RAIB

Rail Accident Investigation Branch

Annual Report 2016

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This report is published 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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Cover image credits:

Top: image taken from RAIB report 05/2016: Derailment at Godmersham.

Second from top: image taken from RAIB report 09/2016: Runaway and collision at Bryn station.

Third from top: image taken from RAIB report 11/2016: Derailment of a freight train near Langworth (image courtesy of Network Rail).

Fourth from top: image taken from RAIB report 04/2017: Collision between a train and a tractor at Hockham Road user worked crossing.

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Preface

This is the Rail Accident Investigation Branch's (RAIB) Annual Report for the calendar year 2016. It is produced in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005 (SI1992) and also meets the requirement of the European Railway Safety Directive (2004/49/EC).

This legislation can be referred to on RAIB's website at www.gov.uk/raib.

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Any term explained in Appendix D is shown in *italics* the first time it appears in the report.

Chief Inspector's Foreword

Our Purpose:

To independently investigate accidents to improve railway safety, and inform the industry and the public.

I am pleased to introduce RAIB's Annual Report for 2016. Since taking on the role as Chief Inspector in December 2015 my first full year has been one of challenges and rewards.

It is sadly the case that during 2016 we have witnessed a multiple fatality accident at Sandilands Junction in Croydon when a tram derailed on the approach to the junction, and turned onto its side. Seven people died and 51 people were taken to hospital, 16 of them suffering serious injuries. I would like to express my sympathy to all those who have been bereaved or injured and to restate my determination that the circumstances of this event will be thoroughly investigated, and recommendations made for the improvement of safety.

The Sandilands Junction accident and the subsequent investigation has been the subject of significant media and public interest. I would like to thank all those who have come forward with information regarding the accident.

Last year I made reference to events where only luck prevented a serious train accident. During 2016 we published four reports and started two new investigations that fall into this category (see the complete list in Appendix A). The two investigations started in 2016 are:

- A bridge partially collapsed onto the railway near Barrow-upon-Soar station on 1 August 2016 (since published (10/2017)). A passenger train had passed less than ten minutes earlier and a freight train was stopped on the approach to the bridge.
- Just outside Watford Tunnel on 16 September 2016 a southbound passenger train collided with a landslip and derailed at 70 mph (112 km/h). The train ran derailed into the tunnel, partly blocking the adjacent line. About ten seconds later, it was struck a glancing blow by a northbound passenger train which, fortunately, did not derail.

Both of the above accidents could have led to multiple fatalities if the circumstances had been slightly different. They are therefore a useful reminder to us all that safety can never be assumed – it is in fact a continuous process of improvement driven by assessing risk and learning from past experience.

Good accident investigation is a powerful tool for revealing the underlying reasons for accidents. An important area explored during an investigation is the extent to which hazards and risk were properly understood by organisations before the accident occurred. This is important because many accidents could have been avoided if someone had asked the 'what if' question before the event.

Chief Inspector's Foreword

We should always be striving to eliminate the possibility of serious accidents before they occur by addressing the underlying causes revealed in less serious accidents and 'near miss' incidents; and looking at why some types of accidents recur. This is one of the reasons why each year we review the types of accidents we have seen before, and look at recurrent themes. This year (as further explained in chapter 4) we are looking at eight recurrent themes that are of particular concern to us.

The role of our investigations is to reveal how well safety measures are performing in the 'real world' and to identify gaps and areas of weakness in risk control measures.

For example, the report into the structural failure at Lamington Viaduct (22/2016) revealed a gap in how one Network Rail route was managing the risk of *scour* affecting bridges over water. With regard to Platform Train Interface (PTI) accidents we identified a gap in the industry's understanding of certain door control systems and how passengers react to closing doors (West Wickham (03/2016); Hayes & Harlington (12/2016)).

We can never eradicate accidents completely. The greatest challenge for me and my team is to continue to do everything we can to improve railway safety; to ask the uncomfortable 'what if' and 'why' questions and to keep digging until the underlying reasons for an accident are revealed.

However, it is rewarding that as a result of our investigations, we have made a number of wide ranging recommendations this year which have the potential to make a real difference in contributing to industry's understanding of risk.

For example, in the Lamington Viaduct report we have recommended that Network Rail improve the management of scour risk by increasing the quality of information available to staff responsible for making decisions about the safety of structures.

In our investigation reports involving PTI accidents, we have highlighted the need to ensure that those staff responsible for dispatching trains (drivers, guards or platform staff) understand that it is sometimes possible for trains to move with a passenger's hand (or other object) trapped in the door. This emphasises the importance of the final safety check. We have also recommended a review of the design of certain door control systems and research into the factors that influence the behaviour of passengers in the vicinity of train doors. (See chapter 3 for more details about our recommendations.)

It is gratifying that the vast majority of our recommendations have led to substantive action to reduce risk. I believe that this reflects both the quality of our recommendations and the positive safety culture that is prevalent right across the railway industry. It also indicates that the Office of Rail and Road (ORR), the primary safety authority in Great Britain, has been proactive in tracking the actions taken in response to our recommendations, and is ensuring that appropriate action is taken.

We have increased the range of media we use to provide more opportunities to communicate key safety messages. In 2016 we launched our new format short report, the safety digest. This report is issued on our web site when RAIB has decided not to carry out a full investigation but there is, nevertheless, valuable safety learning which we would like to communicate.

Chief Inspector's Foreword

I would like to express my thanks to my team for their commitment to the Branch's work. I am proud of the standard of our investigations, and at the same time, I am pleased that this year we have been able to further reduce the average time between an accident occurring and the report being published.

My thanks also go to all those organisations and individuals who have worked with us during the year. Our working relationships with our key stakeholders are as strong as ever. In particular, our dealings with ORR, and the British Transport Police (BTP), have been positive during the ongoing Sandilands investigation. These strong relationships are based on a mutual understanding of our respective roles and technical capabilities. This has meant that we have been able to find ways to work closely with both ORR and BTP without risk to our independence.

It is also good that RAIB has become more prominent in industry safety forums and I would like to thank the large number of organisations that have made this possible, including RSSB, Network Rail and the Rail Delivery Group. My team and I are always happy to explain our findings and recommendations, and to debate key issues arising from our investigations. Our independence is important to us, but it is also essential that we are never seen as remote from the railway industry.

During 2017 our focus will be directed towards the Sandilands Junction investigation and we will do everything we can to ensure that all safety lessons are brought to light, and recommendations made for the improvement of safety on UK tramways.

Simon French

Chief Inspector of Rail Accidents

22 June 2017

Further information about us, our role and our legal basis can be found on our website: www.gov.uk/raib.

What we do

The Rail Accident Investigation Branch (RAIB) independently investigates accidents, to improve railway safety, and inform the industry and the public. We are not a prosecuting body and do not apportion blame or liability.

Who we are

We became operational in October 2005 to investigate accidents and incidents on the UK's mainline railways, metros, tramways and many heritage railways.

Our organisation consists of full time rail and investigation specialists and support staff. We are based in two operational centres at Derby and Farnborough. Having two centres means we can respond more quickly to accidents in any part of the UK.

Our responsibilities

Our responsibilities include:

- investigating the causes of railway accidents and incidents where we believe our investigation will bring safety learning to the industry;
- identifying factors which may lead to a similar accident happening again or make an accident worse;
- making recommendations, where appropriate, to improve railway safety; and
- publishing the results of our investigations.

Our legal basis

The roles and duties of RAIB are set out in the Railways and Transport Safety Act 2003 (the Act) and its associated implementing regulations, the Railways (Accident Investigation and Reporting) Regulations 2005 (the Regulations). Together, the Act and the Regulations also implement the requirements of the European Railway Directive (2004/49/EC) (the Directive), which came into force in 2004. The Directive creates a common regulatory framework for safety across Europe and requires each member state to establish national safety authorities (eg ORR), and an independent body to investigate rail accidents (RAIB).

Our Priorities

In 2016 - 2017 our priorities are to:

- continue to develop and improve the ways we communicate safety learning to the railway industry, employees, the public and other stakeholders;
- seek opportunities to work closer with key stakeholders within industry to disseminate good practice accident investigation techniques;
- seek to enhance our effectiveness by closer collaboration with the other Accident Investigation Branches (AIBs);

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- review and revise our memorandums of understanding with ORR and national police forces;
- develop a memorandum of understanding with the Chief Coroner concerning the relationship between the three (Rail, Marine and Air) AIBs and coroners in England and Wales; and
- continue to strengthen our working relationships with other accident investigation organisations in the UK, Europe and elsewhere in the world to ensure we maintain and share best practice in all areas of our work.

During the period from 1 January to 31 December 2016, RAIB received 367 notifications of railway accidents and incidents from the industry. These resulted in 52 preliminary examinations.

As a result of the analysis of the information gathered, we started 19 full investigations, one class investigation and 16 safety digests.

Investigation reports published in 2016

RAIB completed and published 24 full investigation reports in 2016. While our aim is to publish reports and safety digests within 12 months, the length of individual investigations can sometimes extend beyond this because of the complexity and scale of the investigation, late notification by the industry or the need to address complex issues raised during formal consultation. In 2016 the average time taken to publish reports was 10.7 months[1] from the date of occurrence (as compared to 11.3 months in 2015). The shortest time taken was 8.4 months and the longest 17.4 months.

Following the accident at Sandilands Junction in Croydon on 9 November 2016 when seven people died, we published an interim report outlining events and the immediate cause on 16 November 2016. (We also published a second interim report on 20 February 2017 and plan to publish our final report later in 2017.)

We also issued ten safety digests and two urgent safety advice notices. (See page 18 for more information on safety digests and page 20 for more information on urgent safety advice.)

Table 1 gives details of our output in 2016.

Table 1 – RAIB outputs in 2016

Preliminary examinations completed	52
Investigations started	19
Class investigations started	1
Safety digests started	16
Full investigation reports published	24
Interim report published	1
Safety digests published	10
Urgent safety advice issued	2

[1] Excluding class investigations.

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Joint investigation: Bureau d'Enquêtes sur les Accidents de Transport Terrestre (BEA-TT) report published on 5 May 2016

Fire on board a freight shuttle in the Channel Tunnel, 17 January 2015.

RAIB worked with BEA-TT, the body responsible for the investigation of railway accidents in France, to jointly investigate this incident. Since the train stopped in the French section of the tunnel, the investigation was led by BEA-TT. RAIB's scope was primarily to determine the cause of the fire and our provisional findings were published on our website on 9 November 2015. BEA-TT's part of the investigation has been completed and the joint final report was published on 5 May 2016. The joint report included important findings concerning Eurotunnel's processes for safety validation of changes to design of its assets.

Six recommendations were made; addressed to the Intergovernmental Commission[2].

Three recommendations were made to address causal factors relating to:

- processes and systems (such as pagodas or other physical barriers between the vehicles and the overhead power line) for detecting aerials and small objects and protecting the vehicles;
- fire detection systems; and
- Railway Control Centre procedures in the event of fire and simultaneous power trips.

Examination of the underlying causes also led to three recommendations to improve Eurotunnel's change management processes.

Northern Ireland

RAIB continues to work closely with Northern Ireland Railways and the national safety authority for Northern Ireland, the Department for Infrastructure (DfI).

In 2016 a report was published regarding an accident at Knockmore Junction (20/2016) in which a passenger train collided with an excavator bucket. There were no significant injuries but the leading vehicle was badly damaged and the track required repair. RAIB made two recommendations and three learning points.

Following the accident at Balnamore in 2013 (in which a car driver was forced to take action to avoid colliding with an engineering train that was traversing the *automatic half barrier level crossing*), RAIB published a report (10/2014) making three recommendations and three learning points. The safety authority responded in 2016.

[2] The binational Intergovernmental Commission is the national safety authority for the entire Channel Tunnel system.

Classification of accidents and incidents that have to be notified to the European Agency for Railways (ERA) 2012 - 2016

RAIB has a duty to investigate and to report to ERA all serious railway accidents, as defined by the Directive, and where necessary, any other similar accident with an obvious impact on railway safety regulation or the management of safety occurring on the railways in the UK.

ERA has published guidance to promote consistent categorisation of investigations in accordance with the Directive. RAIB uses this to classify its investigations according to Articles 19(1) and 19(2).

- Article 19(1) - a serious accident where the investigation is mandatory.
- Article 19(2) - an accident or incident, which under slightly different conditions might have led to a serious accident, ie a near miss of a serious accident – see key below a, b, c, or d:
  a. The seriousness of the accident or incident.
  b. It forms part of a series of accidents or incidents relevant to the system as a whole.
  c. Its impact on railway safety on a community level.
  d. Requests from *infrastructure managers*, the safety authority or the Member State.

The following table (Table 2) shows the breakdown of accidents and incidents that RAIB has investigated between 2012 and 2016 as classified according to Articles 19(1) and 19(2). The figures have been collated according to the date of occurrence and not publication of the report.

Table 2 – Investigations by category sorted by Articles 19(1) and 19(2)[3]

Basis for Investigations by the European Railway Safety Directive category	2012	2013	2014	2015	2016	TOTAL
Article 19(1)	4	5	2	1	5	17
Article 19(2)	20	21	17	20	14	92
Total	**24**	**26**	**19**	**21**	**19**	**109**

Table 3 provides details of the investigations completed in 2016 and the legal basis for the investigation. The references 19(1) and 19(2) relate to the relevant articles in the Directive.

Table 4 provides details of full investigations commenced in 2016 and the legal basis for the investigation.

[3] Figures do not include class investigations (which address more general safety issues).

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Table 3 – Full investigations completed in 2016

Report Number	Event date	Publication date	Title of investigation (location)	Occurrence type	Basis for investigation	
					19(1)	19(2)
01/2016	23/03/2015	11/01/2016	Derailment at Washwood Heath West Junction, Birmingham.	Freight train derailment		a
02/2016	22/02/2015	20/01/2016	Collision between a train and a fallen bridge parapet at Froxfield, Wiltshire.	Collision with an obstacle		a
03/2016	10/04/2015	29/02/2016	Passenger trapped and dragged under a train at West Wickham.	Train movement accident involving a passenger		a
04/2016	12/03/2015	09/03/2016	Passenger trapped in train doors and dragged at Clapham South station.	Train movement accident involving a passenger		a
05/2016	26/07/2015	06/04/2016	Derailment at Godmersham, Kent.	Collision with an obstacle		a
06/2016	12/05/2015	12/04/2016	Tram collision with pedestrian near Market Street tram stop, Manchester.	Train movement accident involving a pedestrian		a
07/2016	14/05/2015	28/04/2016	Collision between a train and a tractor at Oakwood Farm *User Worked Crossing*, Knaresborough.	Level crossing injury		a
08/2016	07/03/2015	05/05/2016	Signal passed at danger on approach to Wootton Bassett Junction, Wiltshire.	SPAD		a
09/2016	27/11/2014	09/05/2016	Runaway and collision at Bryn station, Wigan.	Runaway incident		a
10/2016	03/06/2015	01/06/2016	Freight train derailment at Angerstein Junction.	Freight train derailment		a
11/2016	30/06/2015	27/06/2016	Derailment of a freight train near Langworth, Lincolnshire.	Freight train derailment		a
12/2016	25/07/2015	30/06/2016	Passenger trapped and dragged by a train at Hayes & Harlington station.	Train movement accident involving a passenger		a
13/2016	01/08/2015	13/07/2016	Freight train collision near Logan, East Ayrshire.	Collision with other train	X	
14/2016	11/09/2015	01/08/2016	Overspeed at Fletton Junction, Peterborough.	Unauthorised train movement		a
15/2016	17/09/2015	03/08/2016	Collision with buffer stops at King's Cross.	Collision with an obstacle		a
16/2016	07/11/2015	04/08/2016	Derailment at Knaresborough.	Passenger train derailment		a
17/2016	22/10/2015	09/08/2016	Collision between two trams at Shalesmoor, Sheffield.	Collision with other train		a
18/2016	28/03/2015 & **03/11/2015**	29/09/2016	Two signal passed at danger incidents, at Reading Westbury Line Junction and Ruscombe Junction.	SPAD		a
19/2016	05/01/2016	06/10/2016	Overspeed at Queen's Park, London.	Unauthorised train movement		a
20/2016	04/02/2016	17/10/2016	Collision at Knockmore Junction, Northern Ireland.	Collision with an obstacle		a
21/2016	14/02/2016	27/10/2016	Collision between a train and a piece of equipment at Barrow-upon-Soar, Leicestershire.	Collision with an obstacle		a
22/2016	31/12/2015	14/11/2016	Structural failure caused by scour at Lamington viaduct, South Lanarkshire.	Infrastructure failure		a
23/2016	23/02/2016	21/11/2016	Fatal accident at Grimston Lane *footpath crossing*, Suffolk.	Level crossing fatality	X	
24/2016	02/03/2016	05/12/2016	Derailment of a passenger train at Ealing Broadway.	Passenger train derailment		a

Table 4 – Full investigations commenced in 2016

Event date	Title of the investigation (location)	Occurrence type	Basis for investigation	
			19(1)	19(2)
05/01/2016	Overspeed at Queen's Park, London.	Unauthorised train movement		a
02/02/2016	Track worker safety outside *possessions*.	Class investigation		
04/02/2016	Collision at Knockmore Junction, Northern Ireland.	Collision with an obstacle		a
14/02/2016	Collision between a train and a piece of equipment at Barrow-upon-Soar, Leicestershire.	Collision with an obstacle		a
23/02/2016	Fatal accident at Grimston Lane footpath crossing, Suffolk.	Level crossing fatality	X	
02/03/2016	Derailment of a passenger train at Ealing Broadway.	Passenger train derailment		a
03/04/2016	Collision at Plymouth station.	Collision with other train		a
07/04/2016	Occupied wheelchair contacting a passing train at Twyford station.	Train movement accident involving a passenger		a
10/04/2016	Collision between a train and tractor at Hockham Road user worked crossing, near Thetford.	Level crossing injury		a
07/06/2016	Trains passed over washed out track at Baildon, West Yorkshire.	Infrastructure failure		a
14/06/2016	Near miss at Dock Lane level crossing.	Level crossing near miss		a
24/06/2016	Track worker near miss, Shawford.	Staff hit by train (near miss)		a
01/08/2016	Partial collapse of a bridge onto open railway lines at Barrow-upon-Soar, Leicestershire.	Infrastructure failure		a
07/08/2016	Fatal injury to passenger at Balham.	Train movement accident involving a passenger	X	
15/08/2016	Tram collision with a pedestrian at David Lane, Nottingham.	Train movement accident involving a pedestrian		a
16/09/2016	Collision with landslip and derailment at Watford Tunnel.	Infrastructure failure		a
05/10/2016	Fatal accident at Alice Holt footpath crossing.	Level crossing fatality	X	
09/11/2016	Fatal accident involving the derailment of a tram at Sandilands Junction, Croydon.	Passenger train derailment	X	
22/12/2016	Fatal collision between a tram and a pedestrian near Woodbourn Road tramstop.	Train movement accident involving a pedestrian	X	
29/12/2016	Near miss at Cardiff Central.	Failure of signalling system		a

Summary details of open investigations can be can be found at www.gov.uk/raib under the link to 'Current investigations'.

2 Operational Activity 2016

Safety digests

We began publishing safety digests in 2016 (replacing bulletins). They are intended to share the key safety messages highlighted by a particular incident where we have decided not to publish a full investigation report.

We will publish a safety digest (and not a full investigation report) for any of the following reasons:

- the safety learning has already been (or will be shortly) covered by a safety recommendation in an investigation report;
- the safety learning mainly relates to compliance with existing rules, procedures or standards; and/or
- the safety learning has a narrow application.

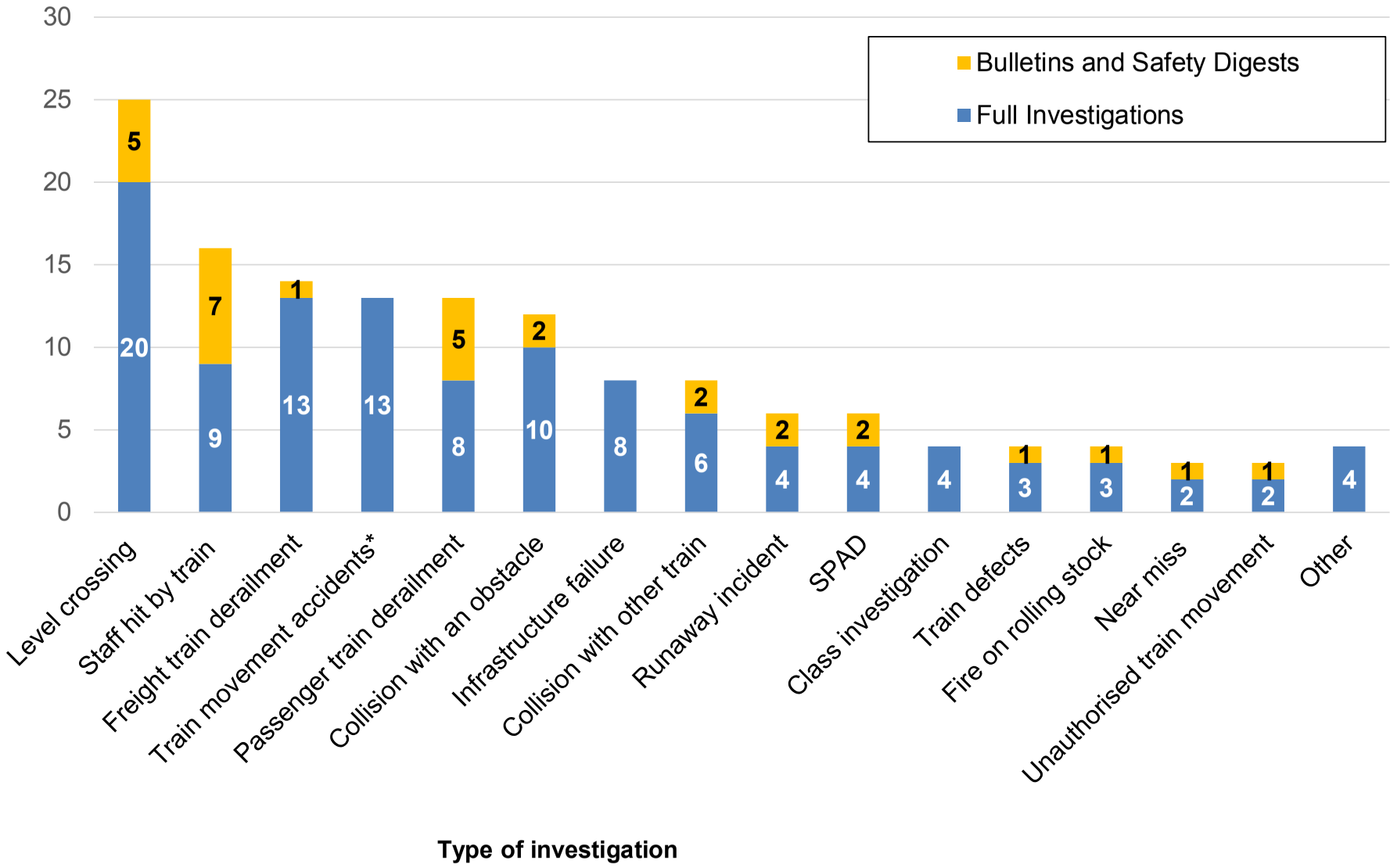
During 2016, we started 16 safety digests and published ten on our website (six have since been published in 2017).

Table 5 – Safety digests started in 2016

Event date	Publication date	Report number	Title of the investigation (location)	Occurrence type
27/02/2016	19/05/2016	D01/2016	Collision between two freight trains in a work site near Ivybridge, Devon.	Collision with other train
22/03/2016	16/06/2016	D03/2016	Runaway and derailment of a rail vehicle near Bury.	Runaway incident
24/03/2016	14/06/2016	D02/2016	Signal passed at danger near Ketton, Rutland.	SPAD
08/04/2016	25/07/2016	D04/2016	Near miss at Maesyfelin Bridge, near Pontyclun.	Staff hit by train (near miss)
16/06/2016	18/08/2016	D05/2016	Derailment at London Paddington.	Passenger train derailment
19/07/2016	24/10/2016	D06/2016	Overspeed incidents, Somerset.	Near miss (non level crossing)
03/08/2016	10/11/2016	D08/2016	Collision at Yafforth level crossing *AOCL.*	Level crossing injury
03/08/2016	31/10/2016	D07/2016	Near miss at Kyle Beck near Tollerton.	Staff hit by train (near miss)
10/09/2016	29/11/2016	D09/2016	Level crossing collision near Dymchurch.	Level crossing minor damage
24/09/2016	22/12/2016	D10/2016	Fire on heritage tram at Gynn Square, Blackpool.	Fire on rolling stock
30/10/2016	12/01/2017	D01/2017	Runaway & derailment of a locomotive, Toton Sidings.	Runaway incident
02/11/2016	06/03/2017	D06/2017	Near miss at Surbiton.	Staff hit by train (near miss)
05/11/2016	23/02/2017	D04/2017	Charter train derailment near Southampton Eastern Docks.	Passenger train derailment
26/11/2016	25/01/2017	D02/2017	Near miss at Thorney Marsh Lane level crossing, Castle Cary, Somerset.	Level crossing near miss
29/11/2016	02/03/2017	D05/2017	Near miss with a pedestrian, Trinity Lane footpath crossing, Waltham Cross.	Level crossing near miss
08/12/2016	31/01/2017	D03/2017	Collision between train and an engineering trolley, Stowe Hill Tunnel.	Collision with an obstacle

Chart 1 gives a breakdown of the total number of investigations and bulletins/safety digests started, by type of accident, for the five year period 2012 – 16.

Chart 1 – Types of incidents/accidents investigated on National Networks, Light Rail, Metro and Heritage Railways 2012-2016.



Note* 'Train movement accidents' include passengers and members of the public (not staff)

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Urgent safety advice (USA)

RAIB can issue urgent safety advice at any stage during an investigation when it believes there is a need to provide immediate information to the relevant industry bodies about the wider safety issues that have been identified. If the issue affects other European member states the safety advice is reported to ERA via their safety information system (SIS); this action alerts all member states to the advice. During 2016 RAIB issued urgent safety advice on two occasions. Both of these were UK specific and therefore they were not sent to ERA SIS.

Table 6 – Urgent safety advice issued by RAIB in 2016

Incident date	Incident	Urgent safety advice	Date of USA
02/03/2016	Derailment at Ealing Broadway	USA issued regarding the availability and control of accurate and current safety critical documentation. London Underground Ltd is advised to take urgent steps to ensure that there is adequate process in place covering the issue, management and control of safety critical documentation for signal operators, line controllers and other staff with responsibility for the safe movement of trains.	16/03/2016
09/11/2016	Derailment and overturning at Sandilands Junction	The factors that led to the over-speeding are still under investigation. Until these factors are better understood, and before the junction re-opens to passenger operation, RAIB advises London Trams and Tram Operations Ltd to jointly take measures to reduce the risk of trams approaching Sandilands Junction from the direction of New Addington at an excessive speed. Options for consideration should include the imposition of a further speed restriction before the start of the existing 20 km/h speed restriction around the curve and/or additional operational signs.	14/11/2016

3 Recommendations

Our investigation reports make recommendations to improve safety and to prevent the reoccurrence of similar accidents.

In the 24 reports published in 2016, RAIB made a total of 73 recommendations; the average number of recommendations per report is three.

We direct recommendations to any organisation we think is best placed to implement the changes required (the 'end implementer'). This includes railway, non-railway, private and public sector organisations.

Each recommendation is sent to the appropriate safety authority[4] or public body.

The purpose of dealing with recommendations in this way is so that the safety authority can ensure that the 'end implementers' properly consider the recommendations, and where appropriate act on them, as the Directive and Regulations require. The Regulations give the safety authority (primarily ORR) the power to require end implementers to provide full details of the measures they intend to take, or have taken, to implement the recommendation.

The safety authority is also required to inform RAIB, within a period not exceeding 12 months, of the measures taken, or the reasons why no implementation measures are being taken.

RAIB has no statutory powers to follow up on the implementation of recommendations, unless it is necessary to do so as part of a subsequent investigation. However, ORR, other safety authorities, and other public bodies are required to report to RAIB the actions taken.

Our website includes details of the response to our recommendations. These are contained in an Index of RAIB recommendations which captures the latest status of each recommendation (as reported to us by the relevant safety authority or public body).

A colour-coded version of the index has also been produced to highlight the status of recommendations that were made or changed during 2016, or which remain open as at 31 December 2016.

There is also a link to a recommendation status report that provides the full text of each recommendation.

These status reports are compiled from information provided to us by ORR, other safety authorities, or other public bodies, and the categories used are:

i. Implemented - all actions to deliver the recommendation have been completed.

ii. Implemented by alternative means – the intent of the recommendation has been satisfied in a way that was not identified by RAIB during the investigation.

iii. Implementation ongoing - work to deliver the intent of the recommendation has been agreed and is in the process of being delivered.

iv. Progressing – the relevant safety authority has yet to be satisfied that an appropriate plan, with timescales, is in place to implement the recommendation; and work is in progress to provide this.

v. Non-implementation – recommendation considered and no implementation action to be taken.

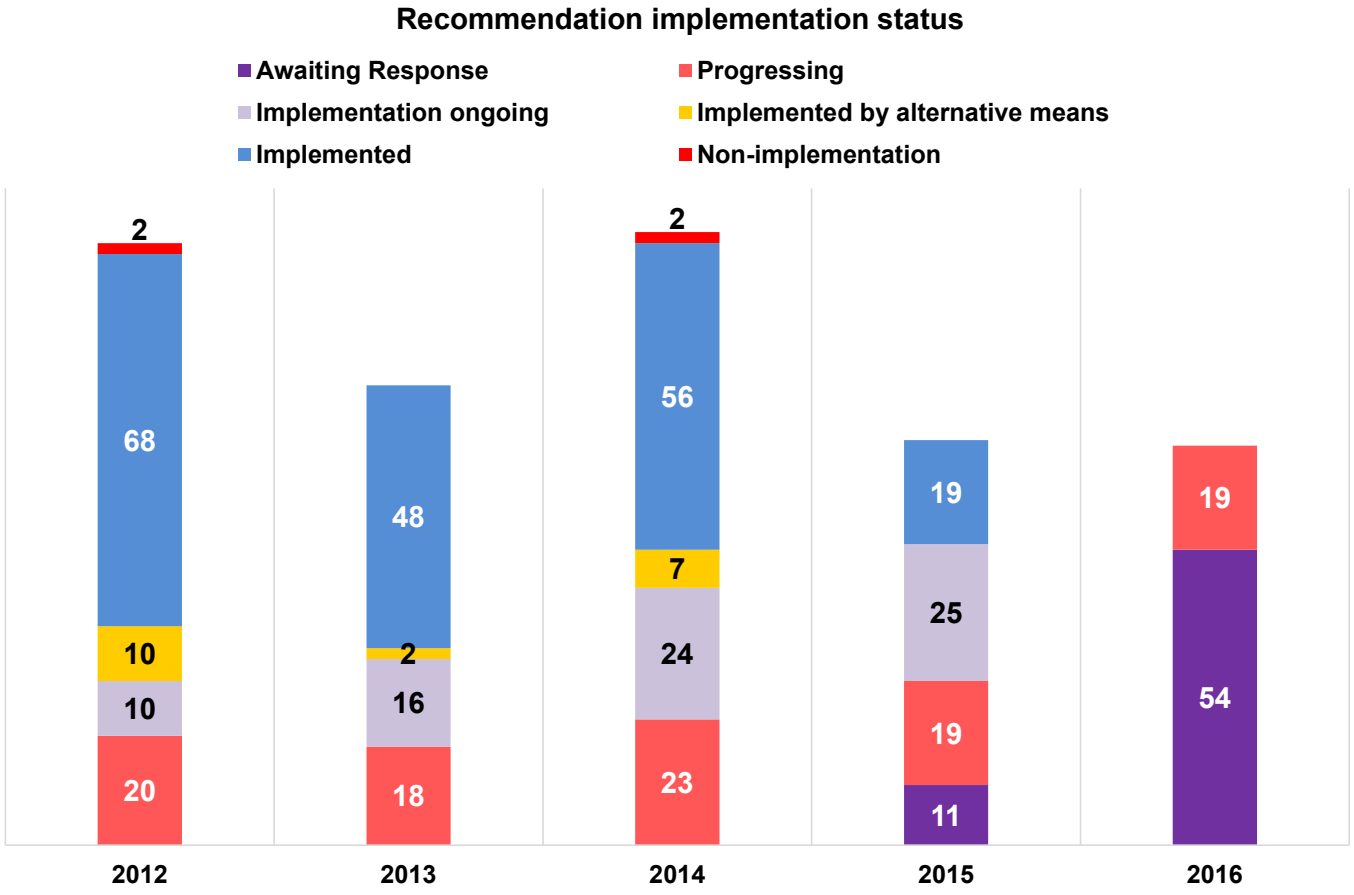
[4] The safety authority is the safety regulator; for Great Britain this is primarily the ORR although there are some recommendations made by RAIB where the Health and Safety Executive (HSE) has been the safety authority (for factors relating to accidents that were outside the control of the railway, and were the responsibility of other organisations to which the Health and Safety at Work etc Act 1974 applies); for the Channel Tunnel it is the Intergovernmental Commission and for Northern Ireland it is the Department for Infrastructure.

3 Recommendations

If RAIB is still awaiting an initial report from the relevant safety authority or public body on the status of the recommendation it is categorised (by RAIB) as 'Awaiting Response'.

The following chart summarises the status of recommendations made between 1 January 2012 and 31 December 2016.

Chart 2 – Recommendation implementation status by year since 2012 (includes recommendations made not only to safety authorities but also public bodies).



Where RAIB has concerns, based on risk, over the way that an organisation has responded to a recommendation, RAIB raises these concerns with the relevant safety authority and the responses are marked with a coloured triangle in the Index. We may also add a comment and this will appear in the recommendation status report.

The triangles used are as follows:

- ▲ RAIB has particular concerns that no actions have been taken in response to a recommendation.
- ▲ RAIB has concerns that the actions taken are inappropriate or insufficient to address the risk identified during the investigation.
- △ RAIB notes that substantive actions have been reported but RAIB still has concerns.

The following table shows those recommendations where the status has changed during 2016, but RAIB has concerns about the response.

Table 7 – Summary of recommendations of RAIB concern

Investigation Name	Rec no	Topic	Concern	Triangle Colour
Double fatality at Bayles & Wylies footpath crossing, Bestwood, Nottingham (32/2009).	7	Review of whether it is reasonably practicable to upgrade headlights of older rolling stock.	The recommendation was about studying whether old stock should be brought up to date; this has not been addressed other than to say that it is not reasonably practicable to modify older rolling stock. The recommendation asked for the RSSB to assess the reasonable practicability of such modifications and propose changes to group standards if appropriate. Instead, RSSB considered the recommendation would be addressed by making it explicit in the standard the legal obligations of duty holders and by offering guidance on what to consider in any fleet-wide assessment. RAIB are concerned that this alternative implementation will not meet the intent of the recommendation.	Blue ▲
Runaway and subsequent collision near to Loughborough Central station, Great Central Railway (04/2015).	2	Improved implementation of the safety management system's assurance processes.	ORR are carrying out assurance activity this year to confirm that the Great Central Railway safety management system is working as per the review. RAIB is concerned that no new processes have been introduced which could increase the effectiveness of future inspections and audits.	Blue ▲
Accident at Balnamore level crossing, Ballymoney, Northern Ireland (10/2014).	1	Review of the rules relating to activities at level crossings in pre-planned possessions.	DfI NI has reported that Northern Ireland Railways has taken suitable actions to address the recommendation and consider it closed. From the information we have, RAIB remain concerned that the intent may not have been met.	White △

3 Recommendations

Repeat causality

RAIB has identified three accidents during 2016 that might have been avoided had a previously identified causal factor been addressed more fully by the railway industry, or in a more timely fashion. These are:

i. Passenger trapped and dragged under a train at West Wickham (03/2016).

ii. Freight train collision near Logan, East Ayrshire (13/2016).

iii. Two SPAD incidents, at Reading and Ruscombe (18/2016).

For further information please see Appendix B.

Examples of significant learning

Some of our investigations have contributed to enhancing industry's understanding of specific areas of risk. We have made a number of wide ranging recommendations (and identified a number of learning points) this year which have the potential to reduce that risk. Examples include:

- Our investigation at Barrow-upon-Soar (21/2016) raised concerns over whether Entities in Charge of Maintenance (ECMs) understand what is required of them. Learning points included that ECMs should recognise their legal obligation[5] to maintain a vehicle in a safe condition.
- A learning point arising from the investigation into the collision between a train and a fallen bridge parapet at Froxfield (02/2016) stated how important it is that emergency service control rooms ensure that the railway industry is rapidly given an accurate description of a hazard when the safety of the railway is affected.
- Three investigation reports have been published this year which involved PTI incidents (West Wickham (03/2016); Clapham South (04/2016) and Hayes & Harlington (12/2016)). These reports have highlighted the need to ensure that those staff responsible for dispatching trains (drivers, guards or platform staff) understand the need for vigilance that it is sometimes possible for trains to move with a passenger's hand (or other object) trapped in the door. This emphasises the importance of the final safety check. We have also recommended a review of the design of certain door control systems and research into the factors that influence the behaviour of passengers in the vicinity of train doors.
- The recommendations made in the Wootton Bassett report (08/2016) addressed gaps in the understanding of risk associated with heritage stock operating on the national network.
- Recommendations made in the Logan report (13/2016) address the issue that more needed to be done in controlling the risk of collision in long work sites. The railway industry has now decided to reconsider some of the options identified in previous RAIB investigations.
- Recommendations made in the Reading & Ruscombe report (18/2016) address the need for industry to improve the management of fatigue risk.
- Lamington Viaduct (22/2016) revealed a gap in how one Network Rail route was managing the risk of scour affecting bridges over water. We have recommended that Network Rail improves its management of scour risk and increase the quality of information available to staff responsible for making decisions about the safety of structures.

[5] As stated in The Railways and Other Guided Transport Systems (Safety) Regulations 2006.

Recommendations 3

Recommendations and reports published in 2016

Recommendations made in 2016 were targeted at the following organisations (in some cases they were made to more than one implementer):

- Department for Transport (1).
- London Underground Ltd (4).
- Main line freight train operators (9).
- Manufacturers (4).
- Metro, train operating company (4).
- Network Rail (28).
- Northern Ireland Railways (2).
- Other public bodies (2).
- Passenger, train operating companies (TOC) (12).
- RSSB (6).
- Railway contractors (4).
- Rolling stock leasing companies (ROSCO) (5).
- Rolling stock maintainers (4).
- Tramway operators (1).

4 Identification of important recurrent issues and areas of concern

The purpose of this chapter is to capture some important areas of safety learning identified by RAIB during 2016. It is not intended to be comprehensive in scope but is focused on those areas which were either prominent during the year or of particular concern to RAIB. The topics selected this year are:

1. Failure of earthworks and structures.
2. Track worker safety.
3. Condition and maintenance of freight and engineering rolling stock.
4. Level Crossings.
5. Platform train interface (PTI).
6. Fatigue.
7. Collisions in long work sites.
8. Safety critical communication.

Recurrent themes

1. Failure of earthworks and structures

As periods of extreme weather become more common in the UK and the railways' structural assets age, there will be a corresponding increased need to focus on the management of structures and earthworks.

By December 2015 RAIB had published 25 reports (including two class reports and one bulletin) concerning earthworks, drainage and failures in structures (or deficient inspection).

In 2016 RAIB published one report and started a further three investigations:

- Structural failure caused by scour at Lamington Viaduct (22/2016).
- Trains running over unsupported rail, Baildon, on 07/06/2016 (since published (03/2017)).
- Partial bridge collapse, Barrow-upon-Soar on 01/08/2016 (since published (10/2017)).

Partial bridge collapse at Barrow-upon-Soar

- Derailment and collision, Watford tunnel on 16/09/2016 (ongoing).

Areas of particular concern emerging from these investigations in 2016 include:

- management and mitigation of scour risk;
- correct application of procedures linked to the safety of structures in case of extreme weather events;
- responding to drivers' reports of rough riding on structures;
- communications between operating staff following reports of infrastructure failure; and
- factors affecting the stability of cutting slopes.

The derailment and collision near Watford Tunnel was of particular concern since it caused a train to run derailed into a tunnel, where it was struck by a train travelling in the opposite direction.

4 Identification of important recurrent issues and areas of concern

Trains involved in derailment and collision near Watford Tunnel (image courtesy of BTP)

RAIB has concluded that the consequences could have been much worse if the derailed train had moved closer to the opposite line, or if the train coming the other way had not slowed down before the point of collision. This event illustrates the importance of earthwork management as part of the railway industry's risk management regime.

Previously RAIB has recommended that industry (RSSB) considers the practicability of design elements on the *bogie* that limit the degree of deviation from the track following derailments (Barrow-upon-Soar, Recommendation 3, (18/2008)). However, although a feasibility study was undertaken by RSSB, the recommendation did not result in any change to standards or bogie design. The accident at Watford provides yet another example of where bogie features, not provided for this purpose, limited the degree of deviation following the derailment.

Our investigation into the partial failure of the viaduct at Lamington, Scotland, is a reminder that, under certain circumstances, the scouring effect of a swollen river can undermine bridge piers to the point where the structure above starts to fail. The risk of scour is often higher for older bridges, particularly those with shallow foundations.

RAIB believes safety of assets can only be assured if those responsible:

- clearly understand the construction, condition and risk to their assets;
- identify the control measures in place; and
- recognise how they contribute to safety and what must be done to keep them in place.

Initiatives already started by industry

Network Rail has undertaken an internal review of scour, flooding and associated extreme weather events across all its Routes. This review identified a range of issues, particularly relating to the completeness and accuracy of scour assessments, and proposed a programme for improvement.

RAIB is aware that Network Rail is continuing to examine ways in which new technology, such as remote monitoring systems, can be used to monitor the condition of earthworks and structures, and to warn of the impending possibility of catastrophic failure.

2. Track Worker Safety

By December 2015 RAIB had published 18 reports (including three bulletins) about accidents and incidents involving track workers working on lines that are still open to traffic.

In 2016 we published:

- Maesyfelin bridge (safety digest D04/2016) in which a gang of workers narrowly avoided being struck by a train.

A further investigation and safety digest were started both involving near-miss incidents:

- Shawford on 24/06/2016 (since published (05/2017)).
- Surbiton on 02/11/2016 (since published (safety digest D06/2017)).

RAIB started a class investigation in February 2016 (since published (07/2017)) into the safety of track workers outside possessions, based on analysis of ten representative near miss incidents that occurred during 2015. The analysis has identified common causal factors that led to things going wrong.

Our findings from these four reports are highlighting the need for:

- correct planning and use of safe systems of work that are specific to the location of the work;
- maintenance of site discipline and vigilance, particularly for experienced staff carrying out routine work;
- improvements in procedures and/or training for those in leadership roles to be able to adapt to changes in circumstances;
- improvements to the training of track workers in non-technical skills;
- changes in the competence requirements for people who lead track work in higher-risk situations; and
- more research to be done regarding fatigue of workers.

Initiatives already started by industry

RAIB is encouraged that Network Rail and its contractors remain committed to address track worker safety issues.

Network Rail's Annual Return 2016 describes a list of twenty-one projects that comprise its 'Home Safe Plan'. These are intended to address 'key safety risks to passengers, public and workforce, health priority areas and process improvement for risk controls and an integrated management system'.

Network Rail has reissued its standard 'Safety of People Working On or Near the Line', NR/L2/OHS/019, and is introducing the role of a person in charge; this person will undertake the Rule Book duties of a Controller of site safety (COSS) as well as being responsible for the work being carried out by the work group.

It is also pressing ahead with its development of new technology, such as:

- high integrity protection systems, blocking the entry of trains to a site of work;
- high integrity warning systems, providing warnings to staff of trains approaching a site of work; and
- electronic permits to work.

4 Identification of important recurrent issues and areas of concern

3. Condition and maintenance of freight and engineering rolling stock

Derailment at Angerstein Junction (10/2016) (courtesy of Network Rail)

The condition of freight and engineering rolling stock has featured as a factor in a significant number of investigations in recent years. This factor covers a wide variety of potential issues including the management of maintenance, wagon design and distribution or configuration of contents.

As at December 2015 RAIB had published 31 reports including five bulletins in which the condition of freight and engineering rolling stock was considered a factor.

In 2016 we published four reports and one safety digest:

- Derailment at Washwood Heath West Junction (01/2016).
- Runaway and collision at Bryn station, Wigan (09/2016).
- Freight train derailment at Angerstein Junction (10/2016).
- Collision between a passenger train and a conveyor boom projecting from an aggregates train at Barrow-upon-Soar (21/2016).
- Signal passed at danger near Ketton (safety digest D02/2016).

An issue of particular concern to RAIB relates to the activities of ECMs. Our investigations into the accidents at Washwood Heath West Junction, Angerstein Junction and Barrow-upon-Soar have raised concerns over whether all ECMs yet have the knowledge and management systems to ensure compliance with their legal obligations including their central role in assuring that wagons remain fit to operate.

Our investigations show that if ECMs are to fulfil the role assigned to them they need to deliver:

- a clear definition of maintenance requirements covering all safety critical components (including any electrical systems); and
- processes to ensure that those responsible for maintenance activities are working in accordance with the agreed plan.

4. Level Crossings

(Left) Hockham Road user worked crossing (04/2017); and (right) Dock Lane user worked crossing (08/2017)

By 31 December 2015 RAIB had published 55 investigation reports including two class reports and four bulletins relating to accidents and incidents at level crossings.

During 2016 two full investigations and two safety digests were published:

- Collision between a train and a tractor at Oakwood Farm user worked level crossing (07/2016).
- Fatal accident at Grimston Lane footpath crossing (23/2016).
- Collision at Yafforth level crossing (AOCL) (safety digest D08/2016).
- Level crossing collision near Dymchurch, user worked level crossing (safety digest D09/2016).

A further three full investigations and two safety digests were started during the year:

- Collision between a train and tractor at Hockham Road user worked crossing on 10/04/2016 (since published (04/2017)).
- Near miss at Dock Lane user worked level crossing on 14/06/2016 (since published (08/2017)).
- Fatal accident at Alice Holt footpath crossing on 05/10/2016.
- Near miss at Thorney Marsh Lane user worked level crossing on 26/11/2016 (since published (safety digest D02/2017)).
- Near miss with a pedestrian, Trinity Lane footpath crossing on 29/11/2016 (since published (safety digest D05/2017)).

Safety issues of particular concern emerging from our investigations include:

a) How level crossings are used, particularly in two areas:
   - in the context of an ageing population, the management of risk to all types of vulnerable users; and
   - user behaviour and how it is affected by crossing layout (eg crossing surfaces that do not cross the railway line at an angle of 90 degrees).

b) Safety validation of new level crossing equipment:
   - the investigations into accidents at Oakwood Farm (07/2016) and Hockham Road (04/2017) found that the new signalling equipment had not been subject to thorough safety validation. Although we recognise the value of innovation, and the potential of new technology, these investigations have revealed that the safety approval processes were applied in such ways that foreseeable hazards were not addressed or evidence of safety was inadequate.

4 Identification of important recurrent issues and areas of concern

In recent years, RAIB has become concerned about signaller error as a cause of accidents at level crossings where it is necessary for vehicle drivers to telephone the signaller for permission to cross (ie user worked crossings with telephones).

In addition to our investigation of the collision between a train and tractor at Hockham Road, 2016 saw the opening of two other investigations into dangerous occurrences of this type (at Dock Lane and Thorney Marsh level crossings). In each case people were given permission to cross the railway with vehicles when trains were too close for this to be done safely.

Communicating with level crossing users is one of many duties carried out by a signaller. In an environment where signalling control areas are becoming larger, and the number of crossings overseen by an individual signaller is increasing, it is important that the railway industry considers carefully the measures required to control the risk of signaller error leading to collision. Giving permission for users to cross the railway will often require signallers to carefully check the location of trains and estimate the time available for users to cross in safety. Although the reliability of such decisions is likely to be improved if signallers are provided with better information, it would be preferable to see, over the longer term, the removal of crossings where the only form of protection is the telephone.

Initiatives already started by industry

RAIB's investigations into level crossing safety reveal a number of existing initiatives that Network Rail are developing to address particular areas of risk. Those of particular interest to RAIB include:

- the installation of red/green stop lights at high risk user worked crossings and improvements to the design to address concerns about safety integrity levels;
- the development of alternative technology to provide audible warnings to pedestrians that trains are approaching (ie reducing reliance on the sounding of train horns);
- the development of a new version of the All Level Crossing Risk Model;
- joint Network Rail and BTP targeted advertising campaigns on level crossing safety; and
- continued closures of crossings and construction of footbridges/underpasses.

To preserve its independence, RAIB does not become directly involved in the development of industry initiatives and the programme for closures and upgrades. However, we do fully support the continued closure of crossings, on the basis of assessed risk, as the only way to fully eliminate the risk of users being struck by trains. We also support the use of interim measures to reduce risk, where immediate closure is not justified.

5. Platform Train Interface (PTI)

By 31 December 2015 RAIB had published 12 reports and one bulletin relating to PTI incidents and three further reports were published in 2016:

- Passenger trapped and dragged under a train at West Wickham (03/2016).
- Passenger trapped in train doors and dragged at Clapham South station (04/2016).
- Passenger trapped and dragged by a train at Hayes & Harlington station (12/2016).

These reports raise the question 'what makes some passengers react in an unsafe way to closing train doors?' Consequently, RAIB has recommended that research be undertaken to better understand the factors affecting the behaviour of passengers in the vicinity of train doors. These reports also identify other key safety learning:

- the need for a review of design of certain types of door control systems to prevent doors being opened by passengers after the driver has initiated the door closure sequence (the issue is already being addressed);
- the need for dispatchers/drivers/guards to allow sufficient time for passengers to leave a train before initiating the door closure sequence, and to undertake an adequate final safety check (where this is a requirement) after the doors have closed;
- the need for station managers to carry out reviews of the visibility of the platform/train interface available to dispatchers/drivers/guards - particularly when platforms are crowded (eg optimising camera positions); and
- the need to ensure that people who dispatch trains, understand that door interlock can be obtained with a hand (or other small object) trapped in the door.

Our investigations cover too small a sample for us to draw conclusions about the relative safety of the different methods of train dispatch. However, for all methods of train dispatch, safety depends on:

- the provision of suitable equipment (eg cameras and CCTV monitors where required);
- rigorous compliance with safety rules by trained operating staff; and
- effective management of risk at stations, particularly where visibility can be poor or platforms are crowded.

Initiatives already started by industry

RAIB is aware of a number of existing railway industry initiatives to address areas of PTI risk. Initiatives of particular interest to RAIB include:

- Train dispatchers, including drivers, have been re-briefed on the need to carry out the final safety check (to confirm that no-one is trapped in the train's doors) following RAIB's urgent safety advice[6].
- A programme seeking to develop improved detection of trapped objects on some types of existing rolling stock.
- Sensitive edge detection systems continue to be fitted to new trains.

[6] Relating to Hayes & Harlington incident (12/2016).

4 Identification of important recurrent issues and areas of concern

- Heathrow Express has fitted passive gap fillers at platform edges to reduce the size of the gap between the train and platform.
- London Underground has initiated a three year PTI strategy. This plan is an examination of the existing measures in place to manage the customer risk associated with the PTI, and future measures to improve equipment, governance and processes.
- London Underground is trialling different types of platform edge gap fillers.
- London Underground is reviewing camera coverage to aid safe dispatch, particularly where platforms are curved and/or crowded.
- Reduction of the platform-train interface gap on the Merseyrail system through the design of new rolling stock, and platform height modifications.

Clapham South (04/2016)

6. Fatigue

By December 2015 RAIB had published 14 reports (including one special report) where fatigue had been identified as a contributory factor.

In 2016 fatigue was identified as a contributory factor in two published investigations and one ongoing investigation:

- Over speed at Fletton Junction (14/2016).
- Two signal passed at danger incidents, at Reading Westbury Line Junction & Ruscombe Junction (18/2016).
- Collision between a passenger train and a tractor at Hockham Road user worked level crossing on 10/04/2016 (since published (04/2017)).

Issues of particular concern to RAIB include:

- fatigue risk management at an organisational level;
- inadequate processes to identify members of staff who are at particular risk of fatigue; and
- staff reporting for duty when fatigued.

These investigations highlight the significant influence of fatigue on the performance and decision making of front-line safety-critical workers such as drivers and signallers.

Our recommendations and learning points, arising from these investigations, demonstrate that there are key areas of fatigue risk management that the industry still needs to fully address. These include rostering, reviewing those *diagrams* drivers report as carrying a higher risk of fatigue, fatigue reporting, mathematical modelling of fatigue, fitness for duty checks, screening for sleep disorders, and the respective responsibilities of both employer and employee in reducing fatigue risk.

Employers should be alert to the signs of fatigue, whether caused by roster design or the individual characteristics of their staff. Employees need to be aware of the risk of fatigue and know how to manage their own fatigue – including reporting if they do not feel fit to work. Reporting fatigue is not an admission of weakness; it may be an unavoidable consequence of work and/or home demands, and it is far better to report fatigue than to have an incident caused by fatigue.

None of these actions are easy, and we recognise that there will always be a risk of fatigue at work in a 24/7 industry such as rail. However, despite the recommendations and learning points made over the years, RAIB considers that progress has been slow and has seen signs that employers have yet to fully address.

Initiatives already started by industry

Three recent RSSB projects are aimed at addressing some of these concerns:

- T1082 Developing fitness for duty checks and predicting the risk of experiencing fatigue.
- T1083 Industry guidance on bio mathematical fatigue models.
- T1084 Guidance on fatigue control options for first night shifts.

In addition RSSB and ORR have both published guidance on this topic.

4 Identification of important recurrent issues and areas of concern

7. Collisions in long work sites

Freight train collision near Logan (13/2016) (image courtesy of Network Rail)

Collisions between trains within a work site create the potential for very serious harm to those involved, major damage and days of disruption to the travelling public. Train movements within work sites and possessions are not regulated by normal railway signalling systems, which is why special care is needed to make sure that trains are always able to stop in the distance that the driver can see to be clear, and that communications between drivers and engineering staff are precise and mutually understood.

By 31 December 2015 there had been five reports (including one bulletin and one class investigation) published which focused on collisions involving trains in long work sites.

In 2016 one investigation report and one safety digest were published:

- Freight train collision near Logan (13/2016).
- Collision between two freight trains in a work site near Ivybridge, Devon (safety digest D01/2016).

Areas of concern highlighted by RAIB's investigations include:

- the absence of effective practical steps that can be taken to reduce the length of worksites;
- methods of monitoring of drivers when they are driving trains within possessions and work sites;
- communication between drivers and engineering staff; and
- the practicalities of driving freight trains in possessions and work sites for long distances at slow speeds.

A number of recommendations have been made by RAIB to address the ways that movements of trains in work sites are regulated, and ways of ensuring clear and accurate communications. Although these recommendations have not yet led to substantive action to improve the problem, RAIB is encouraged to see that the railway industry has now decided to reconsider some of these recommendations.

8. Safety critical communication

Collision between a train and a fallen bridge parapet near Froxfield (02/2016) (image courtesy of Mr John Brown)

Poor communications have featured in numerous investigations since 2005 and was a factor in a number of investigations during 2016 including:

- Collision between train and a fallen bridge parapet, near Froxfield (02/2016).
- Freight train collision near Logan (13/2016).
- Overspeed at Queens Park (19/2016).
- Derailment of a passenger train at Ealing Broadway (24/2016).
- Fatal accident at David Lane on Nottingham tramway, on 15/08/2016 (since published (06/2017)).
- Overspeed incidents, Somerset (safety digest D06/2016).
- Near miss at Kyle Beck near Tollerton (safety digest D07/2016).

As a result of our investigation into the collision near Froxfield (02/2016) RAIB identified learning points for police forces regarding the importance of contacting the appropriate railway control centre immediately they become aware that the safety of a railway line is affected.

Our investigations have also highlighted the importance of engineering staff giving instructions to drivers through a face-to-face conversation when it is safe and practicable to do so. We have emphasised the importance of signallers and drivers repeating back messages so as to reach a clear understanding when communicating safety critical information.

It is disappointing that RAIB continues to observe informal and poorly structured communication between staff, despite the rail industry's efforts over many years to address the issues. When people's lives depend on good working practices, the effective implementation of those practices should be monitored more stringently.

5 Other activities and information about the branch

National Investigation Body (NIB) Network

We continue to participate in the European Union (EU) network of NIBs.

As a result of the recent changes to the Directive we are now working with a number of other NIBs to develop:

a) a peer review process; and

b) the improved sharing of knowledge between NIBs.

In addition, we are working with the NIBs and ERA to improve the management of plenary meetings and to establish mechanisms for co-operation.

Some years ago we were also invited to participate in the Nordic regional grouping of NIBs and we continue to be an active member of this group too.

International Transport Safety Association (ITSA) conference

On 23-25 May 2016 the Chief Inspector (Simon French) attended the ITSA conference in Paris and representatives from 16 countries attended, including USA, Canada, Australia, Japan and South Korea.

ITSA is composed of the independent investigation boards from countries around the world and its mission is to improve transport safety in each member country by sharing information and learning from the experience of others.

Accident investigation good practice workshop

The workshop, initiated by RAIB in 2014, continues to meet. Representatives from RAIB, RSSB, Network Rail, train operators and freight operators met on 28 September 2016 and discussed a variety of issues including investigator competence and report writing. All participants agreed that this was a valuable opportunity to exchange good practice in the field of railway accident investigation.

International Rail Accident Investigation Conference (IRAIC)

The IRAIC organised by the Institution of Mechanical Engineers was held on 15-16 November 2016 in London. Simon French gave a presentation on 'Rail accident investigation, communicating the message'. Many of our inspectors also attended and gave presentations.

RAIB's own safety record

RAIB provides an operational response to railway accidents and incidents, which vary in nature, scale and environment. These operations often present significant health and safety risk to RAIB staff and to people working alongside them. To counter this risk, RAIB has developed and implemented its own Safety Management System (SMS). This identifies RAIB's health & safety policy and the arrangements that it has in place for the management of risk. It also sets out a system for the 'real-time' assessment of risk by means of a process known as Dynamic Risk Assessment.

RAIB monitors its own health and safety performance as an integral part of our management and governance processes. This includes a Health, Safety and Welfare committee which is chaired by the Chief Inspector.

Three minor injuries to RAIB staff were reported during the year. Each of these were recorded and investigated.

Funding

RAIB's budget for 2016-17 was £4.7 million.

Chief Inspectors' Board

This board was established in 2003 by the Secretary of State and consists of the three Chief Inspectors of accident investigation (Rail, Marine and Air). The Board meets at least quarterly to identify and develop common strategic issues to improve independent accident investigation in the UK.

This allows the Chief Inspectors to maintain operational independence and reporting of safety matters to the Secretary of State while benefiting from the branches working together.

Appendices

Appendix A - List of events that could have led to a serious train accident if circumstances had been slightly different

RAIB considers that a multiple fatality accident was narrowly avoided in six events in 2015 and 2016:

Investigation name and event date	Report Number	Incident details
Collision between a train and a fallen bridge parapet at Froxfield on 22/02/2015.	02/2016	A brick parapet, weighing around 13 tonnes, had fallen onto the railway, obstructing both tracks. A train carrying 750 passengers, was travelling at 86 mph (138 km/h) when the driver saw the obstruction. The train struck the masonry but did not derail.
Passenger train derailment at Godmersham on 26/07/2015.	05/2016	Passenger train struck a number of cows and subsequently derailed[7].
SPAD on the approach to Wootton Bassett Junction on 07/03/2015.	08/2016	SPAD and near miss at a high-speed junction, involving two passenger trains.
Structural failure caused by scour at Lamington Viaduct on 31/12/2015.	22/2016	Scouring effect of a swollen river undermined bridge piers to the point where the structure above started to fail. A passenger service passed over this at a speed of about 110 mph (177 km/h).
Partial collapse of a bridge onto open railway lines at Barrow-upon-Soar, Leicestershire on 01/08/2016.	10/2017	Bridge partially collapsed onto the railway. A passenger train had passed less than ten minutes earlier and a freight train was stopped on the approach to the bridge.
Collision with landslip and derailment at Watford Tunnel on 16/09/2016.	Ongoing	A southbound passenger train collided with a landslip and derailed at 70 mph (112km/h). The derailed train continued into the tunnel, partly blocking the adjacent line. About ten seconds later, it was struck by a northbound train which did not derail.

[7] Collisions with cattle are not unusual on UK railways. On rare occasions the consequences of such collisions can be severe. For example on 30 July 1984 an express train struck a cow which had gained access to the track through a damaged fence from a field near Polmont railway station (near Falkirk, Scotland); the collision caused all six carriages and the locomotive of the train to derail, killing 13 people and injuring 61 others.

Appendix B - Repeat causality summary

RAIB has identified three accidents during 2016 that might have been avoided had a previously identified causal factor been addressed more fully, or in a more timely fashion. These are:

i. Passenger trapped and dragged under a train at West Wickham (03/2016):

In this accident, a strap on the passenger's backpack was trapped in the train door as they closed. As the train departed from the platform, she was dragged until she fell onto the platform and then into the gap between the platform and train. The train door closed unexpectedly, and neither the driver nor the driver instructor in the cab were aware of the trapped passenger when the door was closing, or afterwards.

The investigation into an accident at Brentwood in 2011 (19/2011) recommended that RSSB should include in the Railway Industry Standard (RIS) on train dispatch guidance that those responsible for dispatch (including the drivers of DOO[8] (driver only operated) trains) should observe the closing of the train's doors and be alert for any dangerous occurrence while this is taking place. The revised RIS was published in March 2013. It included guidance to operators that, when developing the train dispatch process, they should consider the level of monitoring required during dispatch, with specific emphasis on monitoring during the door close process and during train departure. Southeastern considered that this applied to platform staff, and did not take any action to change the requirements for drivers on the company's DOO routes.

RAIB considers that more effective implementation of the recommendation could have led to the driver checking the DOO monitors while the train doors were closing, so reducing the likelihood of the accident occurring.

ii. Freight train collision near Logan, East Ayrshire (13/2016):

A freight train travelling within a work site collided with the rear of a stationary freight train. One of the factors in this accident was the quality of the information exchanged in communications between the train driver and the engineering supervisor. This had been identified as an issue in four previous RAIB investigations, going back to 2006. In particular, the report on a collision near Arley in 2012 (12/2013) recommended that Network Rail should carry out a wide-ranging review of potential means of reducing the risk of collisions between trains travelling to and from sites of work. This should include the systems of work, planning arrangements, train speeds and reasons for deviations from possession plans. Network Rail established a cross-industry working group to carry out this review, but by the time of the collision at Logan, although the group had developed action plans, they had not been implemented. More timely and effective implementation of this recommendation might have prevented the collision at Logan.

[8] Current safety principles published by ORR use the term 'Driver controlled operation' (DCO) when describing this type of train despatch method.

Appendices

iii. Two SPAD incidents, at Reading and Ruscombe (18/2016):

In both these incidents, freight trains passed signals at danger because the drivers were too fatigued to properly control their trains, and probably fell asleep momentarily on the approach to the signals. One of the drivers was subsequently diagnosed with sleep apnoea. RAIB had previously recommended (investigation into an accident at Brentingby Junction in 2006 (01/2007)) that railway group standards should be revised to require screening for sleep disorders as part of the system of regular medical surveillance applied to train drivers. The relevant group standard was subsequently withdrawn without being amended, but RSSB drew the issue to the attention of train operators. However, there was no reference to it in the standards of DB Schenker (now DB Cargo), the company which employed these two drivers. In its investigation of a run-back incident between Shap and Tebay in 2010 (15/2011), RAIB recommended that DB Schenker should take action to identify and improve shifts on which drivers experienced high levels of fatigue, assess the result, and share its findings with ORR. The Reading and Ruscombe investigation found that any action taken had not been effective, and that the night shifts being worked by the two drivers were likely to have caused fatigue.

Appendix C - Glossary of abbreviations and acronyms

AIB	Accident Investigation Branch
AOCL	Automatic open crossing locally monitored
BEA-TT	Bureau d'Enquêtes sur les Accidents de Transport Terrestre
BTP	British Transport Police
COSS	Controller of site safety
DfI	Department for Infrastructure
DCO	Driver Controlled Operation
DOO	Driver Only Operation
ECM	Entity in Charge of Maintenance
ERA	European Agency for Railways
ITSA	International Transport Safety Association
NIB	National Investigation Body
ORR	Office of Rail and Road
PTI	Platform Train Interface
RIS	Railway Industry Standard
ROSCO	Rolling Stock Leasing Companies
RSSB	Rail Safety and Standards Board
SIS	Safety Information System
SMS	Safety Management System
SPAD	Signal Passed At Danger
TOC	Train Operating Company
USA	Urgent Safety Advice
UWC	User Worked Crossing

Appendices

Appendix D - Glossary of terms

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

Automatic half barrier level crossing	An automatic level crossing fitted with half barriers, road traffic signals on the highway and a telephone to the relevant signal box.*
Automatic open crossing locally monitored	A level crossing with road traffic lights but without barriers, that is equipped with a flashing white light which is observed by the train driver to confirm that the traffic lights are functioning before the train proceeds over the crossing.*
Bogie	A metal frame equipped with two or three wheelsets and able to rotate freely in plan, used in pairs under rail vehicles to improve ride quality and better distribute forces to the track.*
(Driver) Diagram	The itinerary of a particular driver's duty, identifying which trains are to be operated.
Footpath crossing	A level crossing provided solely for use by pedestrians.*
Infrastructure Manager	Any person who is responsible for establishing and maintaining infrastructure or a part thereof, which may also include the management of infrastructure control and safety systems, but does not include a maintainer.*
Pagoda	Roof on a wagon on which HGVs are transported through the Channel Tunnel.
Possession	A section of line that is blocked for the normal running of trains to allow engineering work to be carried out.
Scour	The removal of material from under or adjacent to structural supports, foundations or earthworks by the action of flowing water.
User worked crossing	A level crossing where the barriers or gates are operated by the user. There is generally no indication of the approach of trains, but a telephone may be provided to contact the signaller.*

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