RAIB

Rail Accident Investigation Branch

Rail Accident Report

Signal passed at danger at Loughborough South Junction, Leicestershire 26 March 2020

Report 10/2020
November 2020

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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Signal passed at danger at Loughborough South Junction, Leicestershire, 26 March 2020

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Summary

At around 10:57 hrs on 26 March 2020, a train formed of two locomotives and an empty, un-braked, passenger multiple unit passed a signal at danger about 0.75 miles (1.2 km) south of Loughborough station. The train passed the signal at a speed of about 20 mph (32 km/h) and came to a stand around 200 metres beyond it. The signal was at danger to protect the movement of a passenger service which was just about to leave Loughborough station.

The incident occurred because the train was travelling too fast for its braking capability, and because the braking applied by the driver was insufficient to stop the train from that speed within the available distance. Evidence indicates that the train was travelling at a speed of around 75 mph (121 km/h) on the approach to the signal, whereas the maximum permitted speed for the train, which takes into account its braking capability, was 60 mph (97 km/h). The driver stated that he believed that the maximum permitted speed of the train was 75 mph (121 km/h), based on information that had been provided to him on a train planning document. An underlying cause of this incident was that the train operator's management assurance processes did not detect a lack of compliance with its own safety management system, in areas that resulted in the driver and shunter being inadequately prepared for the movement of the train. RAIB further observed that the driver did not conduct an adequate running brake test at the beginning of the journey, and that the train operator did not adequately manage the retrieval of evidence from the on-train data recorders on the locomotives.

As a result of this investigation, RAIB has made one recommendation for Rail Operations Group to review its management assurance processes relating to operational safety. RAIB also identified two learning points relating to awareness of and adherence to maximum permitted speeds, and the importance of conducting proper running brake tests.

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 which are explained in Appendix A. Sources of evidence used in the investigation are listed in Appendix B.

The incident

Summary of the incident

3 At around 10:57 hrs on 26 March 2020, train 5Q26,[1] a rolling stock transfer move from Old Dalby to Worksop, passed signal LR507 at danger (red) on the down slow line about 0.75 miles (1.2 km) south of Loughborough station in Leicestershire (figure 1). The train was braking as it passed the signal at approximately 20 mph (32 km/h), and stopped around 200 metres beyond it. This distance exceeded the safety overlap[2] of the signal, but was some 600 metres short of the point at which a conflict with other train movements might occur.

4 Signal LR507 was at danger to protect the movement of a southbound passenger service, train 2L58, which was just about to depart from platform 3 at Loughborough station (figure 2).

5 The rail industry's risk ranking for this incident was 'J-21', where 'J' refers to the accident vulnerability ranking (on a scale from A to K, where A represents the worst outcome) and '21' is the risk ranking score itself. This score takes into account several factors associated with the likelihood and consequence of an accident, where the difference between two consecutive numbers represents approximately a factor of two change in risk. The maximum score is 28; therefore, the risk associated with this incident was high, reflecting the potential for a head-on collision with the conflicting movement of train 2L58.

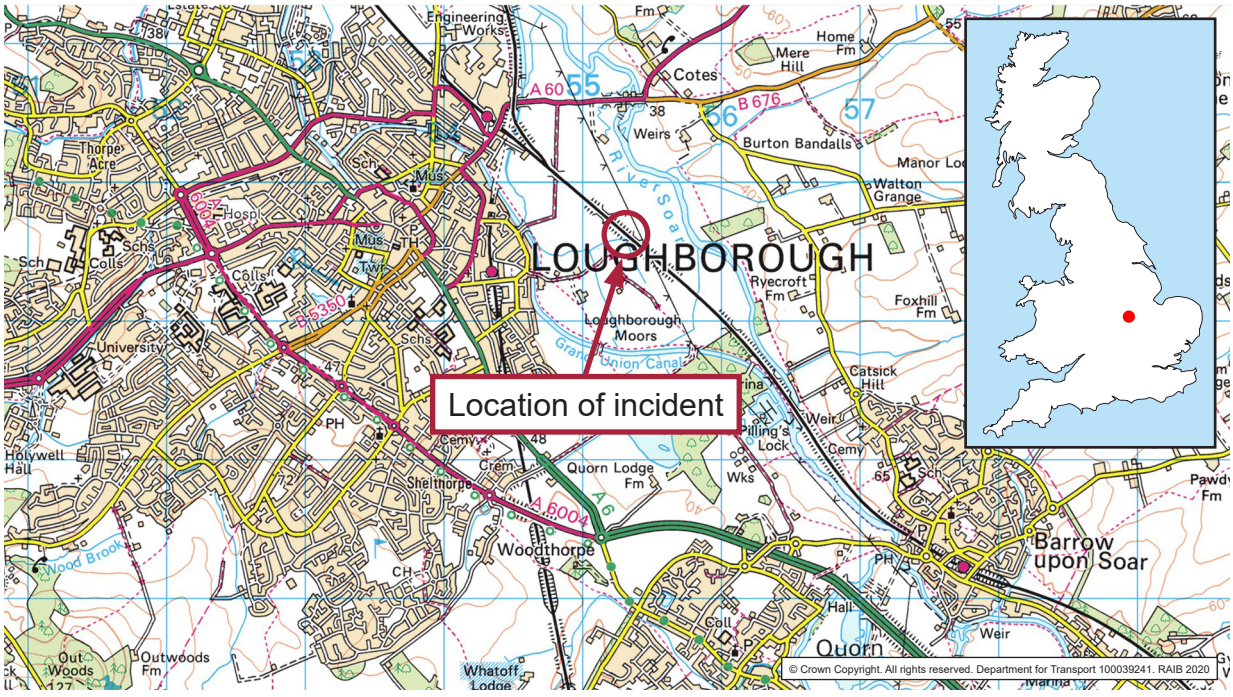

Figure 1: Extract from Ordnance Survey map showing location of the incident

[1] An alphanumeric code, known as a 'train reporting number', is allocated to every train operating on Network Rail infrastructure.

[2] The overlap of a signal is the distance beyond that signal that must be proved to be clear before the preceding signal can show a proceed aspect.

Context

Location

6 The railway at this location comprises four tracks: the up and down fast lines, and the up and down slow lines (figure 2). On the down slow line approaching Loughborough station, the maximum permitted speed is initially 65 mph (105 km/h), reducing to 50 mph (80 km/h) around 300 metres on the approach to signal LR507, then reduces again to 40 mph (64 km/h) just before Loughborough station. There is a gently falling gradient (1 in 508) until Loughborough station, where the track levels out.

7 Automatic warning system (AWS; see paragraph 36) equipment is fitted 186 metres on the approach to the sign indicating the start of the 50 mph speed restriction; this is to draw drivers' attention to a warning sign, co-located with the 50 mph board, for the 40 mph limit ahead.

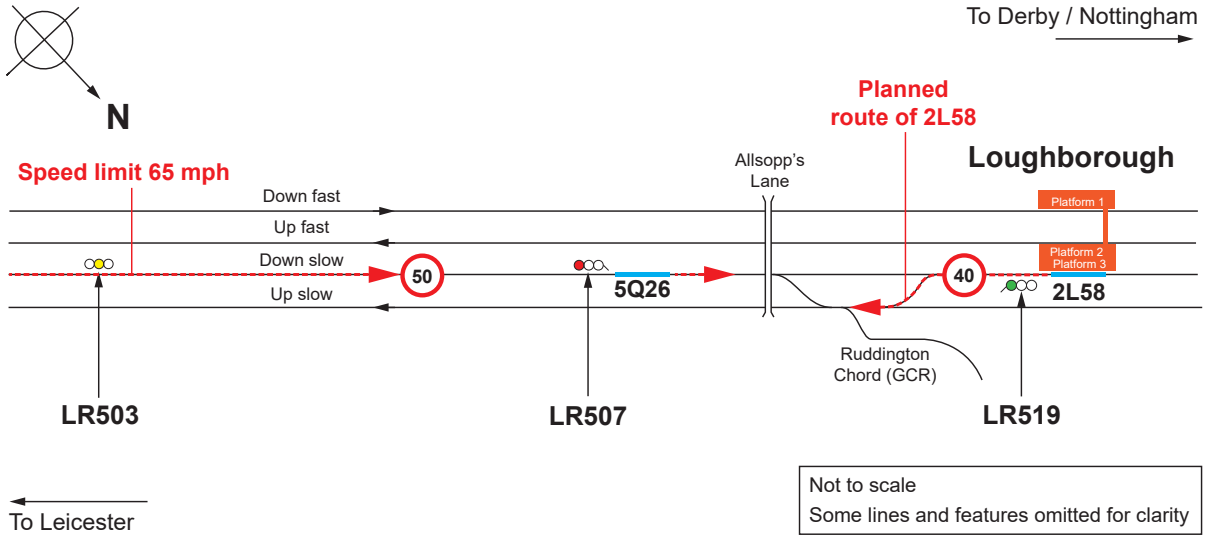

Figure 2: Track layout on the approach to Loughborough, showing significant features referenced in the text

Organisations involved

8 Rail Operations Group (ROG), a subsidiary of Rail Operations (UK) Limited, was the operator of the train and the employer of the staff involved. ROG commenced operating in November 2015. Since July 2019, ROG has provided contractual services to the manufacturer of new class 710 units to move them primarily between a storage location at Worksop and the Rail Innovation & Development Centre (RIDC) Melton test facility at Old Dalby, near Melton Mowbray.

9 Network Rail is the owner and maintainer of the railway infrastructure.

10 ROG and Network Rail freely co-operated with the investigation.

Trains involved

11 Train 5Q26 was the 09:57 hrs Old Dalby to Worksop Down Yard movement. It was formed of a four-coach, class 710, dual-voltage, passenger electric multiple unit (unit number 710272) and two class 57 locomotives, one at the front of the train (locomotive number 57305) and one at the rear (57310).

12 Both locomotives had recently undergone a routine maintenance examination, with locomotive 57305 being examined on 19 March 2020 and locomotive 57310 on 27 February 2020. A post-incident examination revealed a minor problem with brake pressures on locomotive 57310, but this would have had no bearing on the incident.

13 The class 710 unit is a new train that had not yet entered passenger service. It was being moved from RIDC at Melton Mowbray to Worksop. During these movements, the unit is unpowered, hauled by the leading locomotive, and runs with its brakes isolated. Braking is provided solely by the two locomotives, which are connected by a brake pipe running from the leading locomotive, through the saloon of the class 710 unit, to the rear locomotive.

14 In this configuration, taking into account available brake force from the two locomotives and the overall mass of the train, the maximum speed of the train according to Railway Group Standard GORT3056[3] should have been 60 mph (97 km/h). RAIB notes that an absence of three braked vehicles at the rear of the train meant that the train formation did not follow the established practice set out in Rail Industry Guidance Note GMGN2607,[4] which is intended to ensure that the brake force requirements of GORT3056 are met. Nevertheless, the guidance note is not mandatory, and with a 60 mph (97 km/h) maximum speed, the train would meet the brake force requirements of GORT3056.

15 Train 2L58 was the 09:37 hrs East Midlands Railway passenger service from Lincoln to Leicester.

Rail equipment/systems involved

16 Signal LR507 is a three-aspect LED type signal with a position four junction indicator, mounted on a gantry above the down slow line (figure 3). The same gantry also carries signal LR505 for the down fast line.

17 Signalling at this location is controlled from the Leicester workstation at East Midlands Control Centre in Derby. Preceding signal LR507 on the down slow line are signals LR495 and LR503. These signals displayed the correct aspect sequence on approach to the red signal at LR507 (that is, a green signal was showing at LR495, and a single yellow at LR503). All of these signals are fitted with AWS equipment.

18 Signal LR507 is fitted with Train Protection and Warning System (TPWS) equipment both on the approach to the signal (to intervene if a train is approaching the signal too fast) and at the signal itself (if the train passes the signal at danger). The TPWS at signal LR507 activated the equipment on the train when train 5Q26 passed the signal at danger. However, as the train's emergency brake was already applied at that point, TPWS had no effect on the outcome.

19 There has been no previous recorded incidence of signal LR507 being passed at danger. A post-incident assessment found no issues with signal sighting that may have contributed to the incident; the assessment determined that the available reading distance for LR507 (that is, how far away the signal could actually be seen from) was 800 metres, while the minimum reading distance (that required in signal sighting standards for safe operation of the railway) was 183 metres.

[3] GORT3056 'Working Manual for Rail Staff: Freight Train Operations', Issue 5.1, June 2019.

[4] GMGN2607 'Hauling Unbraked Fixed Formations in Freight Trains', Issue 2, March 2019.

Figure 3: Signal LR507 with position 4 junction indicator (picture courtesy of Network Rail)

Staff involved

20 The train driver joined ROG on 29 September 2016 with 40 years' experience in various driving or driving-related roles in the rail industry. He was experienced both with the route and with the class 57 locomotives, as well as with hauling the class 710 units. All of his records of competence and his medical certificate were up to date. The driver had received very positive feedback on his most recent competence assessments and, other than a minor accident in a yard in July 2019 caused by circumstances beyond his control, had no previous incidents on his record.

21 The driver was accompanied in the train cab by a shunter from ROG, who had prepared the train at RIDC Melton. The shunter joined ROG in January 2018 and had no previous railway experience. His records of competence and medical certificate were all up to date.

22 The train movement was planned by a planner at ROG. The planner, who also works for ROG as a train driver, had 27 years' experience in the rail industry, the majority of which was in planning roles. He joined ROG in July 2019.

External circumstances

23 The weather at the time of the incident was clear, with a temperature of 12°C. There is no evidence that the weather played any part in the incident.

The sequence of events

Events preceding the incident

24 At 05:30 hrs on the morning of 26 March 2020, the driver booked on for duty remotely by telephone. He subsequently travelled on the 05:42 hrs passenger train from Chesterfield to Leicester, where he prepared the two locomotives with the shunter. The locomotives departed from Leicester at 07:14 hrs.

25 On arrival at the RIDC Melton facility, the driver and the shunter prepared train 5Q26, marshalling the two locomotives at the front and rear. The driver carried out static brake testing activities in the cab while the shunter performed the corresponding duties on the ground. Witness evidence suggests that these brake tests were all satisfactorily carried out.

26 Train 5Q26 departed RIDC Melton at 09:23 hrs, 34 minutes before its scheduled departure time, and moved to a goods loop outside Melton Mowbray station, where it reversed direction. The train was held in the loop for 45 minutes to allow other services to pass through, and departed from Melton Mowbray at 10:38 hrs, two minutes before its scheduled departure time. It travelled under clear signals towards Syston East Junction where it braked for the 10 mph (16 km/h) speed restriction there. At Syston, the train joined the Midland main line around 7 miles (11 km) south of Loughborough and accelerated northwards (figure 4).

27 Witness evidence suggests that there was nothing remarkable about the journey from Melton Mowbray, and nothing to indicate any problem with the train's braking capability.

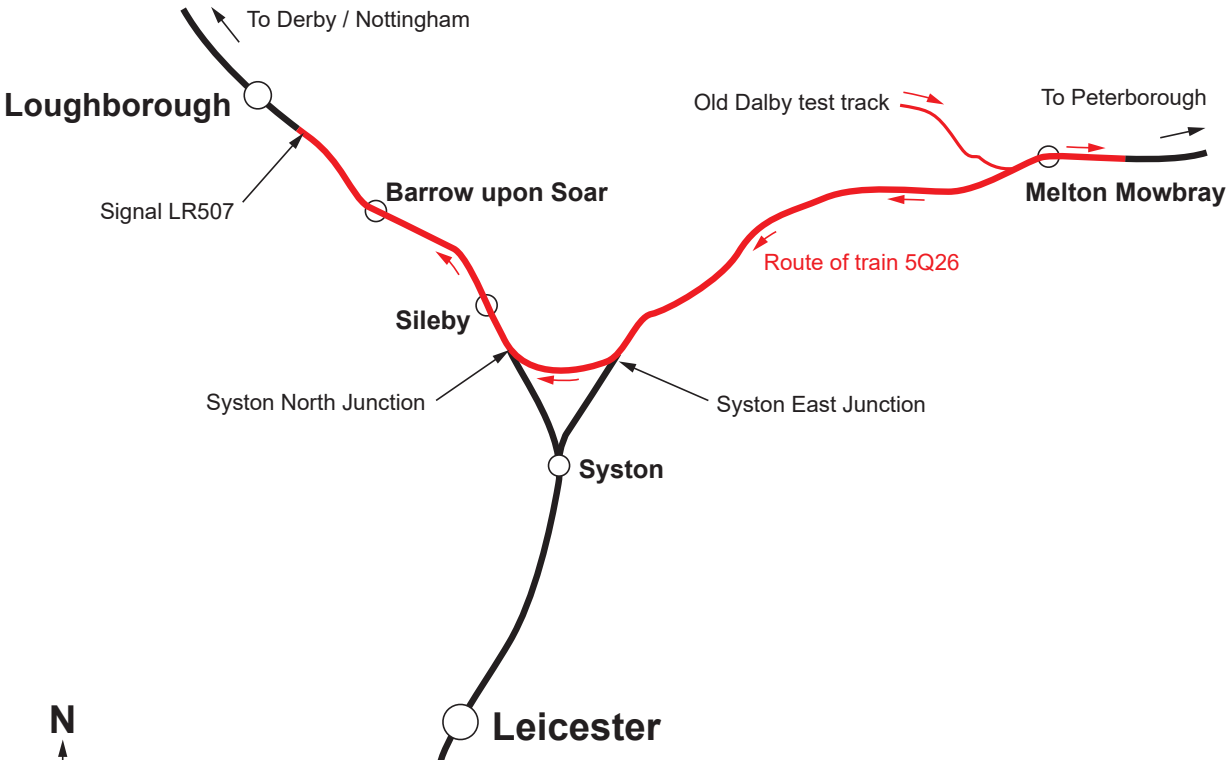

Figure 4: The route of the train

Events during the incident

28 At a point around two miles (3.2 km) before it reached signal LR507, lineside equipment recorded the train travelling at just over 75 mph (121 km/h). Approximately 0.75 miles (1.2 km) later, at about 10:55 hrs, the single yellow signal LR503 came into view from the train.

29 The driver stated that at this point he applied around half of the train's full braking capability. However, this seemed to be ineffective so, by the time the train passed the yellow signal at 10:56:46 hrs, he had increased the braking through full service into emergency brake. RAIB's analysis (see paragraph 57) suggests that this transition from half to full service/emergency braking actually occurred some 820 metres beyond the yellow signal.

30 At 10:57:21 hrs, train 2L58 was arriving at platform 3 at Loughborough station for its scheduled stop, and signal LR519 beyond the station cleared to show a proceed aspect for train 2L58's onward journey.

31 At 10:57:40 hrs, train 5Q26 passed signal LR507 at danger. The train stopped about 20 seconds later, having travelled approximately 200 metres past the signal.

Events following the incident

32 At 10:58:04, the signaller replaced signal LR519 to danger before train 2L58 had departed from Loughborough platform 3, having received an alarm to indicate that 5Q26 had passed LR507 at danger.

33 The driver of train 5Q26 contacted the signaller to report that he had passed signal LR507 at danger. The signaller gave the driver permission to set back behind signal LR507 in order to complete the necessary paperwork.

34 At 11:22 hrs, train 2L58 departed Loughborough station, around 24 minutes behind schedule.

35 Train 5Q26 moved into Loughborough station at 11:55 hrs, where the driver was relieved and taken by road to ROG's head office in Derby for post-incident screening for the presence of alcohol and proscribed drugs, which revealed no issues of concern. The train departed Loughborough at 12:01 hrs and arrived at Worksop at 14:04 hrs, 35 minutes late.

Background information

36 Class 57 locomotives are fitted with both AWS and TPWS equipment, which provide additional information for the driver, and protection from the consequences of passing a signal at danger. On the approach to signals fitted with AWS, the equipment on the train provides a visual and auditory warning to the driver to indicate whether that signal is at clear (green), or showing a cautionary (double/single yellow) or stop (red) aspect. If the signal is green, a bell sounds in the cab. Otherwise a horn sounds, which must be acknowledged by the driver within two to three seconds, or the system will apply the train's emergency brakes. The driver's acknowledgement of the horn warning causes a yellow and black visual indicator (known as the sunflower) to be presented on the driver's interface as a reminder of the state of the signal.

37 AWS equipment is also used at certain speed restrictions, where it is necessary for trains to reduce speed by a significant amount. The 40 mph speed restriction on the approach to Loughborough station is one such example (paragraph 7) and, as such, it would have provided a horn warning to the driver of train 5Q26 on the day of the incident (180 m before the board warning for the 40 mph restriction ahead).

38 TPWS equipment, such as that installed at signal LR507, is intended to prevent collisions resulting from signals passed at danger. It does this by applying the train's emergency brakes if it calculates that a train will pass (determined by speed of approach), or has passed, a signal showing red. TPWS is not designed to prevent trains from passing a signal at danger, but will usually bring a train to a stand before it reaches the point of potential conflict with other trains.

Analysis

Identification of the immediate cause

39 The manner in which the train was driven meant it was unable to stop before passing the red signal.

40 Evidence gathered during the investigation showed that there were no deficiencies in the train's braking system or limitations in wheel/rail adhesion that were causal to the incident (see paragraph 55).

Identification of causal factors

41 The incident occurred because the train was travelling too fast for its braking capability (paragraph 42), and because the braking applied by the driver was insufficient to stop the train from that speed within the available distance (paragraph 50).

Train speed

42 The train speed was too high on the approach to the yellow signal.

43 The maximum permitted linespeed on the approach to the yellow signal is 65 mph (105 km/h), reducing to 50 mph (80 km/h) shortly before the red signal (paragraph 6). Moreover, the maximum permitted speed for this particular train was 60 mph (97 km/h; paragraph 14), further reducing the maximum speed at which it should have been travelling. This speed, derived from lookup tables in Railway Group Standard GORT3056, takes into account several factors associated with the train's braking capability, to ensure that it can stop within the standard spacing of lineside signals.

44 Despite the absence of evidence from the train's on-train data recorder (OTDR; see paragraph 71), there is clear evidence that the train was exceeding its permitted speed on approach to the single yellow signal (LR503). Witness evidence suggests the train speed was between 70-75 mph (113-121 km/h) on this section of line. RAIB's analysis of signalling data indicates an average speed around 70 mph (113 km/h), and lineside equipment recorded the train passing a point around two miles (3.2 km) before the red signal, at just over 75 mph (121 km/h) (paragraph 28).

45 The driver stated that he knew the maximum permitted linespeeds in the area. Although RAIB cannot entirely discount driver fatigue or distraction as possible reasons for the speed of the train, there is no evidence to suggest that these factors influenced the driver's performance. RAIB examined the driver's roster and his mobile phone records, and concluded that neither raised any concerns about possible fatigue or distraction. Witness evidence suggests that although the shunter accompanied the driver in the train cab, there was no conversation or other activity that could have distracted the driver around the time of the incident. The driver stated that he may have been looking backwards along the length of his train at the time (which is a legitimate activity to check the integrity of the train, although there was no particular reason why he should or should not have been doing it at that time), and that this may have drawn his attention away from the train's speed.

Information provided to the driver

46 A probable influence on the driver's performance was his understanding that the maximum permitted speed of the train was 75 mph (121 km/h), based on information that had been provided to him.

47 The only documentary information provided to the driver about the train movement was a train timing sheet, which included details of timings for train 5Q26 along with a return movement from Worksop to Old Dalby, and two light locomotive movements to transit the locomotives between Leicester and Old Dalby. This timing sheet specified a 'limiting speed' for train 5Q26 of just under 75 mph (121 km/h; figure 5). The driver had no other information on the day of the incident to show that the maximum permitted speed of train 5Q26 should have been 60 mph (97 km/h). He stated that his normal experience of driving these trains was with 50 mph (80 km/h) or 60 mph (97 km/h) limiting speeds but on this occasion, with the information provided to him, he believed the train was capable of 75 mph (121 km/h).

Single Train Report

Train: PV 5Q26MC (PH) [ThO (12284897)] [PH/56661501] Rail Operations Group (24/02/2015-31/12/2025)

TrainID:	5Q26MC	Train Class:	5	Train Category:	PV
SignalID:	5Q26	TOC TrainID:		Train UID:	K02026
Bid/Offer Status:	BI			Validity Status:	Y
TOC Status:		TOC Head Code:			
From:	22/03/2020	Until:	28/03/2020	Days Pattern:	ThO (12284897)
Origin Loc.:	OLDDALB	Origin Time:	09:57	Service Code:	56661501
Destination Loc.:	WORKSDY	Destination Time:	13:29	ODT:	Thursday
Distance:	280.028km	Model Train:	SRO-75	Timing Load:	SRO/-/75/-
Publication Date:		Train Length (m):	0	Power Type:	D
		Limiting Speed:	74.5645mph	Trailing Load:	
Bank Holidays:	N	Sleepers:		Catering:	
Reservations:		Brand:		Ops Char.:	
Business Sector:		Accommodation:		UIC Number:	

Figure 5: Extract from the train timing sheet, showing limiting speed and timing load

48 The timing sheet is produced as part of the train planning process, during which the planner at ROG specified a number of parameters associated with the movement. One of these parameters is the 'timing load', which is based on a generic speed capability for the train and from which the planning system derives timing points for the journey, as well as the 'limiting speed' value shown in figure 5. On this occasion, the planner erroneously selected a 75 mph (121 km/h) timing load instead of the correct 60 mph (97 km/h) timing load (paragraph 14); the return movement from Worksop to Old Dalby was correctly specified as 60 mph (97 km/h).

49 Nevertheless, this planning process is concerned with train timetabling and pathing, rather than safety-critical elements of the train preparation and movement. Instead, the driver should have received a standardised train document (as set out in GORT3056), which specifies all the necessary information that drivers need for the safe operation of the train (see paragraph 58).

Train braking

50 The braking applied by the driver was insufficient, for the speed at which the train was travelling, to stop the train before it passed the red signal.

51 According to witness evidence, the driver applied around half of the train's full braking capability on seeing the yellow signal, followed by a full brake application and then emergency braking on passing the yellow signal (paragraphs 28 to 29). However, this was insufficient to stop the train before it passed the red signal. The driver knew that the spacing between signals on the 65 mph (105 km/h) down slow line was the same as that for the 110 mph (177 km/h) linespeed on the adjacent down fast line, and therefore provides greater stopping distance than required for trains travelling at the permitted speed on the down slow line. Given this knowledge, the initial brake application may have been reasonable if the train had been travelling at (or below) its maximum permitted speed (see paragraph 56).

52 In the absence of OTDR evidence (see paragraph 71), RAIB arranged for a reconstruction of the circumstances of the incident at the RIDC Melton test track facility, to determine the train's braking capability at different speeds. The reconstruction involved the same two locomotives (57305 and 57310, which had been quarantined since the incident) and a similar class 710 unit, in the same formation as applied on the day of the incident (figure 6).

Figure 6: The train during RAIB's reconstruction at RIDC Melton on 22 May 2020 (image courtesy of Jason Cross)

53 Three different speeds were used in the testing: 60 mph (97 km/h), to represent the maximum permitted speed of the train; 64 mph (103 km/h), to represent the maximum permitted linespeed; and 73 mph (117 km/h), to represent the actual speed of approach to the yellow signal on the day of the incident. From each of these speeds, two different levels of braking were applied until the train was at a standstill: around half of a full braking application as initially used during the incident, and a full service brake application[5] (that is, six different test runs were conducted in total). These two levels of braking were used so that RAIB could reconstruct the actual braking used during the incident (see paragraph 57).

[5] Due to constraints outside RAIB's control during the testing, emergency braking was not used as a variable at all speeds. However, initial testing indicated that emergency braking produced similar results to a full service brake application; therefore, the full service brake application data was used as an approximation for emergency braking.

54 RAIB used portable GPS equipment on the train to record the stopping distance from each speed at each level of braking, as well as to plot the braking curves associated with each test run. RAIB then analysed these data to infer, by correcting for differences in gradient between the test track and the section of line at Loughborough, what the associated stopping distances would have been at Loughborough.

55 The testing produced results that reflected the observed performance of the train during the incident, and were also consistent with an industry model of stopping distances for this train formation. Therefore, the evidence supports a conclusion that there were no problems with the train's braking or levels of rail adhesion on the day of the incident.

56 The results are shown in figure 7, in which the red line represents the distance to the red signal from first sighting of the yellow signal (in other words, any distances above the red line represent the signal being passed at danger). This analysis demonstrates that the initial speed of the train is the critical factor in determining whether it stops before passing the red signal (as expected because stopping distance is related to the square of the initial speed). Therefore, had the train been travelling at its limiting speed of 60 mph (97 km/h), or even at the maximum permitted line speed of 65 mph (105 km/h), it would have stopped in time under the braking used during the incident.

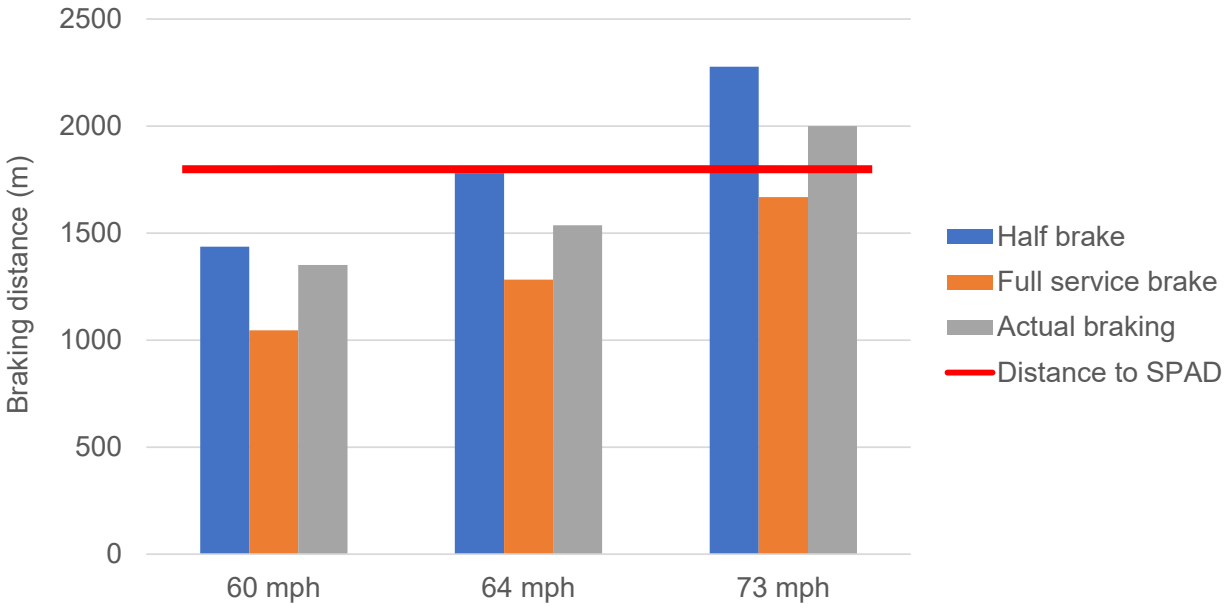

Figure 7: Graph of the brake test results, showing the distance to stop from different speeds and levels of braking, as well as the distance to the red signal from driver's declared initial braking point

57 RAIB further analysed the braking curves to determine the actual braking used during the incident. Assuming that the half brake application was applied on first sighting the yellow signal, the data suggest that the transition to full service/ emergency braking actually occurred at a point some 820 metres beyond the yellow signal, when the train would have been travelling at around 50 mph (80 km/h). This point was in the vicinity of the AWS magnet associated with the warning sign for the 40 mph speed restriction ahead, which would have triggered a horn warning in the train cab (paragraph 37).

Identification of underlying factor

Safety management at ROG

58 ROG's management assurance processes did not detect a lack of compliance with its own safety management system in areas that resulted in the driver and shunter being inadequately prepared for the movement of the train.

59 Railway Group Standard GORT3056 defines the requirements for a train document (commonly referred to as a 'driver's slip') that the driver must have in their possession before and during the journey. This document, which is applicable to freight train operations including the type of train involved in the incident,[6] includes information necessary for the safe operation of the train, such as its formation, load, brake force and maximum speed.

60 ROG's own safety management system (SMS) also sets out the processes for traincrew receiving appropriate information, including the issuing of train documents to drivers as well as providing briefings associated with train movements. However, neither briefings nor train documents were being provided to drivers or shunters. Evidence suggests that until a few months before the incident, such information was disseminated informally by a senior member of staff, who left ROG in January 2020. Since then, ROG expected its drivers to know the train speeds for hauling units with isolated brakes.

61 Similarly, ROG's competence standards for drivers and shunters include modules relating to train documents as well as understanding how to interpret relevant information about train speed and brake force. Again though, several witnesses told RAIB that there was no such training in these areas.

62 RAIB found evidence that ROG had documented SMS and competence management processes. However, the investigation found that there was no management oversight or awareness of how well these processes were being followed. RAIB found no evidence in recent audits or management reviews that could have revealed the gaps in their implementation.

63 The driver stated that he had reported the absence of train documents to ROG, but there is no evidence of any such reports having been recorded in ROG's internal reporting processes, or being acted upon.

64 When ROG began transporting the class 710 units in July 2019 (paragraph 8), it produced a briefing document describing the terms of these movements, including routes, train formations, limiting speeds, and other restrictions. This document was inadequately detailed, in particular as it did not mention the use of class 57 locomotives at all and so did not cover the train formation involved in the incident (despite this being a common formation in use at ROG for these movements).

65 In any case, this briefing document was not proactively or regularly distributed to drivers when they were scheduled to drive these trains. The document was placed on a shared network drive with the intention that drivers could access it with their tablet computers, but ROG's internal investigation into this incident found that it was stored in the wrong location on the network drive and was consequently inaccessible to traincrew.

[6] Although the train's reporting number implied a class 5 designation (which usually means empty passenger coaching stock), the fact that the passenger unit was running with its brakes isolated in the train meant that freight train rules applied to the movement.

Observations

Running brake tests

66 The driver did not conduct an adequate running brake test at the beginning of the journey.

67 The railway Rule Book[7] states that drivers must test that the brakes are working properly by carrying out a running brake test; such a test must be carried out from a speed that is high enough to be sure that the brake is operating effectively and that the speed of the train is being reduced. The running brake test should be carried out at the first opportunity after beginning the journey and in good time before approaching the first stopping place.

68 ROG's general operating instructions for drivers set out these same Rule Book requirements, specifying further that running brake tests should be carried out whenever a locomotive has been coupled to the train, or when taking charge of the train for the first time. Running brake tests are also covered in ROG's competence management system for drivers, and were assessed in the driver's most recent practical assessment before the incident, on 28 January 2020.

69 Witness evidence indicates that the driver used the train's brakes on three occasions before the incident: a mandatory stop on exiting the RIDC test track facility, on pulling into the goods loop outside Melton Mowbray station (paragraph 26), and on slowing for Syston Junction when joining the down slow line towards Loughborough (paragraph 27). The driver considered these occasions to fulfil the requirements for a running brake test, and reported nothing amiss with the train's braking capability.

70 RAIB observes that these braking events during the journey did not constitute an adequate running brake test as defined by the Rule Book and ROG's general operating instructions. The stop on exiting RIDC Melton would have been from a low speed (there is a 20 mph (32 km/h) speed restriction on the line exiting RIDC Melton) and the train reversed in Melton Mowbray goods loop, following which a further running brake test should have been conducted. While the decelerations for Melton Mowbray goods loop and Syston Junction could have suitably tested the brakes, these do not meet the criteria for conducting the running brake test before approaching the first stopping place. Nevertheless, RAIB's reconstruction confirmed that there were no problems with the train's brakes that may have been causal to the incident (paragraph 55), and therefore an effective running brake test would not necessarily have revealed any concerns to the driver that would have affected the incident.

On-train data recorder

71 ROG did not adequately manage the retrieval of evidence from the on-train data recorders on the locomotives.

72 In accordance with its usual practice, RAIB asked ROG to download the OTDR on the locomotives, to facilitate its investigation of the circumstances. Due to the non-availability of individuals and equipment capable of performing the download and the location of the locomotives, ROG did not carry out the download until the evening of 30 March 2020, four days after the incident.

[7] GERT8000/TW1 'Preparation and movement of trains', Issue 10, September 2015 (section 4.6), and GERT8000-Gloss 'Glossary of Railway Terminology' Issue 5.

73 While such a delay is not desirable, it would not normally cause a problem as most modern OTDR equipment is capable of storing at least eight days' worth of data, in line with the current industry standard.[8] However, when ROG downloaded the OTDR from locomotives 57305 and 57310, it transpired that they had stored just over eight hours' worth of data (due to the volume and resolution of variables recorded, rather than the amount of storage available). Consequently, the data associated with the incident was lost, which significantly hampered not only RAIB's investigation, but also those of the Office of Rail and Road (ORR), Network Rail and ROG.

74 The OTDR equipment on the two class 57 locomotives pre-dates the current requirements (which originally came into effect on 5 December 2015), and as such was compliant with a previous standard[9] which specified a minimum of eight hours' data storage.

75 Nevertheless, ROG was unaware of this limitation before the incident. Its competence management process includes the option of OTDR monitoring to unobtrusively assess driver competence, but ROG told RAIB that such monitoring was not being used regularly at the time of the incident. Furthermore, a previous signal passed at danger incident involving a train operated by ROG in 2018 (see paragraph 80) revealed an unrelated problem with its OTDR, in that it was inaccurately recording train speed. This evidence suggests that ROG was not properly managing the OTDR equipment on its locomotives.

76 Related industry guidance[10] on the use of OTDRs states that '*sufficient resources should be provided to ensure the availability of persons competent to download data as soon as is reasonably practicable following accidents, incidents and near misses*'. This principle is reflected in ROG's SMS process[11] for incident management and investigation, which states that persons required to carry out such investigation have the required competencies and necessary resources. Further, the process requires that the OTDR download is immediately carried out following an incident such as this.

77 RAIB observes that although the OTDR equipment on the two locomotives may have been compliant with standards, the fact that ROG was unaware of its limitations meant that there was not sufficient urgency or resource directed towards downloading the data.

Previous occurrences of a similar character

78 At about 13:35 hrs on 26 April 2012, a light locomotive operated by Devon & Cornwall Railways passed a signal at danger at Stafford. The RAIB investigation (RAIB report 16/2013) found that the locomotive had been travelling at excessive speed as it approached the Stafford area. As a result of this investigation, RAIB made recommendations addressed to Devon & Cornwall Railways which were of relevance to the current investigation, in areas of competence management, driver monitoring and safety management.

[8] RIS-2472-RST 'Data Recorders on Trains', Issue One, June 2020.

[9] GMRT2472 'Data Recorders on Trains – Design Requirements', Issue One, June 2002.

[10] ATOC Guidance Note ATOC/GN001 'Use of Data Recorders', Issue 4, August 2012.

[11] RMS010 'Incident Reporting, Management and Investigation', Issue 3, March 2019.

79 On 24 March 2016, a train operated by ROG, consisting of a class 47 locomotive hauling a four-car class 321 passenger unit, passed a signal at danger near Ketton, Rutland, by about 10 metres. The unit was being hauled unpowered from RIDC Melton to Ilford depot in East London. RAIB determined the causes of the incident to be that the unit's brakes were isolated, and that this was not discovered due to the omission of a crucial static brake test. Moreover, running brake tests carried out on the journey were not adequate to reveal the train's reduced braking capability. RAIB highlighted two important safety messages as a result of this incident, relating to effective static and running brake tests (see RAIB safety digest 02/2016).

80 Between the incident at Ketton on 24 March 2016 and that at Loughborough on 26 March 2020, ROG drivers have been involved with four other signal passed at danger incidents:

a. 10 July 2017 at Droitwich Spa, involving a light locomotive

b. 26 March 2018 at Potters Bar, involving a light locomotive

c. 25 November 2019 at Moreton-on-Lugg, involving a light locomotive

d. 8 February 2020 at Bristol Barton Hill depot, involving a class 5 train.

These six incidents represent an average rate for ROG over the four-year period of 9.04 signals passed at danger per million train miles; this compares to a freight national average rate of 2.09 over a similar period. ROG told RAIB that the nature of its operations, being generally planned at short notice, means that its trains are more likely to encounter red signals, and are therefore exposed to higher risk of passing a signal at danger. While this could explain the apparently high rate of signals passed at danger at ROG, there is insufficient data available in the UK rail industry to verify whether ROG is disproportionately exposed to red signals.

Summary of conclusions

Immediate cause

81 The manner in which the train was driven meant it was unable to stop before passing the red signal (paragraph 39).

Causal factors

82 The causal factors were:

a. The train speed was too high on the approach to the yellow signal (paragraph 42, **Learning point 1**)

b. The braking applied by the driver was insufficient, for the speed at which the train was travelling, to stop the train before it passed the red signal (paragraph 50, no recommendation).

Underlying factor

83 ROG's management assurance processes did not detect a lack of compliance with its own safety management system in areas that resulted in the driver and shunter being inadequately prepared for the movement of the train (paragraph 58, **Recommendation 1**).

Additional observations

84 Although not linked to the incident on 26 March 2020, RAIB observes that:

a. The driver did not conduct an adequate running brake test at the beginning of the journey (paragraph 66, **Learning point 2**)

b. ROG did not adequately manage the retrieval of evidence from the on-train data recorders on the locomotives (paragraph 71, see paragraph 87).

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

85 On 28 April 2020, ORR served an improvement notice on ROG under the provisions of the Health and Safety at Work etc Act 1974. The notice concerned the information, instruction and training provided by ROG for employees to plan, prepare and operate locomotive-hauled trains comprising unbraked vehicles. The initial compliance date of the notice was 28 July 2020, although this was subsequently extended to 31 August 2020.

86 In response to ORR's Improvement Notice, ROG has taken the following actions:

a. Introduced a new electronic weekly notice system which includes all of the relevant briefing documents (paragraph 64) for train movements in the coming week. The document associated with the movements between Old Dalby and Worksop has been revised to include details of the train's brake force, weight and maximum speed for all combinations of locomotive with class 710 units. RAIB notes that these combinations still did not include the particular formation of the train involved in the incident on 26 March 2020, but ROG supplements this document with special instructions for such moves, which emphasise the maximum speed for any such formation as 45 mph (72 km/h).

b. Introduced new train documents (paragraph 59) to be issued to drivers of locomotive-hauled trains at the start of each journey. The document is manually prepared by the shunter, and includes details of the train's length, weight, brake force and maximum speed. ROG has also developed training for drivers and shunters on how to use these documents.

c. Issued a safety brief on 18 June 2020 explaining the use of the electronic weekly notice system, the briefing documents and the train document. The safety brief clarified that the maximum speed of the train must only be established from the train document and/or the briefing document, not from train timing sheets.

87 In addition, ROG has made a proposal to the leaseholder of the locomotives to reconfigure the OTDR to increase its storage capability, by reducing the resolution of data recording. At the time of writing, this proposal was in the process of being implemented. To improve its resources in securing OTDR evidence, ROG has also procured more downloading equipment and trained more of its staff in downloading OTDR data.

Recommendation and learning points

Recommendation

88 The following recommendation is made:[12]

1 *The intent of this recommendation is to ensure that ROG's safety management system, including the new procedures that it has put in place as a result of this incident, is not undermined by an undetected lack of organisational compliance with those processes.*

Rail Operations Group should review its management assurance processes relating to operational safety, and take steps to ensure effective monitoring, auditing and management review of its safety arrangements in areas including, but not limited to, the competence management of operational staff, traffic acceptance, and general operating instructions (in line with recognised good industry practice) (paragraph 83).

Learning points

89 RAIB has identified the following important learning points:[13]

1 This investigation highlights the importance of being aware of, and adhering to, maximum permissible speeds both for the type of train being operated and for the section of line on which it is being driven, as defined by controlled information sources (such as the Sectional Appendix and a properly formatted train document).

[12] Those identified in the recommendation have a general and ongoing obligation to comply with health and safety legislation, and need to take this recommendation 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, this recommendation is 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.

[13] '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.

2 Train drivers are reminded of the requirement for a proper running brake test, carried out at a speed that is high enough to be sure that the brakes are operating effectively and that the speed of the train is being reduced. The running brake test must be carried out at the earliest opportunity and in good time before approaching the first stopping place, as set out in Rule Book module TW1 section 4.6.

Appendices

Appendix A - Glossary of abbreviations and acronyms

AWS	Automatic Warning System
ORR	Office of Rail and Road
OTDR	On-train data recorder
RAIB	Rail Accident Investigation Branch
RIDC	Rail Innovation & Development Centre
ROG	Rail Operations Group
SMS	Safety management system
TPWS	Train Protection and Warning System

Appendix B - Investigation details

RAIB used the following sources of evidence in this investigation:

- information provided by witnesses
- data from signalling systems and lineside equipment
- site photographs, maps and diagrams
- competence records
- mobile phone records
- rail industry standards and procedures
- weather reports and observations at the site
- data from a series of brake tests organised by RAIB with the support of ROG, Network Rail and RIDC Melton
- a review of previous incidents and RAIB investigations that had relevance to this accident.

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