine, and the operator had raised the basket slightly to be able to see the track ahead over the body of the vehicle (see paragraphs 66 to 70 and figure 6)).



Figure 6: The view from a similar MEWP with the basket slightly raised at the accident location (in daylight)

- 28 Data downloaded from the data recorder fitted to the MEWP indicates that the machine was brought to a stand 180 metres after beginning the journey from the site of work, near to a bridge where the railway passes over Park Lane. The members of the workgroup who had been accompanying the machines on foot, including supervisory staff, left the railway at the access point adjacent to this bridge. This left the crane and machine controllers alone with their respective operators to continue their journey to Wickford station onboard the machines. Data from a global positioning system (GPS) tracker fitted to the crane indicates that when the MEWP resumed its journey, the crane was approximately 90 metres behind it.
- 29 The crane followed the MEWP, travelling at 7.5 mph (12 km/h). As it did so, it slowly caught up with the MEWP which, according to GPS data, was travelling at 6.5 mph (10 km/h). The top speed of both vehicles was governed either by the limitations of the hydraulic drive or, for the crane, the speed mode selected. Just under two minutes after leaving the bridge, the MEWP operator realised that there was a tool which had been left loose in the basket of his machine. To prevent the tool from becoming a hazard, the operator stopped the machine, retrieved the tool, and placed it in a toolbox to the side of the basket. The MEWP data recorder shows that the machine was stopped for 10 seconds.
- 30 The crane operator stated that during the journey, he had seen the distance between the machines getting smaller, so he had reduced the speed of the crane. He also stated that the rising sun had become a problem, so he had reached out to pull down a roller blind type sunshade, which is positioned above the windscreen. When examined by RAIB after the accident, the sunshade had been lowered to a point where the MEWP would still be visible to the operator (figure 7).
- 31 Data analysed by RAIB shows that the crane was travelling at 3.3 m/s (7.5 mph or 12 km/h) at the point when the MEWP stopped and that it continued at this speed up until the point of collision. This shows that the crane would have been 33 metres away when the MEWP stopped. The crane operator stated that he believed the gap between the vehicles was about 30 metres at the point where he lowered the sunshade, indicating that the MEWP stopped at or around the time the sunshade was lowered.
- 32 The crane operator stated that after lowering the sunshade, he suffered a temporary blindness from 'sunspots' caused by looking into the sun. To relieve this, the operator turned his head to look out of the side window and continued to do this until he heard a shout when the crane arm collided with the MEWP basket. According to the MEWP data recorder, this occurred at 06:59 hrs.

Events following the accident

- 33 The crane arm initially struck the rear of the MEWP basket before passing through the basket cage. The crane's arm then struck the front of the structure of the basket and pushed the MEWP, with all wheels locked, along the track for 2.1 metres, before both vehicles came to rest. The MEWP controller, who had seen the crane arm approaching and shouted a warning seconds before the collision, jumped out of the basket.



Figure 7: The view from the crane operator's seat with the sunshade drawn at the accident location (in daylight)

- 34 After the collision, the crane operator attempted to assist the MEWP operator. However, because the basket was still elevated, and pinned in position by the crane's arm, it was necessary to reverse the crane to gain access to the basket. The emergency services were called to the scene and had to cut the MEWP operator free before he could be airlifted to hospital.

Analysis

Identification of the immediate cause

35 The crane did not stop before colliding with the stationary MEWP.

36 The two machines had been travelling in the same direction on the down Southend line, when the operator of the MEWP, which was leading, stopped to stow away a tool which was loose in the basket. The MEWP had been stationary for approximately 10 seconds when the crane struck it (paragraph 30).

Identification of causal factors

37 The crane operator was not aware of the stationary MEWP ahead and made no attempt to stop the crane before the collision occurred.

38 The crane operator stated that after staring into the rising sun for several minutes the glare had affected his vision, and he lowered the sunshade to try and alleviate the problem (paragraph 30). The crane operator stated that he had not realised that the MEWP had stopped when he looked sideways to relieve the temporary blindness and restore his vision (paragraph 32). Although he was no longer looking forwards, the operator did not slow the crane, which continued towards the stationary MEWP.

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

- a. the time available to observe and react to the obstruction had been reduced (paragraph 40)
- b. the crane controller did not warn the operator of the obstruction ahead (paragraph 46)
- c. the crane operator was possibly affected by fatigue (paragraph 51).

Each of these factors is now considered in turn.

Safe distance

40 The time available to observe and react to the obstruction had been reduced.

41 During the journey, the MEWP had been travelling slower than the following crane and, as a consequence, the gap between them had been reducing (paragraph 29). The MEWP was not fitted with a speedometer, so the MEWP operator was not aware of his exact speed. The crane was fitted with a speed display and the crane operator believed he was travelling between 7 and 8 mph (11 and 12 km/h) during the journey.

42 When undertaking movements within a work site,⁵ Handbook 15 states that speeds should be limited to 5 mph (10 km/h). However, permission can be given by the engineering supervisor controlling the work site for machines to travel at speeds up to 25 mph (40 km/h).

⁵ An area within a possession where engineering work is carried out and associated movements of trains and plant may take place.

- 43 The crane controller stated that all work site movements were to be limited to 5 mph (8 km/h) in accordance with the initial site briefing (paragraph 24) and that he felt that his operator had been complying with this requirement. The crane operator understood work site movements should be undertaken at 5 mph (8 km/h) but believed 10 mph (16 km/h) when travelling was allowable if a safe separation distance between the vehicles was maintained.
- 44 The speed differential between the crane and the MEWP meant that the distance between them had reduced from about 90 metres, when they left the vicinity of the bridge over Park Lane, to around 30 metres at the time the crane operator pulled down his sunshade. Network Rail standards⁶ require operators to remain a minimum of 100 metres apart when travelling in convoy with other vehicles. Furthermore, this distance had been the answer to a question the crane operator had correctly answered during the on-track plant operator certification assessment which he had completed six months before the accident. However, when he was asked immediately after the accident, the operator stated that vehicles should be at least 30 metres apart. Evidence gathered by an industry investigation following a similar accident that occurred in 2019 (see paragraph 61) indicated that it had become a common practice for machines to travel with 30-metres separation for the workgroup involved in that accident.
- 45 The MEWP machine controller was riding in the basket of the MEWP, even though this is not permitted by Network Rail standards (see paragraph 48). Witness evidence indicates that the MEWP machine controller was watching for risks ahead of the vehicle and, on looking back a short time before the accident, had seen the crane was following in what they believed to be a safe distance. When the MEWP set off from the bridge, the distance between it and the crane had been around 90 metres, so if the MEWP controller had looked back near the start of the journey, it is likely that the crane would have been far enough away not to cause concern. Immediately before the collision, the MEWP machine controller saw that the crane was too close and shouted a warning (paragraph 33), but by that time the MEWP operator did not have time to move clear of the crane arm.

Role of the crane controller

46 The crane controller did not warn the operator of the obstruction ahead.

- 47 Section 6.1 of Handbook 15 requires machine controllers to be present when the machine they are supervising is being placed on, or being taken off, the railway (a process known as on- or off-tracking), while it is being configured ready for work or while it is working in rail mode. When undertaking movements within a worksite section 9.1 of Handbook 15 states that the way the movement is to be controlled, and exactly what is to be done, must be agreed by the operator and the machine or crane controller. This means controllers continue to have responsibility for movements when the work is complete, the equipment is stowed away and the vehicle is travelling along the railway. Movements can only be made without a machine controller present where specifically permitted in Network Rail instructions.

⁶ NR/L2/RMVP/0200 – Infrastructure plant manual Module P505 – Safe working with plant, Section 9.2.

- 48 As it is not possible for controllers on foot to keep pace with machines at speeds above a couple of miles per hour, Network Rail standards⁷ and section 7.8 of Handbook 15 permit controllers of machines other than MEWPs to ride with the operator in defined circumstances. These include when the movement is planned, when travelling and not working, where provisions such as a suitable seat exist, and following a suitable briefing from the controller. In the case of MEWPs, Network Rail standards⁸ require their controllers to remain on the ground and in a safe position, including while the machine is travelling.
- 49 For the journey from the site of work, the crane controller sat in the cabin of the crane, on a seat facing 90 degrees to the left of the direction of travel and located behind the operator. The view out of the front windscreen from this seat would have been restricted by the operator sitting in the seat in front, but not so much that the view of the MEWP on the track was fully obscured (figure 8).



Figure 8: The view from the rear seat of the crane with a substitute operator (in daylight)

- 50 The crane controller has stated that he had occasionally looked around during the journey, but that the MEWP appeared to be 'far enough' ahead. The controller also stated that he was 'relaxed' with the operator's driving and had been looking out of the side window at the time of the collision, something the seat position would naturally influence a user to do. RAIB has been unable to establish from industry documentation what duties a machine or crane controller is expected to perform when riding on board the machine during a travelling movement, but the actions of the controller indicate that he was not actively supervising the movement of the machine. While it is likely that the controller would have alerted the operator to the stopped MEWP ahead if he had been walking with the machine, it would also have been possible to do this from the seat in the crane cabin.

⁷ NR/L2/RMVP/0200 – Infrastructure plant manual Module P505 – Safe working with plant, Section 11.

⁸ NR/L2/RMVP/0200 – Infrastructure plant manual Module P508 – Mobile elevating work platforms, Section 6.1.

Fatigue

51 The crane operator was possibly affected by fatigue.

- 52 Fatigue can influence an operator's attention to the driving task, their perception of the distance between vehicles and compromise their decision-making, so increasing the likelihood of an accident occurring.
- 53 On the morning before the night shift, the crane operator's partner was feeling unwell, so he decided to stay at home. This meant that it was necessary to undertake a long car journey from his home in the north-west of England to Wickford immediately before beginning work (paragraph 23). By the time of the accident at 06:59 hrs it had been over 15 hours since the crane operator had woken up from his last period of planned sleep (paragraph 23). He had been working for almost 12 hours, was working at night and was on his first night shift of the week. He had also had only 3 hours sleep in the previous 24 hours. These are all factors which may have resulted in him experiencing fatigue. This is further supported by his statement that he had 'probably fallen asleep' at the site of work during his last period of downtime between activities (paragraph 24).
- 54 RRS operate a working hours policy, in line with general practice in the rail industry and Office of Rail and Road (ORR) Guidelines.⁹ This policy includes a maximum door-to-door time clause requiring workers to complete their work shift, and the commute either side of the shift, within 14 hours. The working hours policy is also intended to allow sufficient rest between shifts to limit workforce fatigue. RRS is not able to directly influence the overall working pattern of zero-hours contractors such as the crane operator. For this reason, when planning rosters and rest provision, RRS assumes that workers have already worked a full working week from Monday to Friday and that each individual worker accepts their responsibility to be fit for duty. The planned weekend working hours, when combined with the hotel rest planned by RRS (paragraph 23), fell within the guidelines for fatigue management including the full working week assumed by RRS.
- 55 Although the crane operator did not work as many hours during the week as was assumed by RSS's roster system, his decision to travel directly to site and not to rest at the hotel meant that he had exceeded the 14 hour maximum door-to-door time clause set by RSS.
- 56 Adherence to the working hours policy was assessed by controllers at the Wickford site access control point. The crane operator was aware of his responsibility to be fit for work as this had been explained to him through his training and instruction provided by RRS. However, since he knew that providing the correct information to the access control staff when signing on at Wickford would extend his working hours over the acceptable limit for him to be allowed to work, the operator consciously and incorrectly declared his travel time to Wickford station as only 20 minutes, to avoid exceeding the 14 hour working limit.

⁹ ORR publication 'Managing Rail Staff Fatigue' published 2012, available from www.orr.gov.uk.

Identification of underlying factors

Clarity of roles

57 A lack of clarity in the role of a machine controller during travelling movements may have contributed to a lack of warning of the impending collision to the crane operator. This is a possible underlying factor.

58 The crane controller was travelling in the cab of the crane for the journey back from the site of work to Wickford. This arrangement is permitted under specific circumstances by both the railway Rule Book and Network Rail standards (paragraph 48). However, the actions of the crane controller indicate that he was not aware of the obstruction ahead of the moving vehicle under his control (paragraph 50).

59 The extent of the controller's role in such circumstances is not fully explained in the Rule Book and Network Rail standards (paragraphs 47 to 49). In some circumstances, and where the relevant rules permit it, it may be preferable and safer to allow staff to ride in cabs. This could, for example, minimise the number of staff walking in the vicinity of moving plant over longer distances. However, it is important that the duties of controllers during such movements are explained more clearly and that, where their responsibilities require them to ride in cabs, the seating arrangements allow them to observe and react to potential hazards posed to, or by, their machine.

Site management

60 Learning from previous accidents was not applied to the planning of the work or the application of site assurance processes. This is a possible underlying factor.

61 On 15 August 2019, a collision occurred between a MEWP (supplied by SPL) and a crane (supplied by RRS) near Wellingborough, Northamptonshire. The vehicles had been travelling in convoy with only 30 metres between them. The MEWP had stopped for an estimated 10 to 15 seconds before it was hit from behind by the crane. RAIB did not investigate this collision, but the railway industry's internal investigation into the accident reported that the crane operator had been distracted while retrieving a radio headset which had fallen to the floor. The investigation found that a crane controller sitting in the rear of the crane had not intervened to prevent the collision and that they had a 'lack of attention' when riding in the machine cab. It also found that the work group regularly ignored the requirement to maintain a separation distance of 100 metres between machines. These are similar factors to those involved in the accident on 2 May 2021.

62 The railway industry's investigation recommended that Network Rail consider the fitting of brake lights to rail mounted plant to draw attention to stationary vehicles (see paragraph 80). It also recommended that RRS restate the need to maintain the 100-metre separation to all staff by means of a 'safety alert'. RRS briefed this requirement and supplemented it with additional training and practical demonstrations (see paragraph 78). However, the circumstances of the 2 May 2021 accident indicate that SPL and RRS operators were still not adhering to the required minimum separation.

- 63 Despite this previous accident, RAIB also found that, while the on-track plant plan for the work being undertaken on 1 to 2 May 2021 contained a section relating to machines travelling during the shift, it did not explicitly cover the need to maintain a suitable separation, the speeds at which movements should take place, or who should ensure these requirements are complied with.
- 64 Site compliance inspections are regularly undertaken by SPL and RRS. These are carried out by experienced managers and consider many different aspects of health and safety risks on site as well as compliance with processes. Examples of site inspections undertaken by SPL and RRS at sites under their respective management were provided to RAIB.
- 65 RRS regularly supplies individual members of staff to work sites which are otherwise entirely resourced by SPL, as was the case on 1 to 2 May 2021. RRS was unable to provide any evidence that they had undertaken inspections at such sites to support lone RRS staff. In addition, despite the industry investigation identifying that SPL and RRS staff regularly encroached on the 100-metre separation rule (paragraph 61) neither the SPL, nor the RRS site inspection proforma prompted the inspector to make any check for compliance.

Factors affecting the severity of consequences

66 The injuries suffered by the MEWP operator would probably have been less serious had the machine been driven with the basket in the front position, as required by its certification.

- 67 To allow adequate visibility in the direction of travel, transit movements would normally be made with the basket at the front of a MEWP. Where a movement takes place with the basket at the rear of the machine, the certification document¹⁰ for this model of MEWP required the machine controller to supervise this from the ground.
- 68 The MEWP operator stated that, at the start of the working shift, the MEWP had been set up with the basket at the rear and he had driven it to a location east of Wickford in this configuration without being challenged by the supervisors who were present. During the night, the machines moved location again and travelled from the east of Wickford station towards Ramsden Bellhouse. For this movement, the MEWP travelled with the basket positioned at the front, but the second MEWP had been driven with the basket at the rear, again apparently without challenge. The rail industry investigation into the accident states that the machine controllers travelled in the cab or basket of their respective machines for this journey.
- 69 When the machines began the movement back towards Wickford at the end of the working shift, the machine was again oriented with the basket to the rear. The MEWP operator stated that, although it was possible to rotate the body of the machine to bring the basket to the front, in their experience this would result in unwarranted brake applications while travelling. The MEWP operator believed this was caused by spurious operation of safety interlocks, intended to prevent parts of the machine from fouling an adjacent line. RAIB has been unable to find any evidence to substantiate this belief.

¹⁰ Engineering Conformance Certificate 21/0776/17 issued 25 August 2017.

- 70 The crane arm hit the basket cage first because it was at the rear of the MEWP, breaking through the rear of the cage and pinning the MEWP operator's lower leg with one of the displaced railings. The MEWP controller escaped direct injury from the collision but did sustain some minor injuries when jumping down from the basket. Although the MEWP operator and controller might still have sustained injury as a result of the collision, had the basket been at the front of the machine, it is likely that any injuries would have been less serious than those suffered in the accident.

Summary of conclusions

Immediate cause

71 The crane did not stop before colliding with the stationary MEWP (paragraph 35).

Causal factors

72 The causal factors were:

- a. The crane operator was not aware of the stationary MEWP ahead and made no attempt to stop the crane before the collision occurred (paragraph 35, **Recommendation 3** and **Learning point 1**).

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

- i. the time available to observe and react to the obstruction had been reduced (paragraph 40, **Learning point 2**)
- ii. the crane controller did not warn the operator of the obstruction ahead (paragraph 46, **Recommendation 1**)
- iii. the crane operator was possibly affected by fatigue (paragraph 51, **Learning point 3**).

Underlying factors

73 Possible underlying factors were:

- a. A lack of clarity in the role of a machine controller during travelling movements may have contributed to a lack of warning of the impending collision to the crane operator (paragraph 57, **Recommendation 1**).
- b. Learning from previous accidents was not applied to the planning of the work or the application of site assurance processes (paragraph 60, **Recommendation 2**).

Factors affecting the severity of consequences

74 The injuries suffered by the MEWP operator would probably have been less serious had the machine been driven with the basket in the front position, as required by its certification (paragraph 66, **Learning point 4**).

Previous RAIB recommendation that is currently being implemented relevant to this investigation

[Collision between mobile elevating work platforms at Rochford, Essex 25 January 2020, RAIB report 08/2020, Recommendation 1](#)

- 75 At around 10:57 hrs on Saturday 25 January 2020, a MEWP collided with a stationary machine of the same type on which two people were installing overhead line equipment. Both suffered minor injuries. The machine operator in charge of the MEWP had lost focus while driving the machine.
- 76 The following recommendation was made by RAIB as a result of its investigation into this accident:

Recommendation 1

Network Rail, in consultation with RSSB, the Mechanical and Electrical Engineers networking group, the Machine Controller Competence Working Group and the Plant Operations Scheme Review Panel, should review and clarify the roles and responsibilities of those responsible for plant operations and movements in possessions and work sites, with the objective of identifying ways of avoiding the duplication of responsibilities and minimising the possibility of confusion between roles. This should involve consideration of:

- *the relevant rules and standards that apply to the control of plant movements, particularly Handbooks 12 and 15;*
- *the roles of engineering supervisor, person in charge/safe work leader, site supervisor, POS representative and machine controller; and*
- *the factors affecting the working relationship between staff from different employers working on the same site, in particular the extent of understanding and appreciation of each person's role.*

The implementation of any changes resulting from this review should be co-ordinated to avoid confusion between existing and revised rules and working arrangements.

- 77 ORR reported to RAIB on 21 September 2021, that work was still progressing after they had rejected the initial changes proposed by industry.

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

- 78 RRS has rolled out a programme of training and instruction reinforcing the need for maintaining 100-metres separation between machines travelling in convoy. This has included the use of practical length examples, such as the length of a football pitch or keeping two structures apart in areas equipped with overhead lines. The programme also includes a practical demonstration requiring attendees to estimate 100 metres in an outdoor environment.
- 79 RRS has briefed site staff, including zero-hours contractors, on the dangers of fatigue and the need to be fit for work. In addition, it has briefed the need for staff to make use of hotels provided to them for the purposes of fatigue management.

Other reported actions

- 80 A recommendation was made by the industry investigation to Network Rail for the consideration of brake lights to road-rail vehicles following a similar accident near Wellingborough (paragraph 62). This is intended to improve the conspicuity of stationary vehicles. This was reviewed by Network Rail on 15 June 2021 and rejected on the grounds that existing control measures already meet the intent of the recommendation.
- 81 Network Rail has issued a series of challenge statements intended to raise industry awareness of its priorities and to promote research and development into new ideas and technologies. In 2019 Network Rail issued a challenge statement entitled 'Risk of Plant Strikes – Colliding with Plant, Infrastructure or People'. This identified priority problems including 'Reliance on machine operator to be able to react potential risks' and 'Operator distractions'. The challenge statement identified goals including the provision of automatic detection and control of unsafe machine movements.
- 82 The road-rail plant industry has begun trials of collision detection and avoidance technology on some vehicles.

Recommendations and learning points

Recommendations

83 The following recommendations are made:¹¹

- 1 *The intent of this recommendation is to clarify the roles and responsibilities of staff in circumstances where on-track plant is travelling.*

Network Rail, in consultation with RSSB, the Mechanical and Electrical Engineers networking group and the Machine Controller Competence Working Group should review and clarify the roles and responsibilities of staff when machines are undertaking travelling movements.

This review should specifically consider the circumstances of this accident and:

- the relevant rules and standards that apply to the control of on-track plant travelling movements
- the role of the machine controller during such movement, including where they should be positioned to discharge their duties and ensure their own safety.

Any changes resulting from this review should be considered for implementation in co-ordination with any other revised rules and working arrangements arising from other similar reviews (such as that undertaken in response to recommendation 1 of [RAIB report 08/2020](#)) (paragraph 72a and 73a).

¹¹ 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.

- 2 *The intent of this recommendation is to ensure that learning from previous accidents and incidents is applied to future planning and assurance processes.*

SPL Powerlines UK and Readypower Rail Services should review how recommendations and safety learning from previous accidents and incidents is incorporated into the planning of future work and site inspections, assurance and safety management processes. As part of this review, SPL Powerlines UK and Readypower Rail Services should also consider how they could incorporate safety learning from accidents and incidents from the wider rail sector (paragraph 73b).

- 3 *The intent of this recommendation is to ensure that the provision of obstacle detection technology for on-track plant is subject to ongoing review as new technology becomes available and/or more cost-effective.*

Network Rail should establish a mechanism for periodically reviewing the availability of obstacle detection equipment suitable for fitting to all types on-track plant. This review mechanism should build on current research programmes and ensure that changes in the available technology and cost of equipment that may help to reduce the risk of future collisions are considered at appropriate intervals (paragraph 72a).

Learning points

84 RAIB has identified the following important learning points:¹²

- 1 When operating moving plant, operators should immediately bring their machine to a stand whenever they are unable to maintain suitable forward visibility, even if this is only for a few seconds.
- 2 The 100-metre distance between travelling machines provides a necessary mitigation against collisions between vehicles. It is important for operators of rail mounted plant to learn by practical example how to judge this distance so that it can be put into practice on the operational railway.

¹² 'Learning points' are intended to disseminate safety learning that is not covered by a recommendation. They are included in a report when RAIB wishes to reinforce the importance of compliance with existing safety arrangements (where 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.

- 3 It is important that staff in safety-critical roles comply with the measures established by their employers to control fatigue and maintain fitness for duty. This includes accurately reporting travelling times, obtaining adequate rest between shifts, reporting when they feel unfit due to fatigue and reporting other factors which may cause them distraction, or affect their decision-making.
- 4 Road-rail vehicles, including MEWPS, must be operated in accordance with their certification and instructions for use. Where compliance with these documents is believed by operators to create issues of reliability or practicability, then this should be brought to the attention of supervisory and management staff.

Appendices

Appendix A - Glossary of abbreviations and acronyms

GPS	Global Positioning System
JMS	J. Murphy & Sons Ltd
MEWP	Mobile elevating work platform
ORR	Office of Rail and Road
POS	On-track Plant Operations Scheme
RAIB	Rail Accident Investigation Branch
RRS	Readypower Rail Services
RRV	Road-rail vehicle
RSSB	Trading name of Rail Safety and Standards Board

Appendix B - Investigation details

RAIB used the following sources of evidence in this investigation:

- information provided by witnesses
- information taken from the MEWP data recorder which includes GPS position data
- information taken from a GPS tracker fitted to the crane
- site photographs and measurements
- weather reports and observations at the site
- a review of the industry investigation report for this accident
- a review of the industry investigation report for a similar collision at Wellingborough, Northamptonshire 15 August 2019
- a review of previous RAIB investigations that had relevance to this accident.

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