



Rail Accident Investigation Branch

Rail Accident Report



Passenger train collision at Norwich 21 July 2013

Report 09/2014
May 2014

This investigation was carried out in accordance with:

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

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Passenger train collision at Norwich

21 July 2013

Contents

Summary	5
Introduction	6
The accident	7
Background	9
Location	9
Parties involved	11
Method of platform allocation	11
Platform capacity	12
Events during the accident	13
Events following the accident	14
The investigation	16
Sources of evidence	16
Key facts and Analysis	17
Identification of the immediate cause	17
Identification of causal factors	17
Crashworthiness performance	28
Observations	29
Previous occurrences of a similar character	29
Summary of conclusions	30
Immediate cause	30
Causal factors	30
Observations	31
Actions reported as already taken or in progress relevant to this report	32
Learning points	33
Recommendations	34
Appendices	36
Appendix A – Glossary of abbreviations and acronyms	36
Appendix B – Glossary of terms	37
Appendix C – Similar incidents	40

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Summary

At 00:11 hrs on Sunday 21 July 2013, a passenger train operated by Greater Anglia carrying 35 passengers collided at 8 mph (13 km/h) with a train stabled in platform 6 at Norwich station. As a result of the collision, eight passengers with injuries were taken to hospital.

The RAIB concluded that the accident occurred because during the last 20 seconds of the driver's approach to the station, he either had a lapse in concentration or a microsleep.

The RAIB identified some factors which may explain the driver's possible lapse in concentration (ie the noise made by the passengers immediately behind his cab and the various thoughts occupying his attention at the time of the approach). The RAIB also found that the driver had a previous operational history indicative that he was prone to lapses in concentration, and that this had not been identified by Greater Anglia's competence management system.

Greater Anglia's investigations of the previous incidents that the driver had been involved in had not raised any concerns about the driver's ability to maintain concentration. This was because the driver manager who carried out the investigation had not been trained to consider that incidents, seemingly different in nature, could be linked by underlying behavioural issues. Opportunities to formally review the driver's operational history were missed and this was also not identified by the internal audits conducted by Greater Anglia.

Furthermore, the driver was tired through a short-term lack of sleep, and his performance might also have been affected by the prescribed medication that he was taking. These could have been other factors leading to a lapse in concentration, or they could have led to the driver having a microsleep.

The RAIB has identified two learning points and made five recommendations as a result of its investigation. The learning points relate to the importance of reporting all incidents to signallers, and the importance of providing occupational health physicians with all relevant medical information during consultation.

Four recommendations are addressed to Greater Anglia with respect to its competence management system, its accident and incident investigation procedures, its auditing processes and its fatigue management system. A further recommendation is addressed to Network Rail, with the support of Greater Anglia, to understand and mitigate the risk associated with permissive train movements at Norwich station.

Introduction

- 1 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.
- 2 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.
- 3 The RAIB's investigation (including its scope, methods, conclusions and recommendations) is independent of all other investigations, including those carried out by the safety authority, police or railway industry.
- 4 All dimensions in this report are given in metric units, except speed and locations which are given in imperial units, in accordance with normal railway practice. Where appropriate the equivalent metric value is also given.
- 5 The report contains abbreviations and technical terms (shown in *italics* the first time they appear in the report). These are explained in appendices A and B.

The accident

- 6 At 00:11 hrs on Sunday 21 July 2013, train reporting number 2C45 collided with a train *stabled* in platform 6 at Norwich station (figure 1).
- 7 Train 2C45 was the 23:34 hrs Great Yarmouth to Norwich passenger service operated by Greater Anglia carrying 35 passengers, as well as a driver and a conductor. It was travelling at 8 mph (13 km/h) at the time of the collision. The train stabled in platform 6 was empty (figure 2).
- 8 Eight passengers on train 2C45 were injured during the collision and taken to hospital. They were discharged later that day. Others were treated at the scene by paramedics for minor injuries.

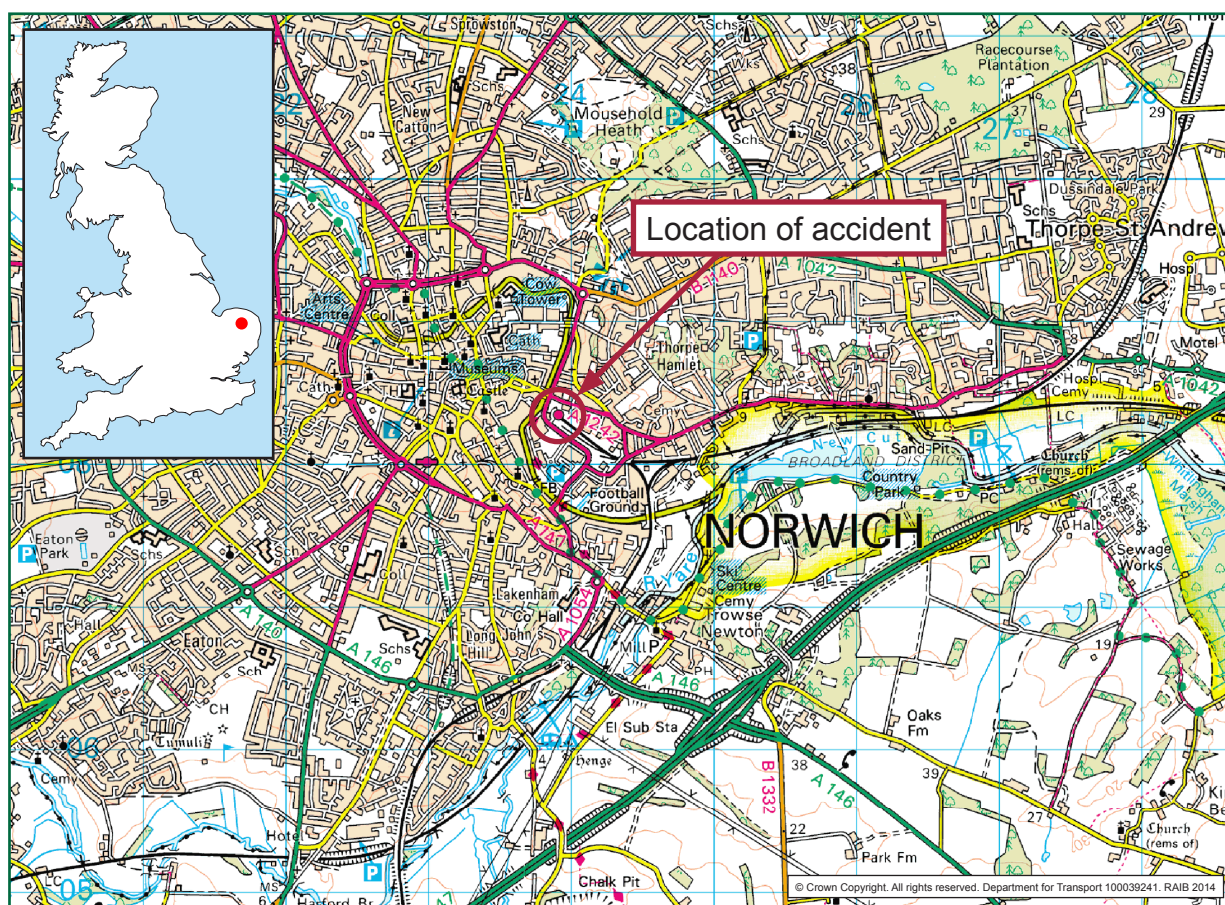


Figure 1: Extract from Ordnance Survey map showing location of accident

- 9 Train 2C45 was a two-car class 156 *diesel multiple unit* (DMU). The train stabled in platform 6 was a two-car class 158 DMU. There was some minor damage to the gangway of train 2C45 and to the couplers of both trains (figure 3).
- 10 During the collision the train stabled in platform 6 was pushed back against another train also stabled in the same platform. This second stabled train, which was also an empty two-car class 158 DMU, was not damaged.



Figure 2: Train 2C45 after the collision (courtesy British Transport Police)



Figure 3: Train 2C45 after the collision (courtesy British Transport Police)

Background

Location

- 11 Norwich station is a terminal station located 124 miles and 9 *chains* from London Liverpool Street (via Cambridge). The maximum permitted speed on the approach to the station is 25 mph (40 km/h). The station has 6 platforms of various lengths, platform 6 being the shortest at 132 metres. All terminating railway lines at Norwich station are fitted with *buffer stops*.
- 12 The signalling system on the UK national railway network does not normally allow two trains in the same *signal section* so as to reduce the risk of collision. However, for operational reasons, it is sometimes necessary to have more than one train in a section. This is particularly the case at stations, where it can be necessary to have more than one train in a platform for the purpose of stabling, or to split and join trains. Allowing two or more trains to enter the same signal section is subject to specific rules and is known as *permissive working*. Network Rail's *Sectional Appendix* for Norwich station shows that permissive working is authorised in all platforms.

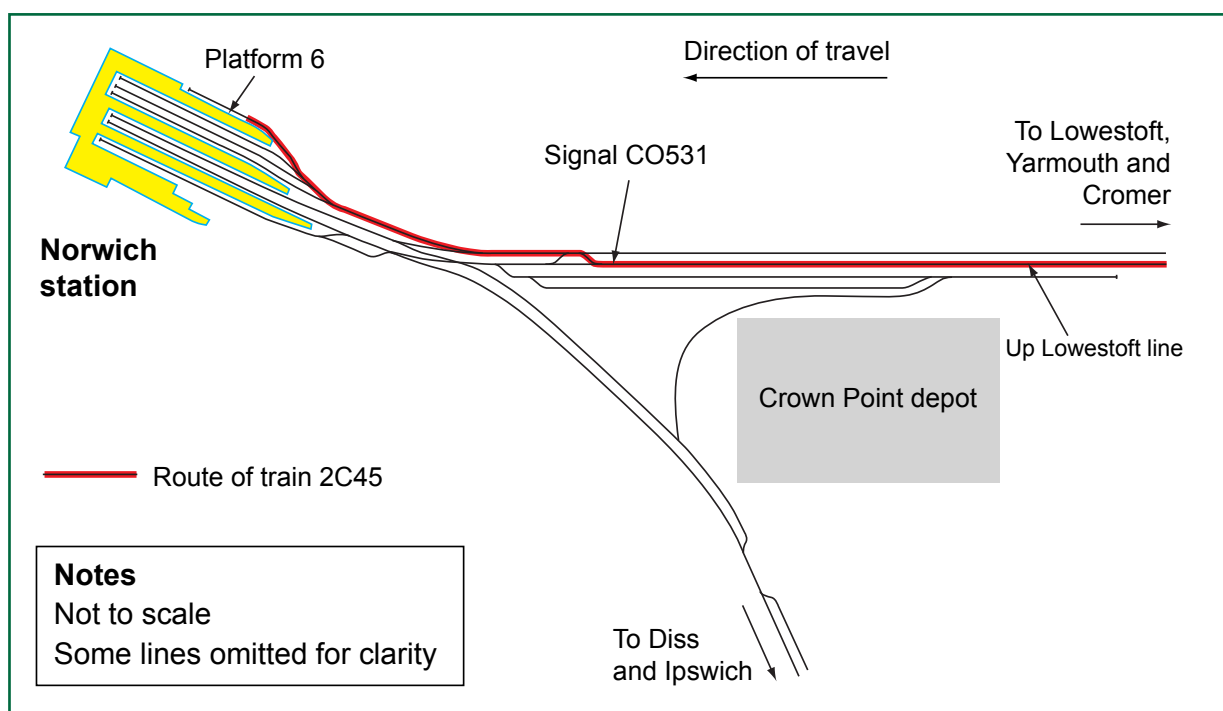


Figure 4: Schematic diagram showing location of accident and route of train 2C45

- 13 Signals in the Norwich area are mainly 2 or 3-aspect colour light signals. Train movements within the area are controlled by Network Rail's signal box at Colchester (51 miles 52 chains from London Liverpool Street via Chelmsford) using the *track circuit block* method of train working.
- 14 The driver of a train approaching the station from Great Yarmouth on the *Up* Lowestoft line is informed at signal CO531 whether the section ahead of him (in this case up to the buffer stops at the end of the line) is either occupied by train(s) or not. Signal CO531 is located 712 metres from the bottom of the *ramp* of platform 6 (figure 4).

- 15 Signal CO531 is a 2-aspect colour light signal (*main signal*) with a *position light signal* and a *route indicator* (figure 5).
- 16 If there is no train in the signal section ahead, once the signaller at Colchester signal box has requested the *route* and the *interlocking* confirms that the route has been set, the main signal *clears* to show a single yellow aspect¹ indicating to the driver that there are no trains in the signal section up to the buffer stops (figure 5). The position light signal will not clear if the main signal has cleared.
- 17 If there are already one or more trains in the platform that a train is routed into, the main signal will not clear. Instead, after the track circuit immediately on the approach to the signal has been occupied for a minimum of 22 seconds² (and provided that there are no conflicting movements ahead of the signal), the position light signal will clear to two white lights. This informs the driver that the platform ahead of his train is occupied by one or more trains and that he should drive at caution, ready to stop short of any obstruction (figure 5). This is usually referred to as *calling-on*.
- 18 The route indicator is used in combination with either the main or position light signal to inform the driver which platform the train is routed into.

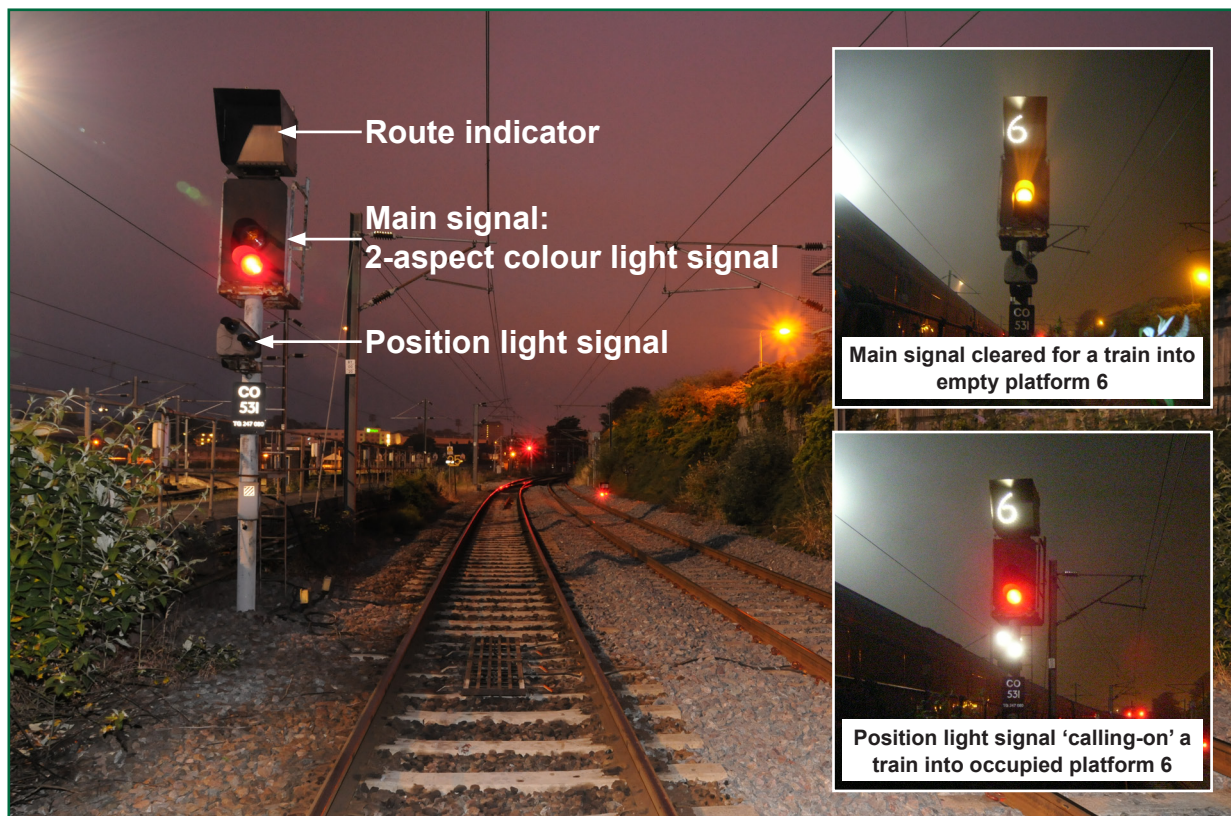


Figure 5: Signal CO531 (main photograph courtesy of British Transport Police)

¹ For platforms 3 to 6 at Norwich station, clearance of the main signal is delayed until one of the two track circuits on the approach to the signal becomes occupied.

² The minimum amount of time a track circuit needs to be occupied before a signal can clear is location-specific. It is dependent on many parameters including, among others, the length of the track circuit on the approach to the signal and the maximum likely speed of the approaching train. This time delay applies for permissive moves into any platform (1 to 6) at Norwich station.

Parties involved

- 19 Train 2C45, formed of unit 156402, was owned by Porterbrook (a rolling stock leasing company) and operated by Greater Anglia who also employed the driver and conductor. The trains stabled in platform 6 were both operated by East Midlands Trains. The one directly involved in the collision with train 2C45 (unit 158774) also belonged to Porterbrook.
- 20 Norwich station was operated by Greater Anglia, who also employed the station staff involved in the accident.
- 21 The track and signalling equipment were owned, operated and maintained by Network Rail, who also employed the signallers at Colchester.
- 22 BUPA employed the occupational health physician who assessed the fitness for work of the driver.
- 23 All parties freely co-operated with the RAIB and provided assistance during the course of this investigation.

Method of platform allocation

- 24 Norwich station is located close to Crown Point train maintenance depot (figure 4). Crown Point depot is operated by Greater Anglia and is used to maintain and prepare its trains.
- 25 During the day, train movements in and out of Norwich station generally run in accordance with the national *Working Timetable*. The Working Timetable defines the time at which each service is planned to arrive and depart and the platform allocated to that service. However, for operational reasons it can be necessary to diverge from the Working Timetable, in particular for platform alterations.
- 26 At night time and in preparation for the morning service, the running of Norwich station is closely linked to the activities at Crown Point depot and deviations from the Working Timetable become more frequent. At the end of the day, some of the trains arriving at Norwich station will be sent to Crown Point depot for re-fuelling, cleaning and light maintenance. Others will be kept at the station where cleaning will be carried out in preparation for the morning service.
- 27 Due to the significant number of deviations from the Working Timetable, the station supervisor, helped by the Duty Traincrew Manager (DTM) and the depot staff decide which trains will stay at Norwich station overnight and which ones will go to Crown Point depot. It is important that trains that are required to go to Crown Point depot during the night do not get trapped behind trains that will remain in the station. It is also important that trains are stacked along the platforms in the correct running order for the morning. The operational requirements each night are variable and therefore the station staff (the station supervisor and DTM) have to produce a plan every day showing how they intend to manage the situation.
- 28 This plan is normally prepared at the start of the day and faxed to the signallers at Colchester signal box. As the day progresses, any further alterations to the plan are communicated by the station supervisors to the signaller by phone.

- 29 Within Colchester signal box, the signaller's panel for Norwich station can display the reporting numbers of two trains in each platform (figure 6). This is insufficient for the signallers to understand the platform occupation remotely as there can be more than two trains in any platform, as was the case in platform 6 on the night of the accident³.

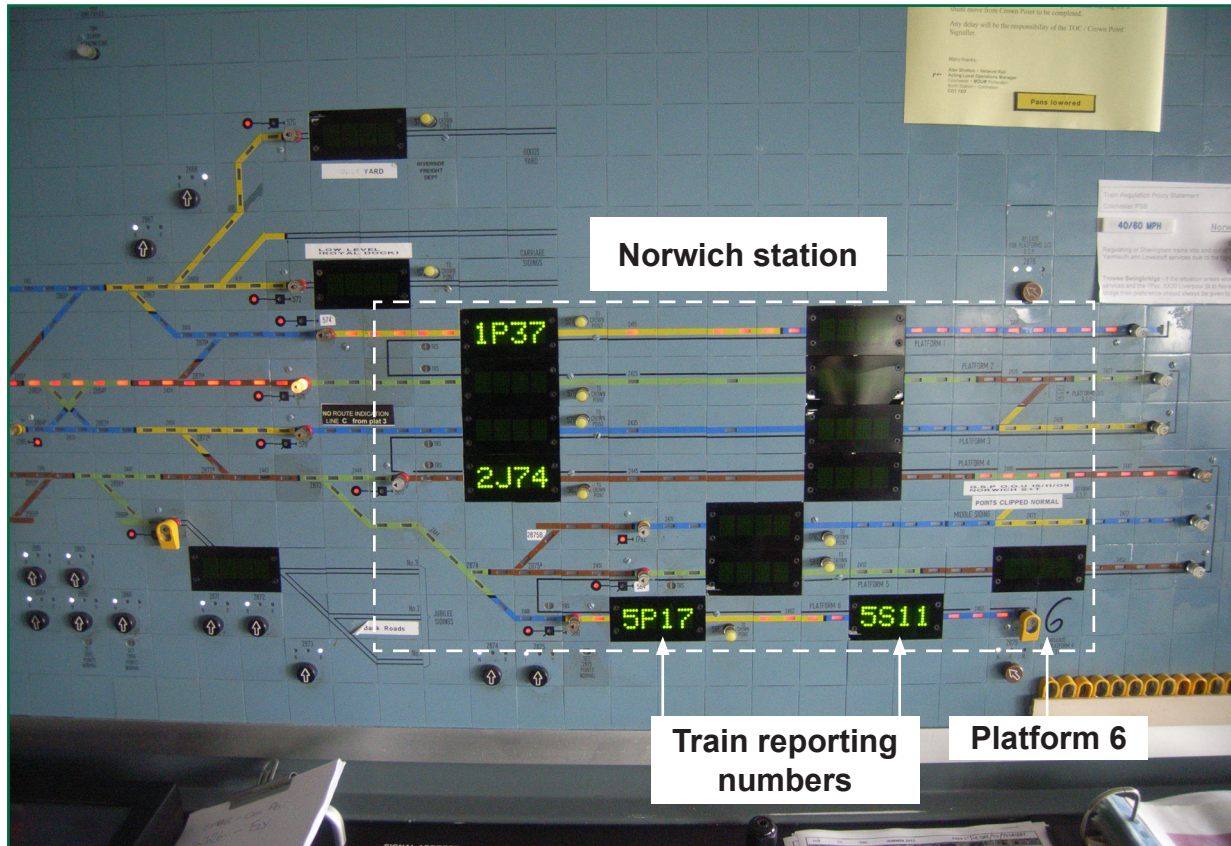


Figure 6: Norwich station on Colchester signal box panel

- 30 The overall effect of the working arrangements is that the signallers at Colchester signal box rely entirely on the information given to them by the Norwich station staff for platform allocation. They do not routinely challenge any request made for platform allocation, as they assume that the station staff have reasonable grounds for the decision.

Platform capacity

- 31 The *usable length* of platform 6 at Norwich station is 132 metres. The vehicles of class 156 and 158 DMUs are 23 metres long which indicates that platform 6 has a maximum capacity of five vehicles. This capacity has changed over the years as the length of vehicles has increased. For example, at the time of the last re-signalling of the Norwich area in the mid-1980s, the DMUs operating in the area were typically 18.5 metres long which meant that six vehicles could comfortably fit in platform 6. The number of trains using Norwich station has also increased since the mid-1980s which has led to more permissive moves being required.

³ The signallers also have no way of knowing, other than being told by station staff, how long each train is; multiple unit trains at Norwich may be formed of 1 to 4 coaches.

- 32 Despite the fact that platform 6 can now only accommodate five vehicles, it was not unusual for six vehicles to be routed into the platform for operational reasons, as was the case on the night of the accident. With six vehicles in platform 6, the rear door of the last vehicle might be over the platform ramp. This presents a risk of injury to any passengers detraining through this door. Before June 2013, Greater Anglia managed this risk by asking its conductors to remain vigilant on the approach to Norwich station so that passengers could be directed away from the rear door if necessary.
- 33 On 27 June 2013, following concerns that the capacity of platform 6 was being exceeded on regular occasions, Greater Anglia issued a briefing note to its station staff in charge of platform allocation at Norwich station to remind them of the capacity of each platform. Platform 6 is correctly recorded on this briefing note as having a maximum capacity of five vehicles. The briefing note alerts the station staff to the risk of the rear door being above the platform ramp but does not explicitly forbid the practice. However, it does not explain what to do if the situation arises.
- 34 Greater Anglia stated that the note was briefed to the station supervisors face-to-face. The station supervisor who was on duty at the time of the accident on 21 July 2013 had signed a signature sheet to acknowledge that he had been briefed. The briefing note was also displayed in the station supervisors' office as a reminder. Witness evidence indicates that the briefing note was displayed in the DTMs office at Norwich station too, but there was no signature sheet for DTMs to confirm that they had been briefed. The DTM who was on duty at the time of the accident on 21 July 2013 stated that he was unaware of this briefing note.

Events during the accident

- 35 On the evening of Saturday 20 July 2013, train 2C45 was timetabled to go into platform 5. This was confirmed to the signaller at Colchester at 23:49 hrs during one of twenty telephone conversations about platform allocation that took place between the station supervisors⁴ and the signallers⁵ from 19:23 hrs to 00:02 hrs.
- 36 In an earlier conversation at 21:37 hrs the station staff had been advised that platforms 2 and 3 had to be left clear of trains that night. This was in preparation for an engineering *possession* which was planned to start at 00:45 hrs. The possession covered all platforms and meant that train movements would not be possible at Norwich station after that time. The possession was planned to be given up at 07:45 hrs on Sunday morning. This notification meant some alterations were needed to the platform allocation plan.
- 37 Shortly before midnight, the DTM decided that train 2C45 would be routed into platform 6 behind two East Midlands Trains units which had already been stabled there for the night. This would avoid having to *shunt* train 2C45 later on. The DTM informed the station supervisor of his decision. Despite the fact that it meant that six vehicles would now be in platform 6, the station supervisor said he did not think to query this decision as it came from a more senior member of staff. He was also aware that the arrangement had been in use at Norwich station for years.

⁴ A shift change took place at 22:00 hrs which meant that the signallers received calls from two station supervisors during the evening.

⁵ A shift change took place at 20:45 hrs which meant that two signallers received calls from the station staff during the evening.

- 38 At 00:02 hrs, the station supervisor contacted the signaller to ask him to route train 2C45 into platform 6. At that time, train 2C45 was still approximately 4 miles (6.4 km) away from signal CO531. Despite having been told in an earlier conversation at 23:37 hrs that platform 6 was full with the two East Midlands Trains units, the signaller did not query this instruction either (paragraph 30). The signaller set the route for train 2C45 from CO531 to platform 6 shortly afterwards.
- 39 At 00:05 hrs, the DTM called the conductor on train 2C45 to warn him that his train would be directed to platform 6 which was already occupied by four other vehicles. This call was to warn the conductor to position himself at the rear door on arrival at Norwich to prevent passengers from alighting through that door. At 00:05 hrs, train 2C45 was approximately 2 miles (3.2 km) away from signal CO531.
- 40 Train 2C45 arrived at signal CO531 at 00:08 hrs (figure 7). The main signal was displaying a red aspect. As the train came to a stand, the position light signal cleared together with the route indicator showing the number '6'. After a 20 seconds pause at the signal, the driver applied power for 22 seconds and the train accelerated to a speed of 20 mph (32 km/h). He then allowed the train to *coast* for 55 seconds as it approached Norwich station.
- 41 About 185 metres away from the rear of unit 158774 in platform 6, the driver applied the brakes in *step 1* in two short, successive events (each of 2 seconds duration, 2 seconds apart). This reduced the speed from 18 mph (29 km/h) to 15 mph (24 km/h). By the end of the second brake application, the train was still 132 metres away from unit 158774. At this point, the driver had a full view of platform 6 and of the trains stabled in that platform. He then allowed his train to coast towards the platform.
- 42 Approximately 15 metres from unit 158774, the driver applied the emergency brake while the train was travelling at 12 mph (19 km/h). The train was unable to stop in the distance available and it collided with unit 158774 at 8 mph (13 km/h) at about 00:11 hrs.

Events following the accident

- 43 At the moment of the collision, the conductor said he was standing in the rear vestibule of the trailing vehicle ready to prevent passengers from using that door. He said he immediately understood that the train had been involved in an accident and started walking through the train to see if anybody had been hurt. As he realised that people had been injured, he called the station supervisor to request the attendance of the emergency services.
- 44 The driver, knowing that his train had been involved in an accident, said he decided to leave his driver's desk exactly as it was. He opened the cab back door and stepped into the saloon. He realised at this point that the leading vehicle was in darkness. However, there was light coming into the vehicle from the platform lighting (figure 2). He said he too intended to start checking on the passengers but he met the conductor shortly after stepping out of his cab.
- 45 After a quick exchange with the conductor, the driver released the leading door to let the passengers onto the platform.

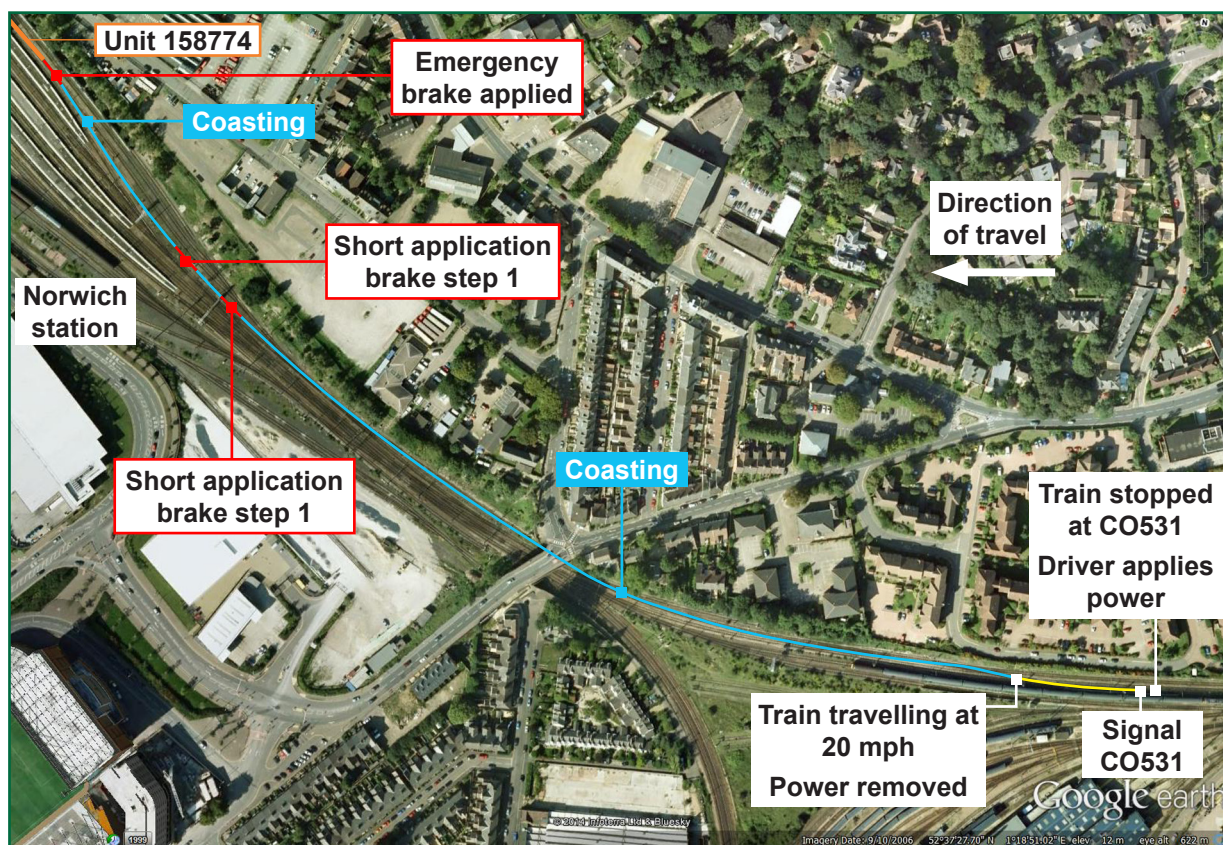


Figure 7: Journey from CO531 to the point of collision

- 46 At 00:17 hrs, the station supervisor called the emergency services while he was running towards platform 6. Once he got there, he made contact with the driver and conductor. Some of the passengers on the platform became aggressive towards the driver and the station supervisor had to intervene. This prompted him to contact the British Transport Police whose office is located on platform 5 at Norwich station. They were quickly on site and took control of the situation. In the meantime, the DTM, who is responsible for drivers and could see the developing situation on the platform from his office, spoke to the driver on the phone and asked him to come to the DTM's office so that the DTM could start arranging for drugs and alcohol testing which is routine for staff following an incident. The driver left the scene and went to the DTM's office after this call.
- 47 At 00:20 hrs, a Community First Responder from the East of England ambulance service arrived on site. By 00:26 hrs, the first ambulance and the first appliance from the Norfolk Fire and Rescue service had also arrived. Together they started looking after the passengers who had been injured during the collision.
- 48 In the confusion that followed the collision, neither the driver nor any other staff thought to contact the signallers at Colchester who continued to route trains towards Norwich station for another 24 minutes. Had the signallers been made aware of the accident, it is likely that they would have elected not to route trains from signal CO531 to preserve the evidence and avoid the potential of a repeat incident.
- 49 The signal box was eventually alerted to the accident at 00:35 hrs by Network Rail's route control who had been alerted to the accident by Greater Anglia's control. The signallers stopped all train movements in the area at that time.

The investigation

Sources of evidence

50 The following sources of evidence were used:

- interview and witness statements;
- the train's *On-Train Data Recorder* (OTDR);
- a download of the data-logger for the signalling equipment in the Norwich station area;
- results of testing carried out on the signalling equipment;
- telephone voice recordings to and from the signaller's panel at Colchester signal box on the day of the accident;
- site photographs and measurements;
- video footage of two cab rides into Norwich station from signal CO531;
- train maintenance and post-incident inspection records;
- records of the driver's operation since 1989;
- the driver's medical records;
- Greater Anglia's procedures;
- weather reports and observations at the site; and
- previous RAIB investigations that had relevance to this accident.

Key facts and Analysis

Identification of the immediate cause⁶

- 51 **The driver did not stop his train in the available distance.**
- 52 The analysis of the OTDR shows that the driver applied the brakes 146 metres away from the point of collision. This was a short brake application which only lasted 2 seconds. At the end of the brake application, train 2C45 was still 132 metres from the point of collision.
- 53 Between 132 metres and approximately 15 metres from the point of collision (paragraph 42), the OTDR recorded no action by the driver. There was no brake application during the 20 seconds that it took the train to cover this distance. The OTDR showed that the *driver safety device* remained activated by the driver during that time.
- 54 The driver consistently stated that he thought he had put his train in brake step 1 on the immediate approach to the platform. Had he put his train in brake step 1 at the bottom of the ramp, the RAIB calculated that train 2C45 would have stopped short of unit 158774.

Identification of causal factors⁷

- 55 The driver said he could not recall all of the events between passing signal CO531 and the collision with unit 158774. However, there is no evidence to suggest that the driver struggled to understand the situation he was facing: he was clear that he had seen and was aware of the four vehicles already stabled in platform 6. The driver also stated that it was not the first time that he had been faced with this situation in platform 6 at Norwich station.
- 56 The RAIB considers that the accident was caused by either of the following scenarios taking place during the 20 seconds before the emergency brake application:
- a. the driver, due to a lapse in concentration⁸, did not notice that his train was not in brake step 1; or
 - b. the driver had a *microsleep*.

⁶ The condition, event or behaviour that directly resulted in the occurrence.

⁷ Any condition, event or behaviour that was necessary for the occurrence. Avoiding or eliminating any one of these factors would have prevented it happening.

⁸ In the context of this report, concentration is defined as the ability to focus the attention on a task while ignoring other distractions.

- 57 The following factors may have promoted the driver's lapse in concentration:
- the driver's mind was busy dealing with other thoughts;
 - the driver was prone to lapses in concentration;
 - the driver was tired; and
 - the driver suffered from the side effects of prescribed medication.

Each factor is considered in further detail later in the report.

The RAIB has not found any evidence to indicate that the driver was undertaking other activities that could have diverted his attention during the 20 seconds before the emergency brake application. However, given that the driver said he could not recall all of the events between passing signal CO531 and the collision with unit 158774, this possibility cannot be discounted. The RAIB has confirmed he was not making or receiving calls or text messages on a mobile phone.

- 58 The following factors may have promoted the driver's microsleep:
- the driver was tired; and
 - the driver suffered from the side effects of prescribed medication.

Each factor is considered in further detail later in the report.

- 59 Post-incident testing by Greater Anglia at Crown Point depot confirmed that the train's braking system was working as intended and that the speedometer in the cab was reading accurately. A review of the OTDR by the RAIB indicated that the brakes, when applied, achieved the specified deceleration rates. An inspection of the photos taken by the British Transport Police inside the cab immediately after the accident, as well as video footage taken by Network Rail during a day-time and night-time cab ride into Norwich station, showed that the sightlines of the driver were not obstructed or limited during the last 250 metres of train 2C45's journey into platform 6. An inspection on the night by the RAIB of the track between signal CO531 and platform 6 revealed no concerns over the *adhesion conditions*. These factors are discounted as being causal.

Driver's mind busy dealing with other thoughts

- 60 **The RAIB identified the following possible sources of distraction to the driver:**
- the noise made by the passengers immediately behind his cab;**
 - thinking of calling the conductor to tell him about the platform allocation; and**
 - his mind moving onto the next task.**

Passenger noise

- 61 There were 35 passengers on train 2C45. This included two groups returning from separate stag parties in Great Yarmouth. One of these groups was seated immediately behind the driver's cab. The driver and conductor both described the atmosphere on the train as 'lively'. The driver also recalled that the noise level was getting louder as the train approached Norwich station. He described some of the passengers banging on the toilet door (immediately behind the driver's cab on this vehicle) shortly before the collision.

- 62 It is possible that the noise made by the passengers immediately behind his cab distracted the driver.

Contacting the conductor

- 63 The driver stated that, when his train was approximately 100 to 150 metres from unit 158774, he identified that there were four vehicles in platform 6. He recalled thinking about calling the conductor to warn him that the rear door of the train might end up over the platform ramp. He described how his hand started reaching for the handset, but he decided that he would not have enough time to conduct the conversation.
- 64 Although this indicates that the driver was aware that he was undertaking a permissive move with four vehicles ahead of his train, thinking about calling the conductor may have distracted the driver from properly controlling the train's approach.

Moving onto the next task

- 65 The driver stated that he could recall some of his thoughts during the last part of the journey. In particular, he recalled thinking about the relief that he felt that his working day was about to finish, and wondering where he had parked his car at the station. His mind had started moving onto the next task before completing the task in hand.
- 66 The reduction in attention level associated with the end of a working shift is recognised as a source of errors⁹. It is possible that thinking about the next tasks distracted the driver and prevented him from concentrating on the task in hand.

Propensity to lapses in concentration

- 67 On the basis of the driver's previous operational history and the way he was driving on the day, the RAIB has concluded that the driver was prone to lapses in concentration.**

- 68 The RAIB reviewed the records of the driver's career covering the period from when he joined British Rail in 1984 to the accident at Norwich on 21 July 2013. Since becoming a driver in 1989, the driver had been involved in more than 20 incidents. He had been held responsible by his employer for 14 of these incidents. These included signals passed at danger, speeding incidents, failures to call at a station, station overruns, stopping short at a station, an unscheduled stop at a station, AWS/TPWS interventions, a door incident and accepting a wrong route. The RAIB has been unable to source reliable data to compare this driver with others in terms of operational performance. However, after the accident, Greater Anglia described the rate of one incident every two years (the driver had 14 incidents in 24 years) as not typical of even an average driver.
- 69 On the basis of its review of the incident records, the RAIB concluded that, in the majority of the incidents attributed to the driver, a lack of concentration was a likely underlying factor.

⁹ In 2006, RSSB in collaboration with ATOC produced a DVD called "The 21st Century Professional Driver" based on its research into lifestyle and self-management. This DVD has a specific chapter describing the risks associated with the mind moving-on at the end of the working shift.

- 70 The RAIB analysed the OTDR records for the driver's last two return journeys on the day of the accident. This analysis showed that the driver exceeded the maximum permitted line speed on more than 10 separate occasions in the space of three hours. This erratic style of driving is indicative of either a driver prone to lapses in concentration or of one unwilling to comply with rules. Given that Greater Anglia had no concerns regarding the driver's willingness to comply with rules, it is likely indicative of the driver's propensity to lapses in concentration and is particularly significant as the driver was on a *development plan* for a previous speeding incident at the time (paragraphs 78d and 88).
- 71 The driver was also unable to explain why his train stood for 20 seconds at signal CO531 after the signal had cleared without him taking any actions that were recorded on the OTDR (paragraph 40). There were no operational reasons for the driver not to apply power immediately. This might be further evidence that the driver was having lapses in concentration towards the end of his journey.
- 72 The driver's propensity to lapses in concentration had been apparent for some time in his operational history, but had not been addressed by Greater Anglia's Competence Management System (CMS) or through the development plans following incidents. This was because his propensity to lapses in concentration had not been identified during either:
- his competence assessments; or
 - the investigations of his previous incidents.
- These are now considered in turn.

Competence assessments

- 73 Greater Anglia manages the competence of its drivers by assessing them during direct and indirect observations in accordance with the company's CMS. There are three types of assessment:
- formal driving assessments during which a driver is observed directly by a driver manager;
 - un-obtrusive assessments where a driver is not directly supervised or aware of the assessor's presence – this is mainly achieved by the review of a download of the OTDR; and
 - assessments of a driver operating a train driving simulator (mainly used for out-of-course and emergency scenarios).
- 74 These assessments focus on the skills and knowledge that drivers require to undertake the driving task (eg driving techniques, route and traction knowledge). Apart from these specialist skills, drivers will also draw on a range of *non-technical skills* to carry out the driving task. Non-technical skills include the ability to take in information, focus and take decisions.

- 75 The understanding of the importance of non-technical skills in the railway industry has evolved significantly in recent years. In 2012, RSSB¹⁰ project T869¹¹ provided feedback to the whole industry on a pilot project in which two train operating companies incorporated non-technical skills into their safety management system. In March 2013, RSSB published guidance¹² to duty holders on best practice for competence management. For the first time in the railway industry, this included guidance on integrating non-technical skills into the competence management system.
- 76 Maintaining concentration is a non-technical skill. However, it was not included in Greater Anglia's CMS. At the time of the accident in July 2013, Greater Anglia's CMS focused only on the technical skills needed for train driving. As a result, the driver's propensity to lapses in concentration had not been identified during his competence assessments. Even if non-technical skills had been part of Greater Anglia's CMS, it cannot be guaranteed that the driver's propensity to lapses in concentration would have been identified during his assessments, but it may have increased the likelihood that it was.
- 77 Greater Anglia's assessments of the driver carried out over the last nine years featured many recurring comments made to the driver by the assessors on his technical skills. For example, in this period the driver had been reminded eight times how to perform a *running brake test* and he had been reminded six times how to use the *Driver's Reminder Appliance* (DRA). Again, the repeated nature of these comments could have indicated an unwillingness to comply with the rules, but this was not the perception of his employer. The recurring nature of these comments on technical skills seemingly did not alert his manager to be concerned over his non-technical skills (eg his ability to retain information). There were no means within Greater Anglia's CMS to readily identify the drivers who had warranted repeated and similar comments during assessments.

Investigations of previous incidents

- 78 Between June 2010 and July 2012, the driver had been involved in six incidents for which he was held responsible by Greater Anglia. These were:
- an overrun at Stratford station on 8 June 2010;
 - a door incident at Diss on 9 December 2010;
 - acceptance of a wrong route at Trowse Junction on 10 December 2010;
 - speeding at London Liverpool Street station on 14 March 2011;
 - an AWS intervention at Manningtree station on 9 January 2012; and
 - stopped short and doors released at Stratford station on 13 June 2012.

¹⁰ A not-for-profit company owned and funded by major stakeholders in the railway industry, and which provides support and facilitation for a wide range of cross-industry activities. The company is registered as 'Rail Safety and Standards Board', but trades as 'RSSB'.

¹¹ RSSB project T869 "Non-Technical skills required in train driver role: developing an integrated approach to NTS training and investment".

¹² RS100 issue 1 "Good Practice Guidance on Competence Development" published by RSSB.

- 79 Following any operational incident or accident, Greater Anglia carries out an investigation in accordance with the company's procedure¹³. Where the actions of a member of staff are found to be a factor, Greater Anglia uses the findings of the investigation to create a development plan to address the issues that have been identified.
- 80 Following each incident since 2010 (except the incidents at Diss and Manningtree where mitigating circumstances led the driver manager to decide not to put the driver on a development plan despite the incidents remaining on his records), the driver was placed on a Driver Competence Development (DCD) plan. This process is also part of Greater Anglia's CMS. The timescales and contents of each DCD plan are defined on the basis of the importance of the incident and the previous operational history of the driver.
- 81 The duration of the DCD plans for the driver involved in the accident at Norwich gradually increased from a short plan (three-month duration) after the first incident in June 2010 to a long plan (two-year duration) after the speeding incident at London Liverpool Street in March 2011. The DCD plans overlapped and superseded each other as the driver was involved in a new incident before each of the previous DCD plans had been completed (figure 8). The driver had therefore been on a development plan for most of the three years before the accident at Norwich.

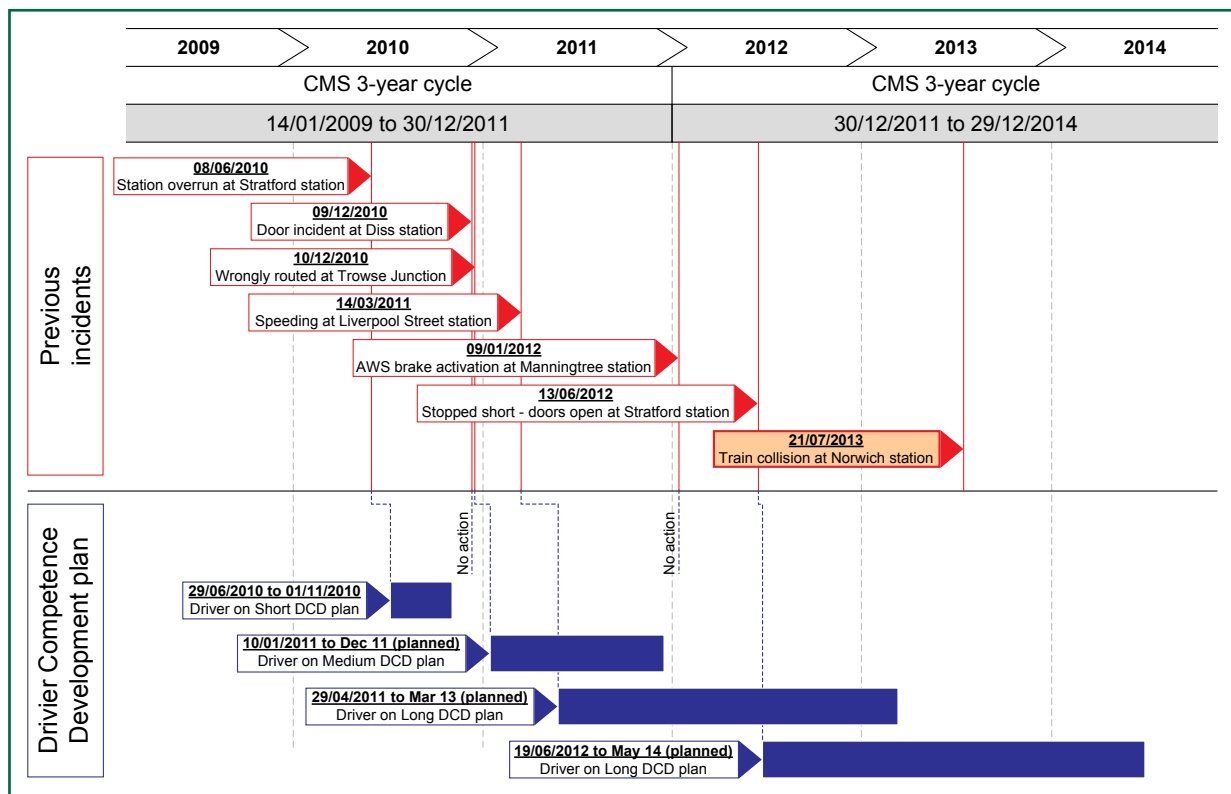


Figure 8: Driver incidents, CMS and DCD plan history

¹³ Safety Manual Section 5 Accident / Incident investigation, issue 3, February 2012 – 5.6 Operational Accidents / Incident Reporting & Investigation.

- 82 The content of a DCD plan depends greatly on the nature of the incident and the findings of the subsequent investigation. According to Greater Anglia's processes, if the investigation identifies underlying behavioural factors (akin to what the industry now classes as non-technical skills), the driver can be sent for further assessments by the Occupational Psychology Centre before the DCD plan is finalised. If the assessment by the Occupational Psychology Centre identifies a shortfall in any non-technical skill, a personalised development plan in the relevant area will be created by the Occupational Psychology Centre and will become part of the DCD plan.
- 83 However, none of the investigations following the six incidents since 2010 raised any concerns regarding the non-technical skills of the driver. As a result he was never sent for an assessment by the Occupational Psychology Centre. Subsequently, the driver's propensity to lapses in concentration was never formally identified.
- 84 Greater Anglia's investigation of the previous incidents did not raise any concerns regarding the non-technical skills of the driver because of the following factors:
- a. the investigator had not been trained to consider that incidents, seemingly different in nature, could be linked by underlying behavioural issues; and
 - b. the driver's operational history was not formally reviewed by a safety panel.
- These are now considered in turn.

The investigator's training in non-technical skills

- 85 In accordance with Greater Anglia's procedure, the incidents that the driver had been involved in since 2010 were investigated by his manager.
- 86 The driver's manager, who had been his manager for the past three years, had identified that the driver had been involved in six incidents during that time (paragraph 89) but he had not recognised this as indicating that he was prone to lapses in concentration. The six incidents that the driver had been involved in since 2010 were all different in nature (station overrun, door incident, wrongly routed, speeding, AWS intervention and stopped short). As a result, the manager undertaking the investigation and preparing the DCD plans thought that he was addressing a different problem each time.
- 87 The driver manager's training records indicated that the last time he was trained on investigation and root cause analysis was in 1999. The content of this training could not be traced, but it is unlikely that the assessment of non-technical skills when considering underlying factors was included in the training (since the railway industry's understanding of the importance of non-technical skills was still in its infancy at the time). The driver manager had never received any specific training on non-technical skills and stated that he knew little about the subject.

Formal reviews of the driver's operational history by a safety panel

- 88 After the speeding incident at London Liverpool Street in March 2011, the driver was placed on a long DCD plan (two-year duration). While he was still on this long plan, the driver was involved in another operational incident (stopped short at Stratford station in June 2012). In accordance with Greater Anglia's internal procedure¹⁴, this should have triggered an internal review known as a Safety Performance Review but it did not. The record of the operational incident review held immediately after the incident does not provide an explanation as to why this decision was made or whether it was even intentional. The operations manager who chaired the operational incident review was unable to recall the reasons for this decision.
- 89 Greater Anglia's internal procedure also indicates that a Safety Performance Review should be convened if there are concerns with a driver's safety performance due to repeated involvement in operational incidents. The driver manager was aware that the driver had been involved in several incidents in recent years. He was concerned about this driver and had shared his concerns with his own manager but they both considered his poor performance not to be exceptional as he was one of several drivers with operational incidents who were subject to multiple DCD plans. They did not initiate a Safety Performance Review because they thought that the driver's performance was being addressed by the DCD plans that the driver was on. According to Greater Anglia, the relatively low level of seriousness of the incidents since 2010¹⁵ might also explain why it did not initiate a Safety Performance Review despite the repeated involvement of the driver in operational incidents.
- 90 There are two types of Safety Performance Reviews defined in Greater Anglia's procedure as stage 1 and stage 2. Holding a Safety Performance Review is the opportunity to review a driver's complete operational history including his competence and the previous incidents he has been involved in. In accordance with Greater Anglia's procedure, the review should try to identify trends in performance to inform its decisions. The output of a stage 1 Safety Performance Review might be to return the driver to duty on a new or revised DCD plan or to refer him to a stage 2 Safety Performance Review where the decision will focus on whether the driver should be removed from driving duties.
- 91 The RAIB considers that holding a stage 1 Safety Performance Review would have been a useful opportunity to carry out an in-depth review of the driver's operational history which might have identified that he was prone to lapses in concentration. This might also have triggered an assessment by the Occupational Psychology Centre and the development of a specific plan to address his shortcomings in non-technical skills (paragraph 83).

¹⁴ Safety Manual Section 8 Competencies, Licences and Permits, issue 6, August 2012 – 8.9 Driver Competence Development DCD.

¹⁵ In accordance with Greater Anglia's procedure, the incidents would have been classified individually as five incidents worthy of a short DCD plan and one incident worthy of a medium DCD plan (speeding incident at London Liverpool Street).

- 92 Greater Anglia operates an internal audit programme which runs on a yearly basis. The aim of the audit is to confirm that Greater Anglia's operational procedures are being followed at each location like Norwich depot. As part of this audit, checks are undertaken on a sample of the drivers' CMS files. The sample includes newly qualified drivers, drivers on DCD plans and other drivers. The audit follows a set of pre-defined questions¹⁶ covering:
- the internal verification process¹⁷;
 - the competence of drivers, instructors and driver managers;
 - the local procedures and administration; and
 - the operation and administration of SLIMS (Safety of the Line Incident Management System).
- 93 The RAIB reviewed the last two internal audit reports for Norwich (2011 and 2012). The driver involved in the accident at Norwich on 21 July 2013 was included in the sample group of drivers for the 2011 internal audit. At the time of the audit, this driver was on a long DCD plan following the speeding incident at London Liverpool Street and had been involved in four incidents since June 2010. The audit did not raise any specific concerns with the way Greater Anglia's procedure was applied to this driver. It confirmed that he was on a DCD plan and that the plan was addressing the nature of the incidents that he had been involved in. None of the pre-defined questions in the audit covered the trigger of a Safety Performance Review due to safety concerns for drivers involved in repeated operational incidents.
- 94 By the time of the second internal audit in 2012, the driver was on his second long DCD plan and had been involved in six incidents since June 2010. The driver was not included in the sample group and hence he does not feature in the 2012 audit report.

Fatigue

95 The driver was tired and this might have affected his performance.

- 96 The RAIB examined the driver's work schedule in the days leading up to the accident. On the evening of the accident (Saturday evening), the driver was on his second consecutive late shift. He had also been rostered to work a late shift on Thursday evening but had taken a day of annual leave. He worked another late shift on Wednesday evening. He had not worked in the five days before that.
- 97 Since it is routinely used by Greater Anglia to develop shift patterns, the RAIB used the Fatigue and Risk Index¹⁸ to assess whether the driver was likely to suffer from fatigue induced by the shift pattern that he was working. Unsurprisingly, considering that the driver had a rest day two days before the accident, the score on the fatigue index is low. This indicates that it is unlikely that the shift pattern would have induced high levels of fatigue.

¹⁶ The questions used during the audits are not defined in Greater Anglia's procedure on audits but appear to have been adopted as a standard template when conducting audits.

¹⁷ Internal verification is an independent review of the CMS file for each driver at the end of the three-year cycle to confirm that it is complete and in accordance with the procedure.

¹⁸ The RAIB has previously highlighted the shortcomings of the Fatigue and Risk Index in its investigation of the incident at Shap in 2011 (see RAIB investigation report 15/2011).

- 98 The driver had been rostered to complete his previous shift on Saturday morning at 02:16 hrs. However, he finished his work early and was allowed to leave; he stated that he went to bed that night at about 01:00 hrs. The driver said he had problems sleeping because of a medical condition (paragraph 105) and the hot and muggy weather that night. He woke up at around 06:30 hrs on Saturday morning, only having had a maximum of 5.5 hours sleep. The driver did not attempt to sleep further again before starting his late shift at 16:45 hrs.
- 99 By the time of the accident at 00:11 hrs, the driver had been awake for nearly 18 hours following a night of poor sleep. The driver, who said he felt fine at the time he started his shift at 16:45 hrs, stated that he felt tired towards the end of his shift and recalled feeling particularly tired during the last outward journey to Great Yarmouth.
- 100 The driver's tiredness might also explain why his train stood for 20 seconds at signal CO531 after the signal had cleared (paragraph 40). This could be further evidence that the driver's alertness level was dropping significantly towards the end of his journey.
- 101 Greater Anglia provides guidance to its drivers on how to manage their lifestyle in its Driver Style Handbook¹⁹. This includes the advice to drivers on how to ensure that they are suitably rested for duty and it provides them with techniques that can be used to reduce drowsiness while driving. It also advises drivers to alert the DTM or driver manager if a driver experiences a level of fatigue or drowsiness that he or she is unable to cope with.
- 102 In January 2012, the Office of Rail Regulation (ORR) published new guidance on the management of rail staff fatigue²⁰ highlighting the importance of having a comprehensive fatigue risk management system as part of the safety management system of an organisation. As well as guidance on work related factors which influence fatigue, this guidance also provides advice on how an organisation can help individuals address factors which influence fatigue (eg lifestyle, age, diet, medical conditions, etc). The guidance invites organisations to operate in a fair culture where employees feel confident that they can report fatigue incidents. The guidance also includes a specific section on the importance of the booking-on arrangements. It encourages organisations to operate a fitness for duty checking system that enables them to identify whether an employee is likely to remain fit for duty until the end of his shift. Greater Anglia's fatigue management procedure²¹ and its Driver Style Handbook both predate the latest guidance from the ORR on fatigue management.
- 103 There is no clear evidence to suggest that this new guidance from the ORR could have affected the outcome of this accident by changing the driver's behaviour, although it cannot be discounted. The driver stated that he felt fine at the time he started his shift and only started to feel tired towards the end of his shift. He stated after the accident that he had experienced higher levels of fatigue in the past. When reflecting on these past instances and on the accident, the driver suggested that his desire to complete his duty might have been the reason why he elected not to raise concerns with the DTM or his manager.

¹⁹ Driver Style Handbook – Issue 2 – April 2011.

²⁰ Managing Rail Staff Fatigue, Management of Health and Safety at Work Regulations 1999, January 2012.

²¹ Safety Manual Section 12 Health Controls, issue 1, May 2011 – 12.2 Management of fatigue.

The effects of medication

104 The prescribed medication that the driver was taking might have affected his performance.

- 105 The driver was diagnosed in January 2004 with a medical condition affecting his lower limbs and as a consequence, the quality of sleep. He was prescribed with medication at the time. This medication is normally prescribed in a starter pack where the strength of the medication taken is increased over a four-week period.
- 106 When used to treat this medical condition, the medication carries the following warning on the National Health Service datasheet that comes with it:
- 'This medicine could affect your ability to drive or operate machinery. Some people who take this medicine may have sudden attacks of sleepiness.'*
- 107 The datasheet also describes the common side effects which include some likely to affect concentration levels (eg confusion) and some likely to affect alertness levels (eg drowsiness, tiredness, excessive or sudden sleepiness, fainting or brief loss of consciousness).
- 108 Between April 2004 and September 2007, the driver had been on three additional courses of treatment using the same medication. Each treatment had to be restarted with a starter pack as the driver had stopped taking the medication of his own accord. The driver, who had reached the full dosage during these treatments, was unable to recall suffering from any side effects at the time.
- 109 On 13 May 2013, the driver went back to his doctor to restart a course of treatment with the same medication. This was in response to the symptoms of the condition flaring up again. The driver stated that he had agreed at the time of the consultation with his doctor that he would take a starter pack over an extended eight-week period as this suited him better. This ramping up period meant that the driver ended up being on full medication approximately one week before the accident at Norwich.
- 110 On 14 May 2013, the driver advised the DTM on duty that day that he had been prescribed the medication. In accordance with Greater Anglia's procedure on medical fitness²² the DTM prepared a medication enquiry form which was sent to BUPA for immediate advice. The enquiry form came back advising the DTM to restrict the driver from carrying out safety critical work (like train driving) until an occupational health assessment had taken place. The driver was removed from driving duties.
- 111 On 24 May 2013, 11 days after being prescribed with a starter pack, the driver was sent to BUPA in London for an assessment by an occupational health physician. On the basis of the consultation, he was assessed as fit for normal duties and returned to driving.
- 112 The driver, at the time of the consultation, was taking a quarter of the final dosage strength. There is conflicting evidence as to whether the physician was made aware that the driver was on this dosage. As the driver increased his dosage, it is possible that he suffered from side effects of his medication. The driver had never reported suffering from any side effects from the medication before the accident, either to the occupational health physician during the consultation or to his employer.

²² Safety Manual Section 12 Health Controls, issue 4, January 2012 – 12.6 Medical Fitness.

Crashworthiness performance

- 113 Based on the mass of the trains involved and the associated speed, the RAIB estimated that the collision energy was low (of the order of 0.25 MJ). The low level of damage to the vehicles (limited to the couplers and gangway) is consistent with this collision energy and reflects the low severity of the collision.
- 114 On the basis of the reduction in speed measured by the OTDR during the collision, the RAIB has calculated that the *crash pulse* was of the order of 0.5 to 1g. Modern railway vehicles are designed to withstand pulses of the order of 3 to 5g, but 0.5 to 1g is sufficient to throw passengers who are not prepared for the impact against the interior of the train and injure them.
- 115 Twenty nine of the thirty five passengers provided information about their injuries and the treatment of these injuries:
- eight passengers were sent to hospital on the night by the paramedics who attended the accident;
 - an additional three passengers attended hospital the following day (these had been seen by the paramedics on the night but were not referred to hospital at the time);
 - a further ten people were treated at the scene for minor cuts and bruises; and
 - eight people reported no injuries.
- 116 The types of injuries sustained were bruising to the ribs, stiff neck and head injuries. Other than one unconfirmed case of cracked ribs, there was no serious injury²³. These injuries are consistent with passengers being thrown against the train interior during a low energy impact considering that the passengers were getting ready to detrain; several of them were standing making them more likely to be injured.

²³ The Railway (Accident Investigation and Reporting) Regulations 2005 define a serious injury. Among other injuries, this includes a fracture, an amputation, a dislocation, a loss of sight (temporary or permanent), burns, an injury requiring admittance to hospital for more than 24 hours, a loss of consciousness, etc.

Observations²⁴

Risk assessment for permissive moves at specific locations

- 117 The distance from signal CO531 to the end of platform 6 was 712 metres. This was in excess of the 400 metres requirement in the Railway Group Standard GK/RT0044²⁵ issue 1 for signals controlling permissive moves into platforms²⁶. This standard was applicable at the time of the accident but only applied to new or upgraded installations. The requirement was in place to reduce the risk of a driver forgetting that he is undertaking a permissive move and approaching the platform at excessive speed.
- 118 GK/RT0044 issue 1 also required Network Rail to undertake a risk assessment at each specific location where permissive working is authorised. The risks should be re-assessed upon changes such as timetable alterations, change of type/length of trains, etc. The RAIB has found no evidence that a risk assessment was carried out for Norwich station despite the fact that Greater Anglia is now operating more and longer trains at the station.
- 119 Although the RAIB is concerned that the operations at Norwich station had not been subject to risk assessment, it was not causal to this accident because the driver of train 2C45 was fully aware that he was undertaking a permissive move into a platform already occupied by four vehicles.

Previous occurrences of a similar character

- 120 With the assistance of RSSB, the RAIB has collated a list of 115 train-to-train collisions during permissive working which occurred between 1998 and 2013. Only eight of these incidents were attributed to factors which have been identified as part of this investigation. Appendix C shows these incidents and their associated factors. None of these incidents were investigated by the RAIB.

²⁴ An element discovered as part of the investigation that did not have a direct or indirect effect on the outcome of the accident but does deserve scrutiny.

²⁵ GK/RT0044 issue 1 "Controls for signalling a train onto an occupied line" was not retrospective when it was introduced in February 2000. It was re-issued in June 2013 with an implementation date of 7 September 2013. In the revised standard, the distance requirement between the stop signal controlling the entry to the platform and the start of the platform being less than 400 metres has been replaced with a requirement to determine the acceptability of the distance on a case-by-case basis using a risk assessment approach.

²⁶ According to the *control tables*, signal CO531 is the calling-on signal for permissive moves into Norwich station. However, the platform allocation is repeated on a route indicator fitted to shunting ground position light signal 1787 located 265 metres away from platform 6. This ground position light signal clears automatically when signal CO531 clears.

Summary of conclusions

Immediate cause

121 The driver did not stop his train in the available distance (**paragraph 51**).

Causal factors

122 This happened because either:

- a. the driver, due to a lapse in concentration, did not notice that he had not applied the brakes (**paragraph 56a**); or
- b. the driver had a microsleep (**paragraph 56b**).

123 It is possible that the driver had a lapse in concentration. The following factors may have promoted this:

- a. the driver was possibly distracted by:
 - i. the noise made by the passengers immediately behind his cab (**paragraph 62**);
 - ii. thinking of calling the conductor to tell him about platform allocation (**paragraph 64**); and
 - iii. his mind moving onto the next tasks (**paragraph 66**).
- b. the driver was prone to lapses in concentration, and this was not addressed or identified by Greater Anglia's CMS, possibly because:
 - i. the CMS did not include non-technical skills (**paragraph 76**, **Recommendation 1**); and
 - ii. the CMS did not flag up repeated comments on technical skills or provide guidance to the driver manager on what actions to take (**paragraph 77**, **Recommendation 1**).
- c. the driver was prone to lapses in concentration, and Greater Anglia did not address or identify this during the investigations of the driver's previous incidents, possibly because:
 - i. the investigator had not been trained to consider that incidents, seemingly different in nature, could be linked by underlying behavioural issues (**paragraph 87**, **Recommendation 2**);
 - ii. there was no formal review of the driver's operational history by a safety panel (**paragraph 91**, **Recommendation 1**); and
 - iii. the missed opportunities were not identified by internal audits (**paragraph 93**, **Recommendation 3**).
- d. the driver was tired and this might have affected his performance (**paragraph 95**); and
- e. the prescribed medication that the driver was taking might have affected his performance (**paragraph 104**, **Learning point 2**).

- 124 It is possible that the driver had a microsleep. The following factors may have promoted this:
- a. the driver was tired (**paragraph 95**); and
 - b. the prescribed medication that the driver was taking might have affected his alertness (**paragraph 104, Learning point 2**).

Observations

- 125 The RAIB observes that:
- a. the risks associated with permissive moves at Norwich station had not been assessed in accordance with the requirement current at the time of the accident (paragraph 118, **Recommendation 5**);
 - b. the line remained open to train movements for 24 minutes after the accident because it had not been reported to the signallers in Colchester (paragraph 48, **Learning point 1**); and
 - c. Greater Anglia's fatigue management system predates the latest guidelines from the ORR on managing the fatigue of rail staff (paragraph 102, **Recommendation 4**).

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

- 126 Greater Anglia has advised the RAIB that the driver involved in the accident at Norwich has been taken to a stage 2 Safety Performance Review where a decision was made to permanently restrict him from train driving.
- 127 On 19 August 2013, Greater Anglia re-issued its briefing note to all station staff (supervisors and DTM) on the length of each platform at Norwich station and the maximum number of vehicles that can be accommodated. Station supervisors and DTMs were asked to sign a form to confirm that they had read and understood the briefing note. The RAIB has been informed that since 19 August 2013 there have been further reported instances when six vehicles have been accommodated in platform 6. The RAIB observes that the various briefings notes have not been entirely adhered to and invites Great Anglia to clearly communicate the output of recommendation 5 of this report to all relevant employees.
- 128 In November 2013, Greater Anglia started a 12-week programme of training driver managers and driver instructors on non-technical skills. Greater Anglia stated that it plans to roll out this training to its drivers taking account of the experiences of other train operating companies in relation to the importance of using suitably qualified individuals to deliver the training (Recommendation 1).
- 129 Greater Anglia stated that it has reviewed its CMS and that it now incorporates assessments of its drivers' non-technical skills. Greater Anglia has not yet issued its updated CMS (Recommendation 1).
- 130 Greater Anglia stated that it has reviewed the ORR's guidance on fatigue management. Following this review, Greater Anglia stated that it is in the process of updating the fatigue management procedures within its safety management system (Recommendation 4).
- 131 Network Rail has added the following clarification to Colchester signal box's *special instructions*:

“Before you allow a train carrying passengers to approach an occupied platform at Norwich station you must confirm with the Person In Charge of the platform that there is enough room for the complete train to be accommodated in the platform. If you are unable to get such confirmation, you may use the platform length table displayed on the panel. However when all platform track circuits are occupied and you are not sure if the train can be accommodated you must not signal the train towards that platform.”

This is in line with the requirements in GE/RT8000/TS2²⁷ issue 3 relating to track circuit block regulations which state that if in doubt, signallers must get confirmation that there is room on the platform before clearing the calling-on signal. It is unclear whether the revised instruction would lead to a different outcome if the same circumstances were to occur again. Therefore the RAIB invites Network Rail to work with Greater Anglia on addressing recommendation 5.

²⁷ GE/RT8000 is known as the Rule Book. It is issued by RSSB.

Learning points²⁸

132 The RAIB has identified two learning points for the railway industry:

- 1 in accordance with GE/RT8000/G1 issue 5 relating to general safety responsibilities, it is important for railway employees to advise the signaller of all accidents and incidents even when there appears to be no immediate risk to the safety of the line (paragraph 125b); and
- 2 it is important to provide a full and accurate account of medical conditions, medical history and prescribed medication during consultation with an occupational health professional (paragraphs 123e and 124b).

²⁸ 'Learning points' are intended to disseminate safety learning that is not covered by a recommendation. They are included in a report when the RAIB wishes to reinforce the importance of compliance with existing safety arrangements (where the RAIB has not identified management issues that justify a recommendation) and the consequences of failing to do so. They also record good practice and actions already taken by industry bodies that may have a wider application.

Recommendations

133 The RAIB has made the following recommendations²⁹:

- 1 *The purpose of this recommendation is to improve the safety performance of Greater Anglia's drivers by developing their non-technical skills.*

Greater Anglia should complete the update of its Competence Management System to include consideration of non-technical skills (paragraph 123b.i). The updated Competence Management System should include:

- the development and delivery of training on non-technical skills to Greater Anglia's drivers, driver managers and driver instructors by suitably qualified trainers (paragraph 128);
- the tools necessary to support its application, including those required to:
 - identify substandard non-technical skills;
 - alert a manager to a driver who is found not to be meeting the competence requirements on repeated occasions; and
 - guide managers on the actions to be taken (paragraphs 123b.ii);
- a briefing of those who manage the implementation of the Competence Management System so that procedures are complied with (eg managers know when to refer drivers to safety review panel) (paragraph 123c.ii); and
- monitoring of the implementation of the updated Competence Management System to confirm that it delivers the expected improvement in the safety performance of its drivers (paragraph 129).

continued

²⁹ 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 Regulation to enable it to carry out its duties under regulation 12(2) to:

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

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

- 2 *The purpose of this recommendation is to improve Greater Anglia's investigations of operational incidents by ensuring that they always consider non-technical skills.*

Greater Anglia should:

- update its accident and incident investigation procedures to include consideration of non-technical skills in the causation of accidents; and
- train all its investigators to assess the role of non-technical skills in the causation of accidents (paragraph 123c.i).

- 3 *The purpose of this recommendation is to ensure that the implementation of Greater Anglia's internal auditing processes identify non-compliances with its procedures.*

Greater Anglia should review and make any necessary changes to the application of the audit procedure, including any locally pre-defined question sets, to ensure that it allows for consideration of compliance with all safety related elements of the operational procedures (paragraph 123c.iii).

- 4 *The purpose of this recommendation is to improve the safety performance of Greater Anglia's drivers by reducing fatigue when driving.*

Greater Anglia should complete the review of its fatigue risk management system to identify and implement improvements. Greater Anglia should continue to refer to the Office of Rail Regulation's guidance, dated January 2012 on 'Managing rail staff fatigue' as part of the review (paragraph 125c).

- 5 *The purpose of this recommendation is for Network Rail to ensure that the risk associated with permissive moves at Norwich station is acceptably low.*

Network Rail should assess the risk associated with permissive working at Norwich station. Greater Anglia should support Network Rail by providing an understanding of the current constraints and processes for short-term alterations to platform allocations. Network Rail should take these into account when assessing the risk and determining any necessary risk control measures.

Network Rail and Greater Anglia should implement any required risk control measures and brief their staff accordingly (paragraph 125a).

Appendices

Appendix A – Glossary of abbreviations and acronyms

AWS	Automatic Warning System
CMS	Competence Management System
DCD	Driver Competence Development
DMU	Diesel Multiple Unit
DRA	Driver's Reminder Appliance
DTM	Duty Traincrew Manager
OTDR	On-Train Data Recorder
ORR	Office of Rail Regulation
RSSB	Railway Safety and Standards Board
TPWS	Train Protection and Warning System

Appendix B – Glossary of terms

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

2-aspect colour light signal	At this location, a railway signal which uses two coloured lights to indicate whether the driver has to stop or needs to be prepared to stop. The lights may show: <ul style="list-style-type: none"> ● Yellow – caution, prepare to stop; and ● Red – stop.
3-aspect colour light signal	Railway signal which uses three coloured lights to indicate whether the driver has to stop, needs to be prepared to stop or can proceed without restriction. The lights may show: <ul style="list-style-type: none"> ● Green – proceed, the next signal may be displaying green or yellow; ● Yellow – caution, the next signal may be displaying a stop aspect; and ● Red – stop.
Adhesion conditions	Describes the friction level at the top of the rail. A high friction is needed at this location to enable the wheels of a train to transfer the traction and braking loads without sliding.
AWS – Automatic Warning System	A fail-safe arrangement of magnets fitted to the track that conveys information about the aspect of the associated signal to the train driver.*
Buffer stop	A device used to stop the progress of rail vehicles at the end of a line.*
Chain(s)	A unit of length, being 66 feet or 22 yards (approximately 20.117 metres). There are 80 chains in one standard mile.*
Calling-on	A signalled route by which the signaller can permit a train to enter an occupied signal section.*
Clear	To clear a signal is to change its aspect from its most restrictive aspect to a less restrictive aspect.*
Coast	Allowing the train to continue under its own momentum after removing power.*
Control tables	A specification that details the signalling controls associated with every signalling function in an interlocking.*
Crash pulse	The level of deceleration that a vehicle involved in an accident is subjected to.
Development plan	A programme of additional monitoring and development activities that a driver would be placed on following an incident.

Diesel Multiple Unit	A train consisting of one or more vehicles, semi-permanently coupled together, with a driving cab at each end. Some or all vehicles may be equipped with axles powered by one or more diesel engines.
Driver's reminder appliance (DRA)	A device in the driving cab that allows the driver to set a reminder when brought to a stand at a signal showing a stop aspect.*
Driver safety device	A system that halts the train if the driver ceases to respond. Previously commonly known as a Dead Man's Handle, most examples are pedals that must be pressed continuously to prevent the brakes from applying automatically.
Interlocking	Controls fitted between points and signals that prevent the signaller from setting conflicting routes.*
Main signal	A colour light or mechanical signal that controls train movement authority on a running line and is not a shunting signal.*
Microsleep	An episode of sleep which may last for a fraction of a second or up to thirty seconds.
Non-technical skills	Generic skills that underpin and enhance technical tasks, improving safety by helping people to anticipate, identify and mitigate against errors (eg situational awareness, maintaining concentration, decision making, etc).
On-Train Data Recorder	A data recorder fitted to a train that records information on the status of train equipment, including speed and brake applications.
Permissive working	A train movement made into a signal section already occupied by another train.*
Position light signal	An additional signal controlling permissive moves.*
Possession	A period of time during which one or more lines are blocked to trains to permit work to be safely carried out.*
Ramp	The inclined area at the end of a platform allowing someone on track level to gain access to the platform. Access to the track by the general public is generally forbidden beyond the top of the ramp.
Route	The signalled path from one signal to the next signal.*
Route indicator	A signal indicator that displays letters and numbers to describe the route ahead to the driver.*
Running brake test	A brake test performed by the driver whilst the train is in motion.*
Sectional Appendix	The publication produced by each Network Rail route containing layout and location details of the rail network.

Shunt	The act of moving vehicles within a defined locality for the purpose of splitting or assembling trains or for positioning.*
Signal section	In a track circuit block area, a portion of line between two consecutive main signals.* A signal section can comprise more than one track circuit.
Special instructions	A set of instructions specific to a signal box explaining how to operate the signal box. These instructions complement the Rule Book.
Stabled	The temporary storage (parking) of trains whilst they are not in use, typically overnight, or until needed next. The vehicles are placed out of service, made inaccessible to the public and usually have all systems on them switched off.*
Step 1	The first position on the driver's brake controller representing the lowest retardation rate that can be achieved by the braking system. There are typically three steps on the brake controller as well as emergency brake.
Track circuit	An electrical or electronic device using the rails in an electric circuit that detects the absence of a train on a defined length of track.
Track circuit block	A signalling system where the line beyond each signal is automatically proved clear to the next signal, and sometimes beyond it, using track circuits. Track circuit block can also be implemented using any automatic train absence detector system.*
TPWS – Train Protection and Warning System	An automatic system fitted to the track and train which is capable of both preventing a train from passing a stop signal or from exceeding a defined speed limit on the approach to a signal to ensure that the train can safely stop at that signal.
Up	In the direction towards London.
Usable length	The length of that part of the platform that can be used by passengers for egress from and access to trains, measured along the platform edge.
Working Timetable	The version of the timetable for use by drivers and signallers, giving full details of all trains.*

Appendix C – Similar incidents

Date	Location	Trains involved	Speed of collision	No of injuries	Listed causal factors (extracted from SMIS ³⁰)
10/05/2012	Euston	Unknown	1 mph	0	Driver misjudged braking distance Driver being managed under Special Monitoring process.
05/06/2011	Euston	Class 378 Class 378	4 mph	1	Lapse in concentration or microsleep due to lack of sleep. Low blood sugar levels combined with 'journey's end'.
02/09/2007	Manchester Airport	Class 185 Class 185	Unknown	0	Complete loss of situational awareness due to microsleep. Poor sleep pattern combined with emotional trauma (death of relative).
15/03/2006	Blackpool North	Class 142 Class 150	5 mph	6	Lapse of attention brought on by a microsleep. Drivers lack of quality sleep and general state of fatigue. Driver's personal childcare issues and only totalling 5 hours broken sleep the night prior to incident. The driver failing to appreciate the impact his lifestyle could have in relation to his state of fatigue.
27/01/2006	Gospel Oak	Class 150 Class 150	4 mph	0	Driver lost concentration and did not take any action for 7 seconds before emergency brakes were applied. Driver screened for sleeping disorder.
29/12/2001	Glasgow Central High Level	Class 334 Class 318	Unknown	0	Driver concentration level was low as preoccupied with his wife's health. Additionally distracted by passengers on the platform.
27/11/2000	Glasgow Central High Level	Class 156 Class 156	Unknown	0	Failure to maintain high level of concentration. Policy for additional annual assessment of medium risk drivers is not sufficiently robust to identify the development of irregular train handling practices.
10/03/2000	Waterloo (Main)	Class 455 Class 455	15 mph	35	Driver failed to control the speed of his train. Loss of concentration is a common feature in all the Safety of the Line incidents for which the Driver has been held responsible. It has not been possible to identify any specific reason for the Driver's loss of concentration on this occasion, although issues relating to his role as a Staff Representative have been suggested as a possible factor. Had the procedures contained in South West Train's Operational Standards Manual been properly carried out, the underlying issues might have become evident.

³⁰ SMIS: Safety Management Information System administered by RSSB

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