



Rail Accident Investigation Branch



# Annual Report 2012 Section 1



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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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## Preface

### Preface

This is the Rail Accident Investigation Branch's (RAIB) Annual Report for the calendar year 2012. 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 the RAIB's website at [www.raib.gov.uk](http://www.raib.gov.uk).

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# RAIB Annual Report 2012

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## Chief Inspector's foreword

### Chief Inspector's Foreword

Each of the Rail Accident Investigation Branch (RAIB) investigations has important findings for the industry to improve the safety of the UK's railways. This Annual Report includes a summary of the recommendations and the actions reported as taken in response. The results are very positive; of those recommendations where the relevant safety authority has already reported the outcome, 95% have been implemented or are in the process of being implemented; thus bringing about real changes in the rail industry<sup>1</sup>.

Viewed collectively, our investigations send another message. There are still areas of risk that we find recurring in our investigations year on year. This report refers to them in section 5, 'Identification of important recurrent issues'. These areas of risk are not unknown to the industry or the safety authority<sup>2</sup> and this report documents some of the initiatives the industry has in progress to deal with them. That we are still having occasion to investigate accidents linked to these areas of risk indicates there is work that the industry has as yet to do.

The two particular areas of risk that we have repeatedly had cause to investigate up to the end of 2012 are level crossing and track worker safety.

#### Level crossings

RSSB's Annual Safety Performance Report for 2012-13 indicates that level crossings presently account for nearly 8% of risk (excluding suicide) on Great Britain's mainline railway.

Network Rail has reported a wide reaching and positive programme for the ongoing reduction of risk at crossings. Recent data presented by RSSB indicates the UK's crossings have the lowest level of user risk in the EU member states and that Network Rail is on-target to achieve a 25% reduction in level crossing risk over Control Period 4 (CP4) 2009-14<sup>3</sup>. Despite this general risk reduction, ORR's recently published Health and Safety Report states that level crossing risk increased by 7% between 2012 and 2013<sup>4</sup>, mainly due to misuse.

In 2012 the RAIB published seven reports concerning level crossing accidents/incidents; four of which were categorised by the industry as being due to misuse (which includes error, misjudgement or wilful misuse). Our investigations concluded that only one of these involved wilful misuse the others involved human error. In all cases, the RAIB found there were still lessons to be learned by the industry. As a result, we have made recommendations aimed at reducing the industry's reliance on human performance as the safeguard against a potential fatal accident, and for changes to be made to the design, inspection, and maintenance of the railway equipment and its operation.

The number of level crossing accidents and the recently reported increase in related risk continues to be a source of concern to the RAIB. By December 2012 the RAIB had completed 39 investigations of accidents at level crossings and made 160 recommendations. At the time of writing this report this had moved on to 41 investigations completed with 166 recommendations.

The following table indicates the outstanding recommendations concerning level crossings as reported to the RAIB.

<sup>1</sup> More details on the recommendation process are provided in section 4 of this report.

<sup>2</sup> The Office of Rail Regulation is the safety authority for the majority of the UK's mainline railways.

<sup>3</sup> RSSB's Annual Safety Performance Report 2012-13.

<sup>4</sup> This conclusion is based on data derived from RSSB's Precursor Indicator Model, which is used to monitor train accident risk to passengers, workforce and members of the public (such as users of level crossings).



## Chief Inspector's foreword

Consequence of accidents at level crossings	Number of level crossing accident investigations since 2005 where there are outstanding recommendations	Total number of outstanding recommendations (and in brackets those reported by ORR as still in progress 2 or more years after publication of RAIB's report)
Fatal accident	7	14 (3)
Injury	1	1 (0)
Near miss	3	9 (0)
Total	11	24 (3)

Level crossing accidents continue to feature very prominently in our work.

### Track worker safety

We continue to be concerned by issues of track worker safety.

Network Rail has informed us that improving track worker safety is another of its major safety initiatives. In 2012 we had started to investigate three related accidents and published two investigation reports and one bulletin; resulting in six recommendations. Whilst ORR's Health and Safety Report 2013 records there has been a notable improvement in track worker safety since 2005, the RAIB has investigated a total of 22 related accidents or near misses over seven years and made 107 recommendations. At the time of writing this report this had moved on to 23 investigations completed with 109 recommendations made.

The table below indicates the outstanding recommendations concerning track worker safety as reported to the RAIB.

Consequence of track worker accident	Number of track worker accident investigations since 2005 where there are outstanding recommendations	Total number of outstanding recommendations (and in brackets those reported by ORR <sup>5</sup> as still in progress 2 or more years after publication of RAIB's investigation report)
Fatal accident	1	2 (2)
Injury	2	6 (5)
Near miss	1	2 (0)
Total	4	10 (7)

### Responses to the recommendations we make

RAIB recommendations must be considered within the framework of health and safety legislation, which places duties upon the recipients in respect of ensuring safety, and gives the relevant safety authority (in most cases the ORR) the powers to enforce these duties. This means that the recipient has a duty to consider the actions to be taken in response to a recommendation. The relevant safety authority has a duty under the Railways (Accident and Reporting) Regulations 2005 to ensure that the recommendation is taken into consideration and where appropriate acted upon.

I expressed a concern in last year's Annual Report that there were 67 recommendations that had not been completed after more than two years following publication of the RAIB's investigation report. The situation has improved since last year but there is still work to do.

<sup>5</sup> At the time of publication of this report.

## Chief Inspector's foreword

ORR has reported at the beginning of August 2013 that there are 35 recommendations, accepted by the industry, yet still to be completed two years following the publication of the RAIB's report; and 28 of these are more than three years old. However, we recognise the ORR's report of completion may not fully represent the extent of implementation on the ground. Industry parties may consider some recommendations as complete but ORR have still to verify completion by inspection before reporting the actions taken to the RAIB.

Moving from the collective to the specific, last year I commented that the RAIB investigated a number of accidents where it emerged that those accidents may not have occurred had earlier RAIB recommendations been completed in a timely manner. During 2012 we have seen this again. We have completed five such investigations; two<sup>6</sup> where the subsequent accidents probably would have been avoided had our recommendations been fully implemented and three<sup>7</sup> where there was less certainty but where the subsequent accidents possibly would have been avoided.

### Looking forward

During our investigations we spend a lot of time communicating our findings and ultimately the purpose and context of the recommendations to the industry. However, at the end of the day it is the industry, supervised by the safety authority, who decides on the prioritisation of our recommendations relative to other safety and operational demands on its resources.

This report contains information provided to us concerning the industry's and ORR's work that is in progress. However, we have a very pressing need for an improved flow of information so that the RAIB can remain sufficiently aware of how, and when, industry initiatives or campaigns will address the more significant risks identified by our investigations, including the areas of risk that we have investigated on more than one occasion. I am currently seeking, with the support of the ORR and Network Rail, this greater transparency to better inform our investigation activity and to ensure we maximise the benefits of our work in improving safety.

Our mission is simple and the commitment of the RAIB team members to delivering it is absolute – to improve both the safety of the members of the public who travel on (or come into contact with) the railway and those that work on it. Our work is often complex and takes us into every corner of the industry. Each of our new findings and recommendations is a signpost to the UK's rail industry towards ways of delivering its targets for continuing improvement in safety.

Carolyn Griffiths



Chief Inspector of Rail Accidents  
23 September 2013

<sup>6</sup> Torworth, RAIB report 02/2012; and Bordesley Junction, RAIB report 19/2012.

<sup>7</sup> Clapham and Earlsfield, RAIB report 03/2012; Stoats Nest Junction, RAIB report 16/2012; and Princes Street Gardens, RAIB report 18/2012.

## 1. The role of the Rail Accident Investigation Branch

Further information about the role of the RAIB can be found on our website by clicking on the following links:

### [1. Background to the Branch](#)

The RAIB became operational in October 2005 as the UK's independent organisation for investigating accidents and incidents occurring on the UK's railways. The roles and duties of the 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 Office of Rail Regulation (ORR)), and an independent body to investigate all rail accidents (Rail Accident Investigation Branch (RAIB)).

### [2. Aims of the Branch](#)

The RAIB's aims are to improve the safety of the railways by carrying out timely investigations into railway accidents and incidents to determine the causes and circumstances, and to make safety recommendations to reduce the likelihood of accidents in the future.

### [3. Objectives of the Branch](#)

To respond promptly and effectively to notifications of railway accidents and incidents.

To conduct thorough investigations in a way that is proportionate to the seriousness of the event and the lessons to be learned from it.

To use the resources of the RAIB appropriately to achieve the maximum effect in the improvement of safety on railways and tramways.

### [4. Scope of accidents and incidents investigated](#)

The scope of the RAIB's investigation work is set out in the Regulations and the Act and covers the mainline railways, metros, light rail and heritage railways of Great Britain and Northern Ireland, the Channel Tunnel and tramways in England and Wales. Under the Act, the RAIB is mandated to investigate any serious railway accident, as defined in the Regulations, and also has the freedom to investigate other types of accident or incident where it believes that an investigation could significantly improve railway safety.

### [5. Accident and incident notification](#)

The Regulations place a duty on railway industry bodies whose staff or property is involved in an accident or incident to notify the RAIB.

# 1 The role of the Rail Accident Investigation Branch

## [6. The RAIB's response to notifications](#)

The RAIB will decide on the basis of the initial notification whether it should immediately mobilise personnel to the accident site. Usually this is to conduct a Preliminary Examination. The RAIB's Chief Inspector or her Deputy, a Duty Co-ordinator and a team of inspectors are on call 24 hours a day, 365 days per year to respond to incidents.

## [7. Preliminary Examination](#)

The purpose of the Preliminary Examination is to gather sufficient details and evidence to enable the RAIB to make an informed decision whether or not to conduct a full investigation.

## [8. Investigation](#)

The RAIB's investigations are conducted completely independently of all other organisations and investigations by other parties. However, it can share factual evidence with industry stakeholders and will share such evidence with other statutory investigatory bodies. It will not share the identities of witnesses or their statements, nor medical records relating to persons involved in the accident or incident, or other information given in confidence. The RAIB will keep involved parties informed of emerging findings throughout the investigation and may inform the broader industry of progress and findings during the investigation by way of an interim report.

If the RAIB decides that a full investigation is disproportionate to the potential safety lessons that may be learned then it might publish a bulletin, which consists of a summary of the findings and identification of safety lessons.

## [9. The investigation report](#)

On completion, the Chief Inspector sends the report to the Secretary of State for Transport and publishes it on the RAIB's website.

## [10. The recommendation process](#)

Where appropriate, the RAIB's investigation reports will include recommendations to improve safety and to prevent the reoccurrence of similar accidents.

## [11. Organisation](#)

The RAIB consists of full time investigators and support staff. They are based in two operational centres, at Derby and Farnborough.

## [12. Board of Transport Accident Investigators](#)

The Board of Transport Accident Investigators was established in 2003 by the Secretary of State, consisting of the three Chief Inspectors of accident investigation (Rail, Marine and Air), and is currently chaired by the RAIB's Chief Inspector. Its purpose is, where appropriate, to ensure consistency of approach and identify and develop any common strategic aims and objectives and best practices. These include the development of a new and common electronic evidence management system, upkeep of the Branches' web sites, and dealing with common risks in a collaborative manner. The Board normally meets quarterly.

## 2. Operational Activity 2012

During the period from 1 January to 31 December 2012, the RAIB received 379 notifications of railway accidents and incidents from the industry. These resulted in 38 deployments of RAIB inspectors to the accident or incident site to carry out a preliminary examination. There were six additional preliminary examinations which did not require deployment to site. As a result of the analysis of the information gathered, the RAIB started 26 full investigations, and issued five Bulletin reports and two Urgent Safety Advices. (See page 16 for more information on Bulletins and Urgent Safety Advice.)

### Investigation reports published in 2012

The RAIB completed and published 28 full investigation reports in 2012. While the RAIB's aim is to publish reports and bulletins within 12 months, the length of individual investigations can sometimes extend beyond this because of the complexity and scale of the investigation. In 2012 the average time from the date of the incident to publication for full investigations was 11.8 months, with the longest being 24 months<sup>8</sup> and the shortest five months. In addition to these, there were five bulletins published in 2012. The average time from the incident to publication of the bulletin was just over three months. Overall the average time for full investigation and bulletin reports to be published was just over ten months.

Table 1 provides a summary of the outputs achieved by the RAIB in 2012. Details on the status of recommendations issued in reports published in 2012 and recommendations subject to a report by the safety authority can be found in [Part 2 of the Annual Report](#).

Table 1 – RAIB outputs in 2012

Preliminary examinations completed	44
Full investigation reports published	28
Bulletins published	5
Urgent safety advice issued	2
Investigations commenced	26

Table 2 provides details of the investigations completed in 2012 and the basis for the investigation, taking account of the reporting requirements of the European Railway Safety Directive and national regulations.

Table 3 provides details of full investigations commenced in 2012 and the basis for the investigation.

Table 4 provides details of an investigation opened in 2011 but not completed by 31 December 2012.

<sup>8</sup> Passenger train derailment near East Langton that occurred on 20/02/2010. This investigation took a long time as it involved complex technical issues requiring extensive testing and analysis work, which was carried out with the industry using specialised test rigs in Germany.

# 2 Operational Activity 2012

Table 2 - Investigations completed in 2012

Report Number	Event date	Publication date	Title of investigation (location)	Occurrence type	Basis for investigation		
					19(1)	19(2)	21(6)
01/2012	20/02/10	30/01/12	Passenger train derailment near East Langton, Leicestershire	Passenger train derailment		a	
02/2012	08/01/11	15/02/12	Tamper driver struck by a train at Torworth level crossing	Staff hit by train (injury)		a	
03/2012	08/03/11	27/02/12	Two incidents involving track workers between Clapham Junction and Earlsfield	Staff hit by train (near miss)		b	
04/2012	03/07/11	13/03/12	Boiler incident on the Kirklees Light Railway	Train defects		a	
05/2012	06/04/11	22/03/12	Partial failure of Bridge 94, near Bromsgrove	Infrastructure failure		a	
06/2012	25/09/11	29/03/12	Collision between a train and a tractor, White House Farm User Worked Crossing	Level crossing injury to member of public		a	
07/2012	26/05/11	23/05/12	Safety incident between Dock Junction and Kentish Town	Train movement accidents involving passengers		a	
08/2012	05/06/11	30/05/12	Fatal accident at Piccadilly Gardens, Manchester	Train movement accidents involving member of public	x		
09/2012	10/10/11	30/05/12	Person trapped in doors and pulled along platform at King's Cross station, London	Train movement accidents involving a passenger		a	
10/2012	03/10/11	21/06/12	Fatal accident at Mexico footpath crossing (near Penzance).	Level crossing fatality to member of public	x		
11/2012	19/06/11	27/06/12	Incident at Llanbadarn Automatic Barrier Crossing (Locally Monitored), near Aberystwyth	Level crossing near miss		a	
12/2012	10/04/11	02/07/12	Detachment of a cardan shaft at Durham station	Train defects		b	
13/2012	11/07/11	05/07/12	Train departed with doors open, Warren Street, Victoria Line, London Underground	Train movement accidents involving a passenger		a	
14/2012	10/09/11	12/07/12	Incident involving a runaway track maintenance trolley near Haslemere, Surrey	Runaway incident		a	
15/2012	24/08/11	18/07/12	Fatal accident at Gipsy Lane footpath crossing, Needham Market, Suffolk	Level crossing fatality to member of public	x		
16/2012	12/06/11	06/08/12	Track worker struck by a train at Stoats Nest Junction	Staff hit by train (injury)		a	
17/2012	18/07/11	09/08/12	Container train accident near Althorpe Park, Northamptonshire	Out of gauge train collision		a	
18/2012	27/07/11	30/08/12	Derailment at Princes Street Gardens, Edinburgh	Passenger train derailment		a	
19/2012	26/08/11	19/09/12	Derailment at Bordesley Junction, Birmingham	Freight train derailment		a	
20/2012	19/12/11	27/09/12	Collision between a train and a lorry and trailer on Llanboidy automatic half barrier level crossing	Level crossing injury to member of public		a	
21/2012	20/04/11	27/09/12	Collapse of the overhead line near to Jewellery Quarter Tram Stop, Midland Metro	Collision with an obstacle		a	
22/2012	22/10/11	27/11/12	Fatal accident at James Street station, Liverpool	Train movement accidents involving a passenger	x		
23/2012	21/05/12	18/10/12	Fatal accident at Grosmont, North Yorkshire Moors Railway	Staff hit by train (fatality)	x		
24/2012	03/02/12	21/11/12	Derailment at Bletchley Junction, Bletchley	Passenger train derailment		a	
25/2012	30/11/11	21/11/12	Road vehicle incursion and subsequent collision with a train, at Stowmarket Road	Collision with an obstacle		a	
26/2012	12/04/12	03/12/12	Person trapped in a train door and dragged at Jarrow station, Tyne and Wear Metro	Train movement accidents involving a passenger		a	
27/2012	28/01/12	13/12/12	Fatality at Johnson's footpath crossing near Bishop's Stortford, Hertfordshire	Level crossing fatality to member of public		a	
28/2012	04/09/11	20/12/12	Near miss incident at Ufton Automatic Half Barrier Crossing, Berkshire	Level crossing near miss		a	

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.

Article 21(6) - a non-serious accident or incident where there is significant potential for learning safety lessons.



Table 3 – Full investigations commenced in 2012

Event date	Title of the investigation (location)	Occurrence type	Basis for investigation		
			19(1)	19(2)	21(6)
05/01/12	Investigation into an incident involving the overhead line near Littleport, Cambridgeshire	Infrastructure failure		a	
28/01/12	Investigation into a fatality at Johnson's footpath level crossing, near Bishop's Stortford, Hertfordshire	Level crossing fatality to member of public		a	
28/01/12	Investigation into a freight train derailment at Reading West Junction	Freight train derailment		a	
03/02/12	Investigation into a derailment at Bletchley Junction, Bletchley	Passenger train derailment		a	
17/02/12	Investigation into the derailment of a tram at East Croydon, South London	Passenger train derailment		a	
19/03/12	Investigation into a dangerous occurrence involving an engineering train at Blatchbridge junction, near Frome in Somerset	Train defects		a	
22/03/12	Investigation into a dangerous occurrence at Lindridge Farm, near Bagworth in Leicestershire	Level crossing near miss		b	
25/03/12	Investigation into the collision of a road-rail vehicle with a buffer stop at Bradford Interchange station	Runaway incident		a	
12/04/12	Investigation into a person trapped in a train door and dragged at Jarrow station, Tyne and Wear Metro	Train movement accidents involving a passenger		a	
26/04/12	Investigation into a Signal passed at danger (SPAD), near Stafford	Signal Passed at Danger (SPAD)		a	
02/05/12	Investigation into a fatal accident at Kings Mill No1 bridleway crossing, Mansfield	Level crossing fatality to member of public		a	
16/05/12	Investigation into an accident at Sandilands tram stop, Croydon	Train movement accidents involving member of public		a	
21/05/12	Investigation into a fatal accident at Grosmont, North Yorkshire Moors Railway	Staff hit by train (fatality)	x		
28/06/12	Train runs over washed-out track formation at Knockmore, Northern Ireland	Infrastructure failure		a	
28/06/12	Accidents due to landslides at Loch Treig (near Tulloch), Falls of Cruachan, Rosyth and St Bees during the summer of 2012	Infrastructure failure	x		
07/07/12	Derailment of a freight train at Shrewsbury	Freight train derailment		a	
16/07/12	Near miss involving track workers at Roydon, Essex	Staff hit by train (near miss)		a	
06/08/12	Track worker struck by train at Bulwell, Nottingham	Staff hit by train (Injury)		a	
10/08/12	Collision between on-track machines near Arley, Warwickshire	Collision with other train		a	
14/09/12	Broken rail incidents on the East Coast Main Line	Infrastructure failure		b	
28/10/12	Engineering possession irregularity near Dunblane, Stirling	Possession <sup>9</sup> irregularity		a	
24/11/12	Serious accident at Charing Cross (main line) station, London	Train movement accidents involving a passenger		a	
28/11/12	Serious accident at Bayles and Wylies footpath crossing, Bestwood, Nottingham	Level crossing fatality to member of public	x		
04/12/12	Fatal accident at Beech Hill level crossing	Level crossing fatality to member of public	x		
04/12/12	Fatal accident involving a track worker at Saxilby	Staff hit by train (fatality)	x		
27/12/12	Derailment of a freight train at Barrow upon Soar, Leicestershire	Freight train derailment		b	

Table 4 – List of investigations opened in 2011 but not completed by 31.12.2012

Event date	Title of the investigation (location)	Occurrence type	Basis for investigation		
			19(1)	19(2)	21(6)
23/09/11	Investigation into the partial failure of a structure inside Balcombe tunnel, Sussex	Infrastructure failure		a	

Summary details of open investigations can be found at [www.raib.gov.uk](http://www.raib.gov.uk) in the section called current investigations register under the publications area.

<sup>9</sup> See Glossary of terms.

## 2 Operational Activity 2012

### Bulletins

Normally, when the RAIB deploys inspectors to the site of an accident or incident, it is to conduct a preliminary examination of the circumstances and key evidence. In some instances, on the basis of a review of this information, the RAIB concludes that further investigation by the RAIB would be unlikely to result in the formal recommendations for the improvement of safety. However, sometimes, more general safety lessons are identified where the RAIB believes that it would be beneficial to make these widely known across the industry, and Bulletins are used for this.

During 2012, the RAIB published five Bulletins on its website.

The Bulletins covered:

- two derailments;
- two accidents to staff - a member of staff was seriously injured while carrying out shunting work; and a track worker was struck by a passing train (suffering minor injuries); and
- one train defect – blowback of a steam locomotive fire, three staff injured.

### Urgent safety advice

In addition, the RAIB can issue urgent safety advice at any stage during an investigation when it believes that 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 the European Rail Agency (ERA) via their safety information system (SIS); this action alerts all member states of the advice. During 2012 the RAIB issued urgent safety advice on two occasions, as follows:

Table 5 – Urgent safety advice by the RAIB in 2012

Incident date	Incident	Date of USA	Urgent Safety Advice	Date sent to ERA SIS
17/02/12	Derailment of tram at facing points	01/03/12	Tram operators should ensure that the vehicles they operate are maintained in a condition that will ensure continued compatibility with the signalling system.	UK specific - not sent to ERA.
21/05/12	Fatal accident at Grosmont, North Yorkshire Moors Railway	01/06/12	Operators of steam locomotives fitted with screw reversers should remind their staff about the risks associated with the unintended movement of the reverser while the locomotive is in motion, and the control measures in place to prevent this.  Operators should also remind all staff involved in shunting operations that they should not go between vehicles until the vehicles are a safe distance apart; are at a stand; secured; and the shunter has reached a clear understanding with the driver about what they are doing.	UK specific - not sent to ERA.



### 3. Operational experience - Summary of incidents and accidents investigated by the RAIB (2008 – 2012)

#### Classification of accidents and incidents that have to be notified to the ERA

The RAIB has a duty to investigate and to report to the 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 United Kingdom. To assist this process, the ERA provides guidance on the decision to investigate accidents and incidents, to promote consistent categorisation and reporting to the ERA. The RAIB uses this to classify its investigations according to the Directive Articles 19(1), 19(2), and 21(6) (see Table 2 for more detail).

The following table (Table 6) shows the breakdown of accidents and incidents that the RAIB has investigated between 2008 and 2012. The figures have been collated according to the date of occurrence and not publication of the report.

Table 6 – Investigations by category sorted by Article 19(1), 19(2), and 21(6)<sup>10</sup>

Basis for Investigations by the European Railway Safety Directive category	2008	2009	2010	2011	2012	TOTAL
Art 19(1)	6	4	1	4	4	19
Art 19(2)	21	13	16	23	22	95
Art 21(6)	2	3	1	0 <sup>11</sup>	0	6
<b>Total</b>	<b>29</b>	<b>20</b>	<b>18</b>	<b>27</b>	<b>26</b>	<b>120</b>

The bar charts 1 to 5, on the following pages, show the total number of investigations carried out by the RAIB; the total broken down by the type of accident and railway for the 5 year period 2008 to 2012<sup>12</sup>.

<sup>10</sup> Figures do not include four class investigations (which address more general safety issues).

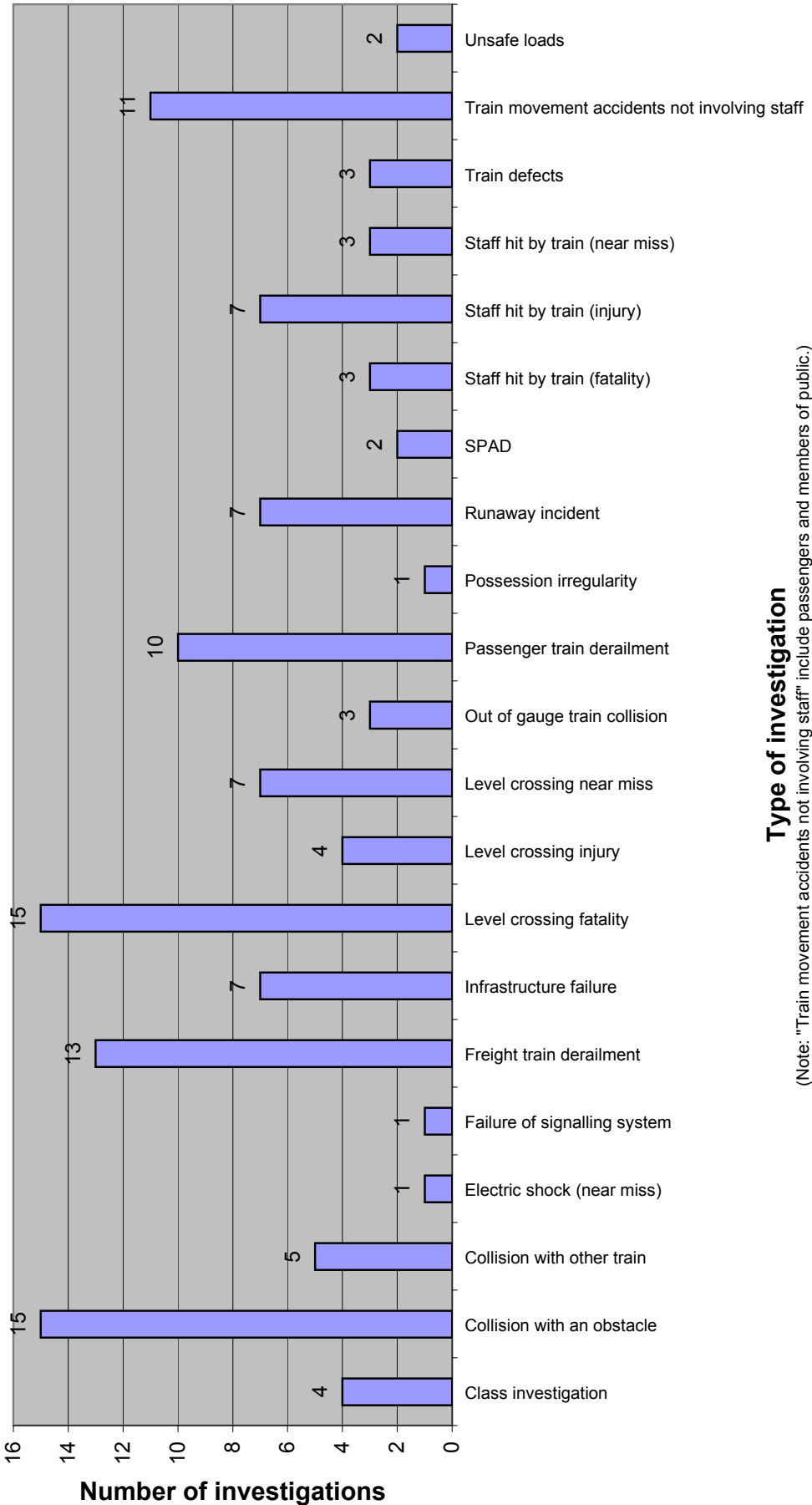
<sup>11</sup> In 2008 the ERA widened the scope of the Directive to include tramways and heritage. Since then, the RAIB has categorised all accidents and incidents according to Article 19(i) or 19(ii).

<sup>12</sup> Figures include 4 class investigations.

3

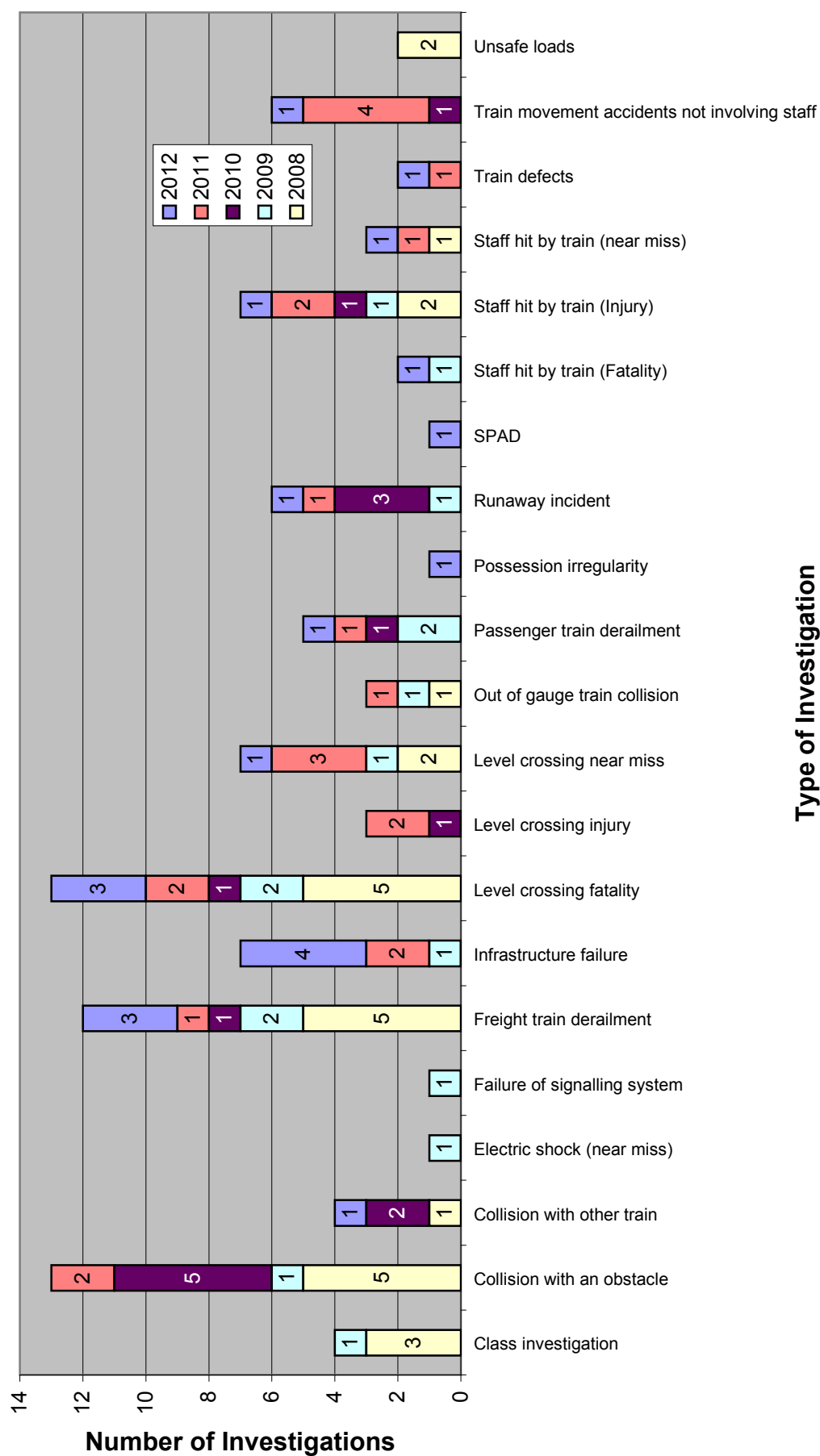
Operational experience

Chart 1 - Types of incidents/accidents investigated 2008 - 2012



**Type of investigation**  
(Note: "Train movement accidents not involving staff" include passengers and members of public.)

Chart 2 - Types of incidents/accidents investigated on National Networks 2008 - 2012

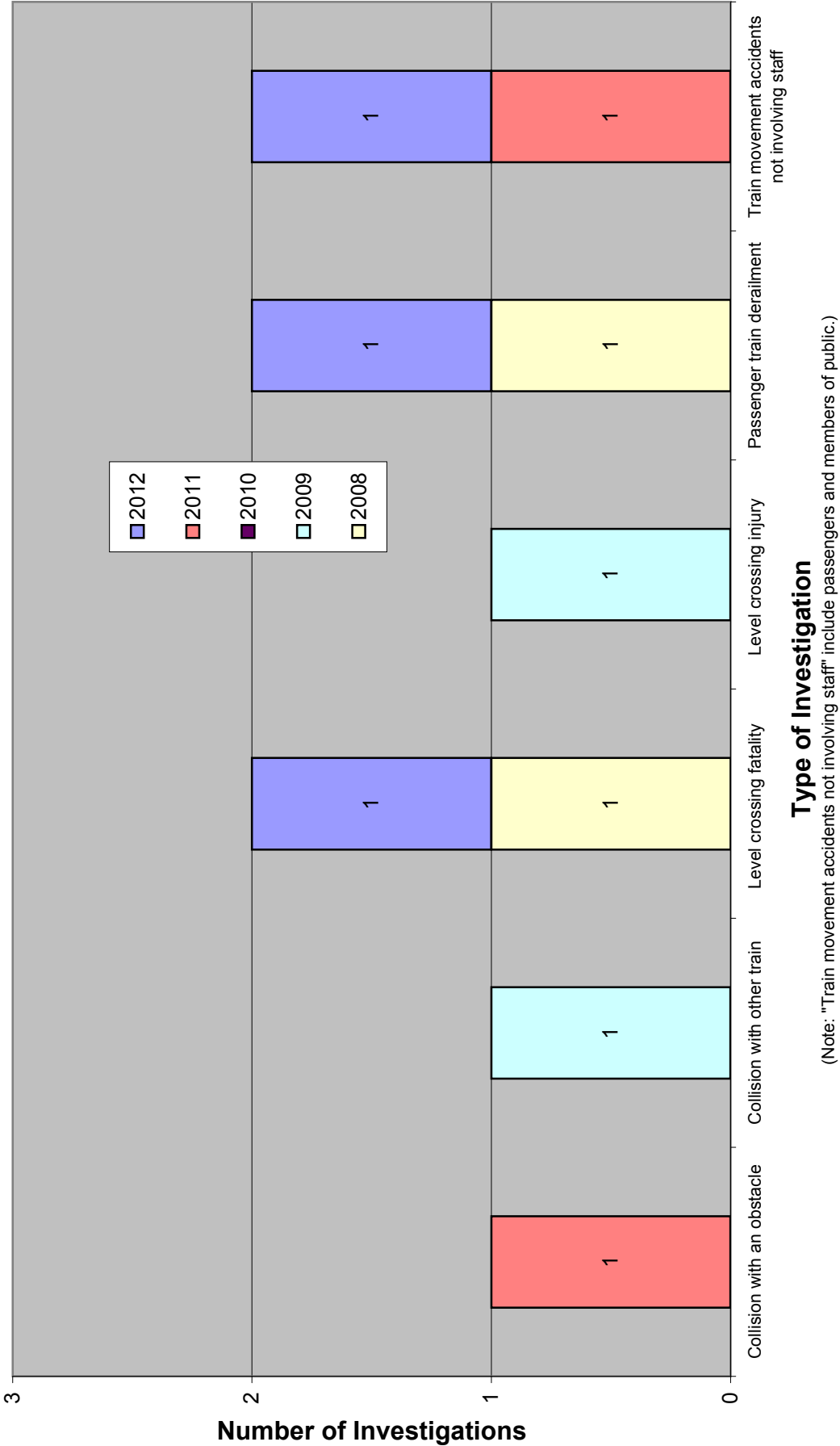
**Type of Investigation**

(Note: "Train movement accidents not involving staff" include passengers and members of public.)

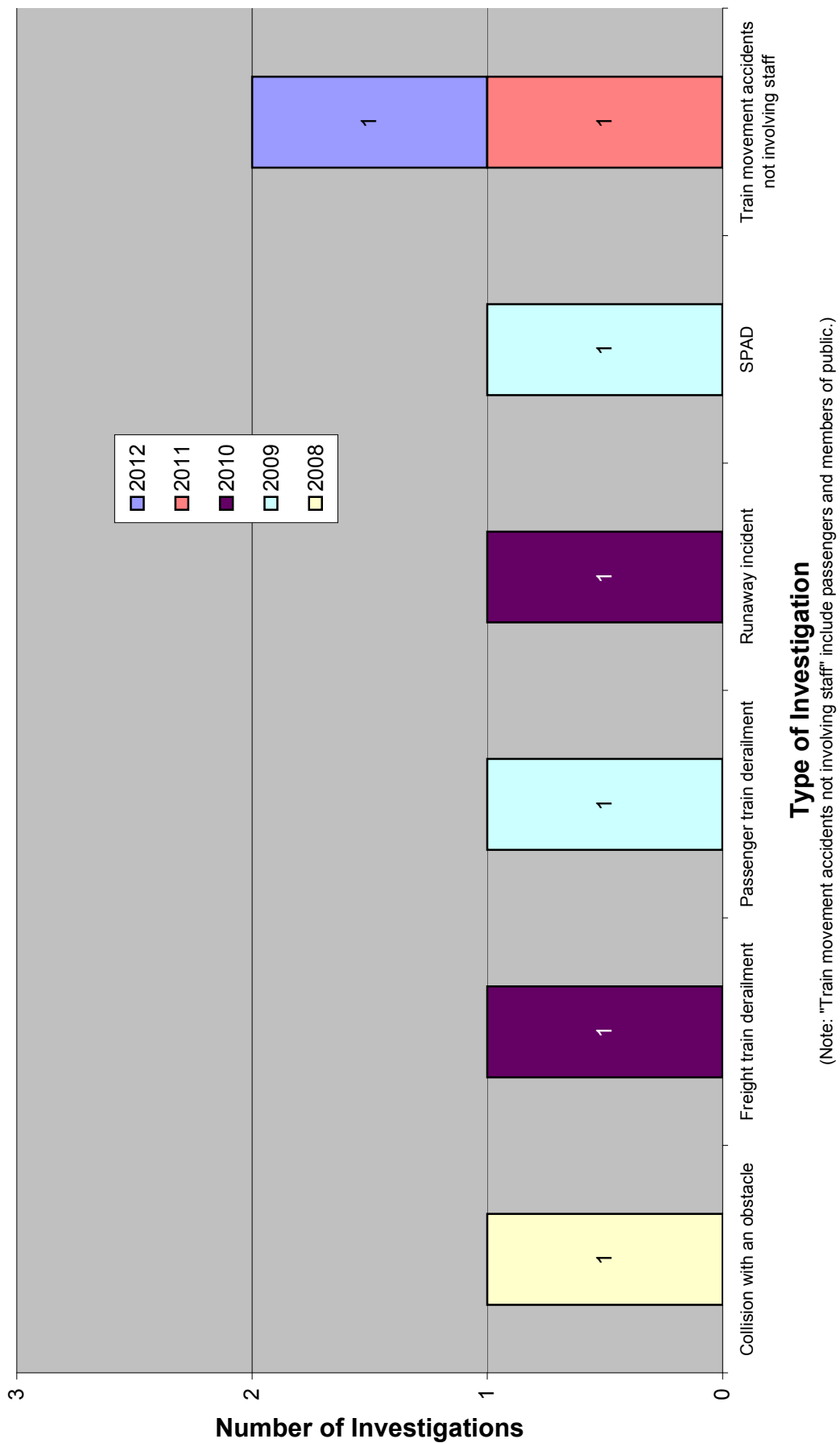
3

Operational experience

Chart 3 - Types of incidents/accidents investigated on Light Rail Systems 2008 - 2012



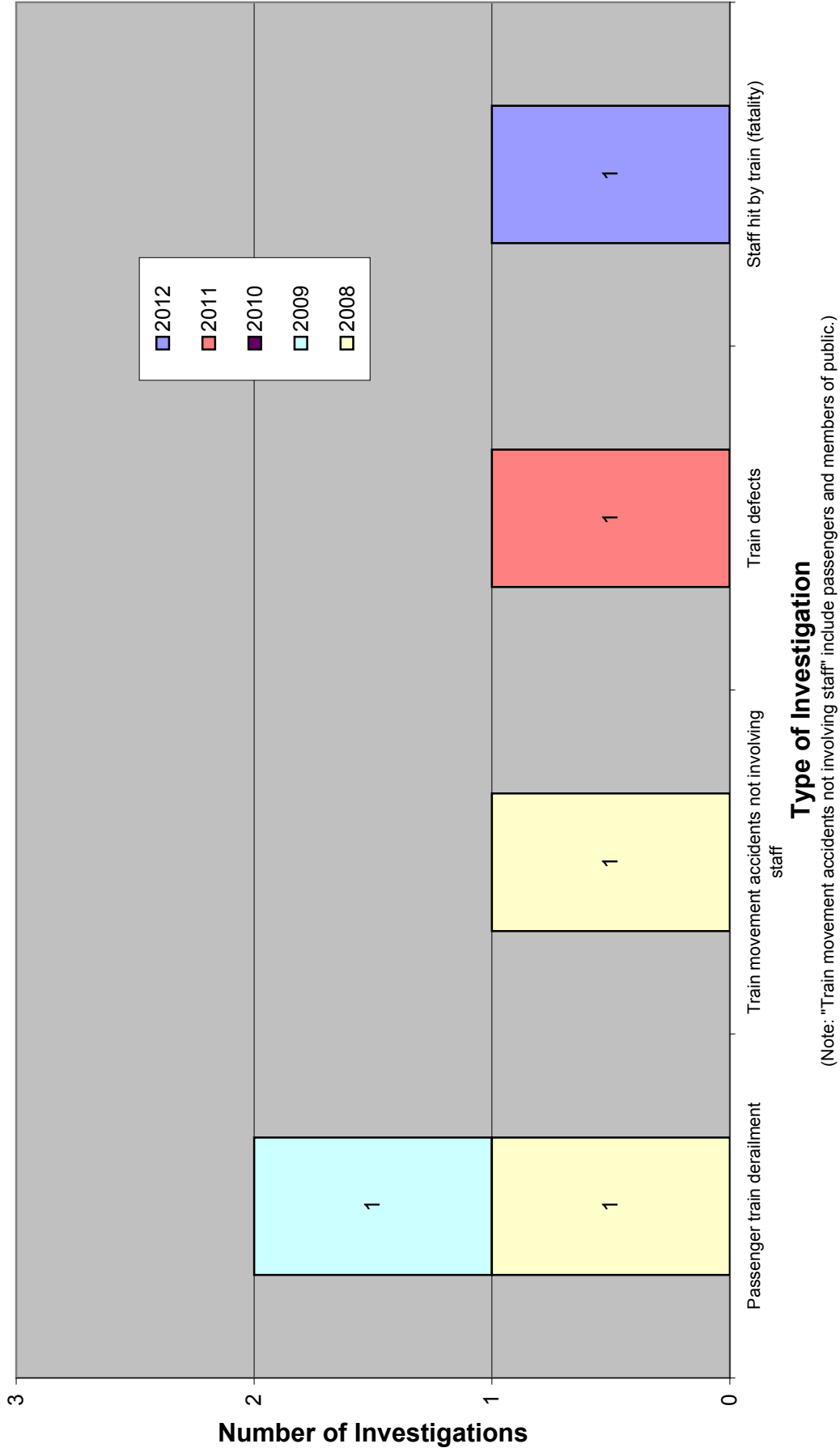
**Chart 4 - Types of incidents/accidents investigated on Metros 2008 - 2012**



3

Operational experience

Chart 5 - Types of incidents/accidents on Heritage Railways 2008 - 2012



## 4. Recommendations

Recommendations are the prime output of the RAIB's investigations in improving safety as required by the [Directive](#) and the [Regulations](#)<sup>13</sup>. The recommendations are addressed to the appropriate safety authority<sup>14</sup>, and to other public bodies where they are the end implementer.

The purpose of addressing the recommendation in this way is so that the safety authority can ensure that the organisations to which the recommendations are made properly consider the recommendations, and where appropriate act on them. The Regulations give the safety authority 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 the RAIB, at a period not exceeding 12 months<sup>15</sup>, of the measures taken, or the reasons why no implementation measures are being taken.

The RAIB has no role or statutory powers to follow up on the implementation of recommendations, unless it is necessary to do so as part of a subsequent investigation. However, the RAIB's Annual Report provides an opportunity for the RAIB to share its views on responses to recommendations.

This section provides an overview of the status of recommendations made by the RAIB. It is compiled from information provided to the RAIB by the ORR, other safety authorities, or other public bodies, and the categories used are based on the following ORR descriptors:

- Implemented - meaning that all associated actions to deliver the recommendation have been completed.
- Implemented by alternative means – the intent of the recommendation has been satisfied in a way that was not identified by the RAIB during the investigation.
- Implementation ongoing – work to deliver the intent of the recommendation has been agreed and is in the process of being delivered.
- In-Progress - meaning a timeframe for delivering the recommendation has been agreed with the ORR and work is in progress.
- Non-implementation - meaning that no measures will be taken to implement the recommendation.
- Awaiting Response – meaning awaiting initial response from ORR on the status of the recommendation.

Between 1 January 2008 and 31 December 2012, the RAIB made a total of 678 recommendations. The following table provides a summary of the status.

<sup>13</sup> The European Railway Safety Directive (2004/49/EC) and Railways (Accident Investigation and Reporting) Regulations 2005.

<sup>14</sup> The safety authority is the safety regulator; for the mainland UK this is primarily the Office of Rail Regulation (ORR) although there are some recommendations made by the RAIB where the Health and Safety Executive (HSE) has been the safety authority (for accidents occurring that were not attributed to the railway and are investigated under the Health and Safety at Work etc Act 1974); for the Channel Tunnel it is the Inter Governmental Commission and for Northern Ireland it is the Department for Regional Affairs.

<sup>15</sup> In accordance with Regulation 12(2)(b) of the Railways (Accident Investigation and Reporting) Regulations 2005.

## 4

## Recommendations

Table 7 – Recommendation implementation status per year

Recommendations issued		Awaiting Response		In-Progress		Implementation ongoing		Implemented by alternative means		Implemented		Non-implementation	
Year	Nos	Nos	%	Nos	%	Nos	%	Nos	%	Nos	%	Nos	%
2008	181	0	0%	4	2%	1	1%	2	1%	169	93%	5	3%
2009	196	1	1%	25	13%	0	0%	0	0%	162	83%	8	4%
2010	98	12	12%	16	16%	3	3%	0	0%	66	67%	1	1%
2011	93	2	2%	31	33%	8	9%	0	0%	52	56%	0	0%
2012	110	108	98%	0	0%	1	1%	0	0%	1	1%	0	0%
<b>TOTAL</b>	<b>678</b>	<b>123</b>	<b>18%</b>	<b>76</b>	<b>11%</b>	<b>13</b>	<b>2%</b>	<b>2</b>	<b>0%</b>	<b>450</b>	<b>66%</b>	<b>14</b>	<b>2%</b>

Further details of the recommendations where a change of status has been reported to the RAIB during 2012 are detailed in Part 2 of this report.

In the 28 reports published in 2012, the RAIB made a total of 110 recommendations; the average number of recommendations per report is approximately 4. The majority of the recommendations made in 2012 were targeted at the following organisations (in some cases they were made to more than one implementer):

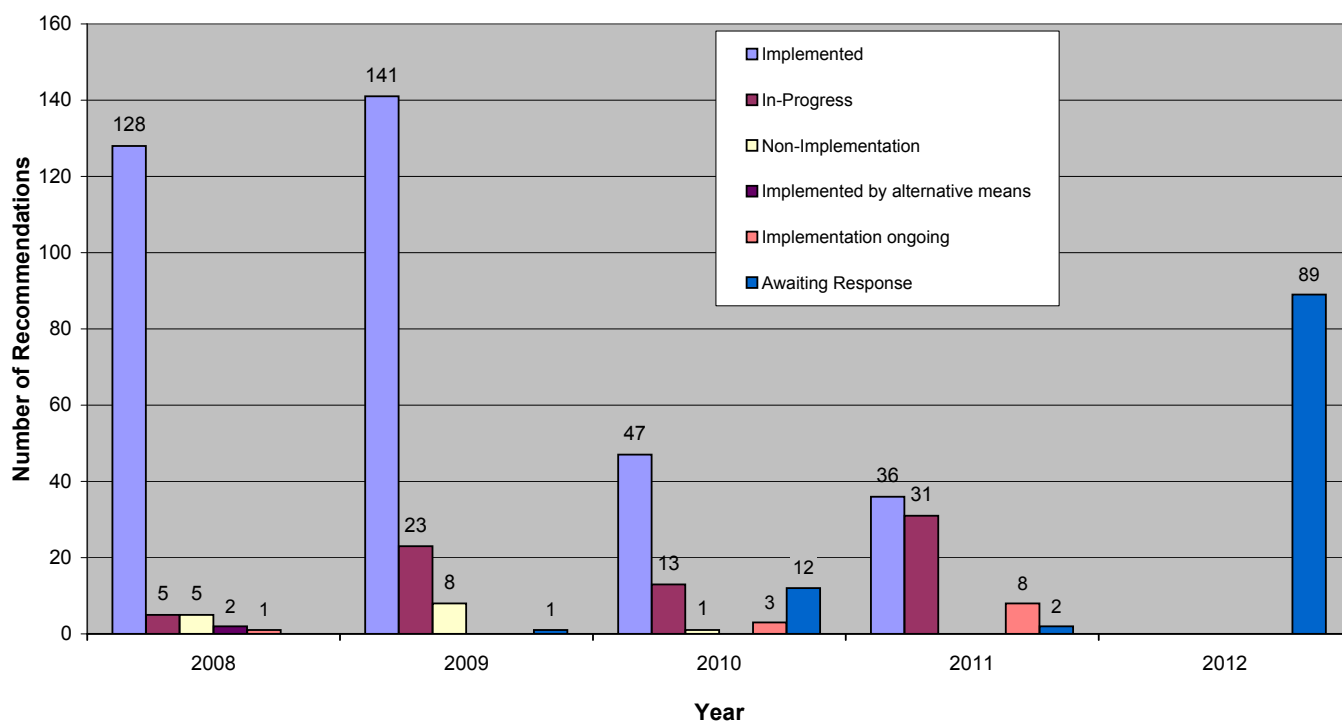
- Network Rail (52).
- Main line passenger and freight train operators (13).
- London Underground Ltd (4).
- Other Public Bodies (6).
- Rail Safety and Standards Board (5).
- Manufacturers (3).

The number of accidents investigated and the number of recommendations made should not be taken as an indicator for assessing the safety of the UK railways. There is no way to assess how many incidents/accidents have been avoided as a result of the actions taken. The statistical data on UK's railway safety is published by the ORR on its website. These statistics can be found at: <http://dataportal.orr.gov.uk>.

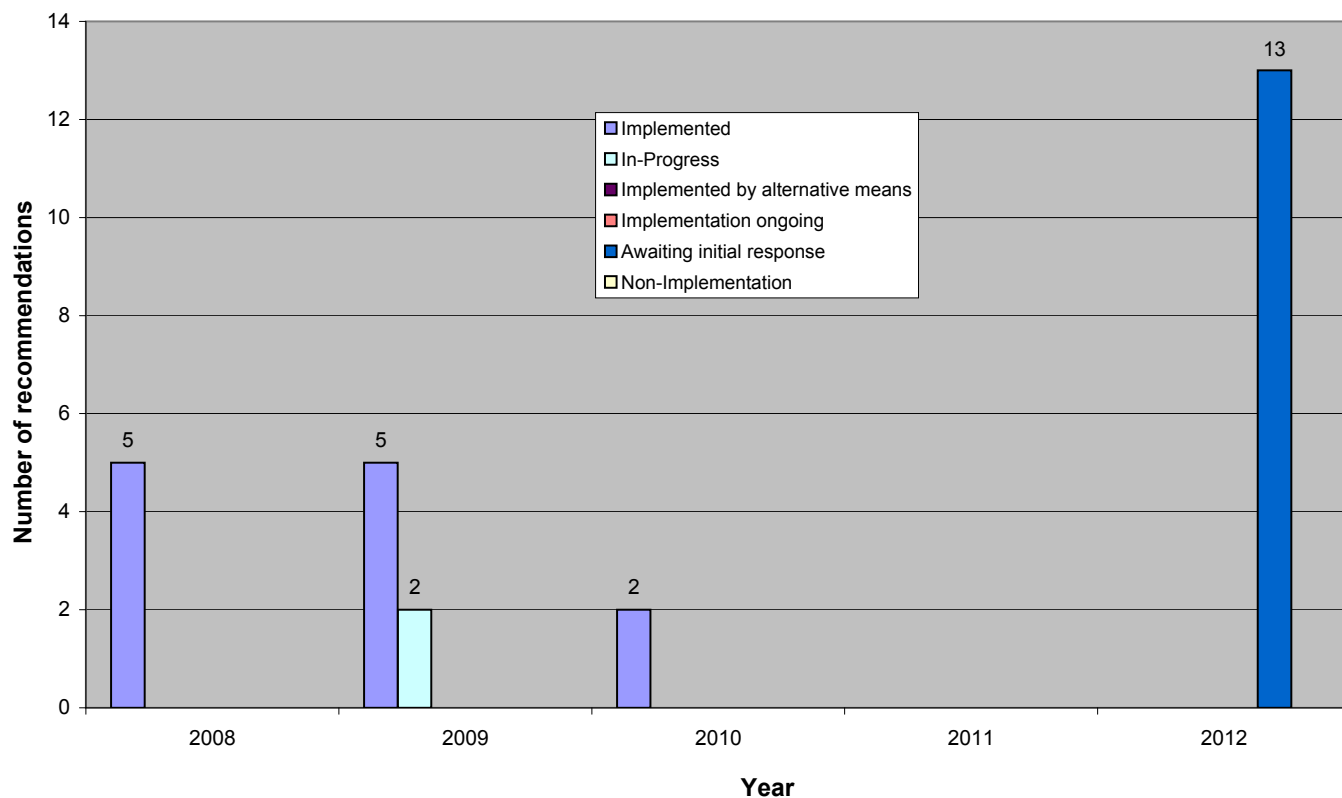
Charts 6 to 10, on the following pages, show the number of recommendations made in RAIB reports to the main rail sectors.



**Chart 6 - National Network recommendation implementation status**



**Chart 7 - Light Rail recommendation implementation status**



## 4

## Recommendations

Chart 8 - Heritage recommendation implementation status

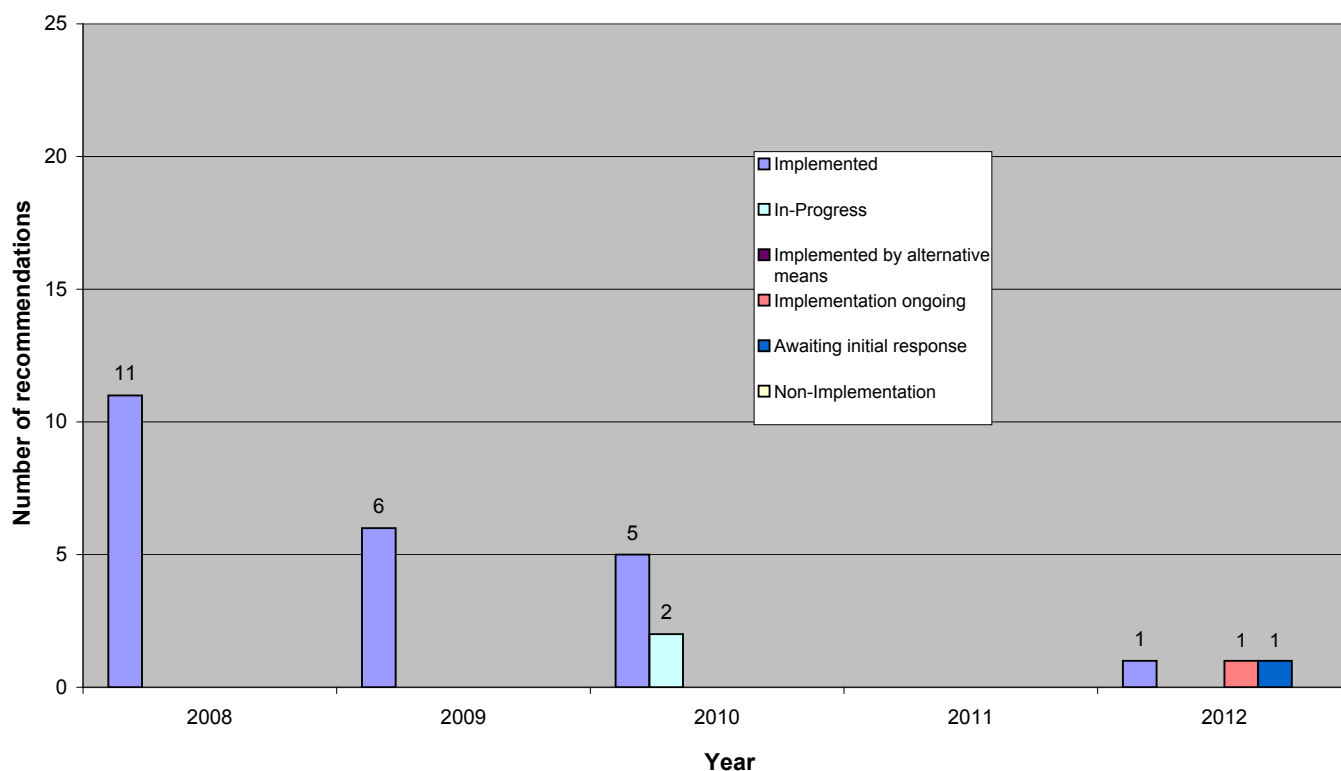
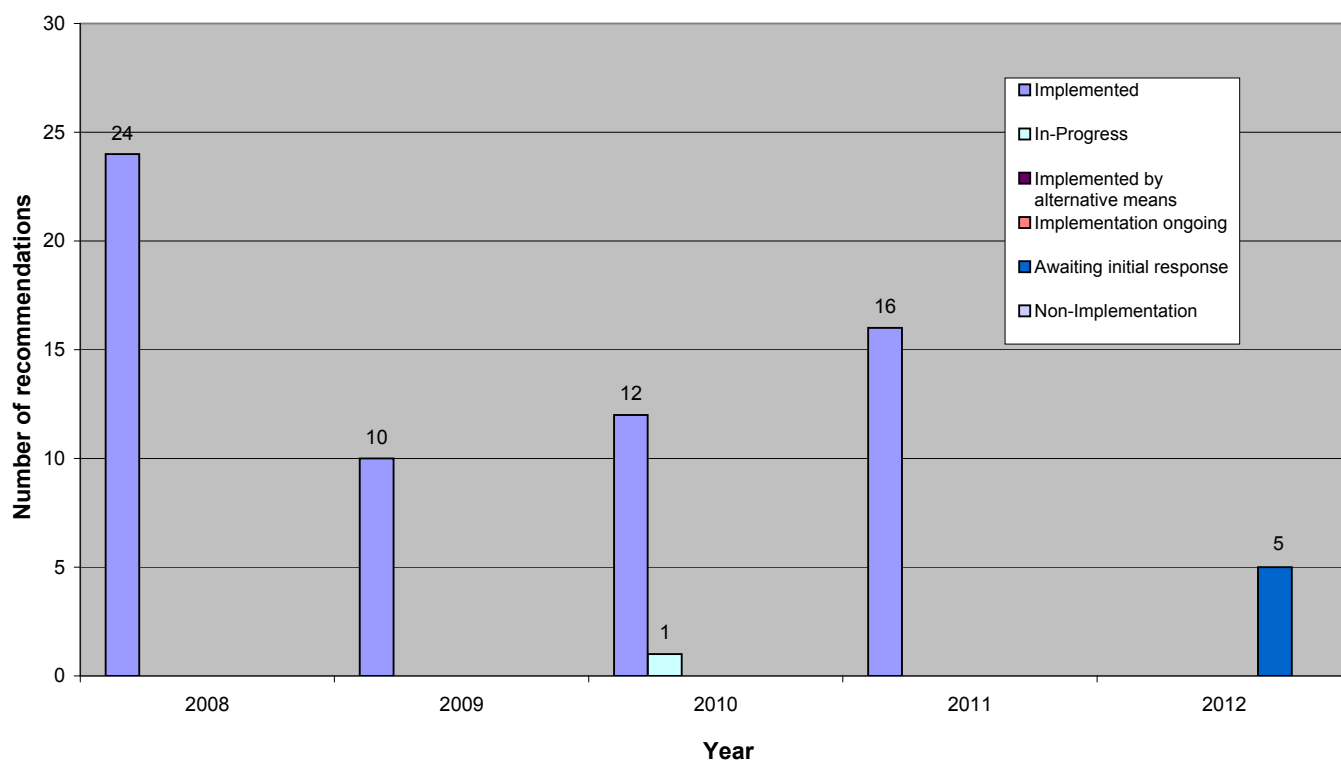
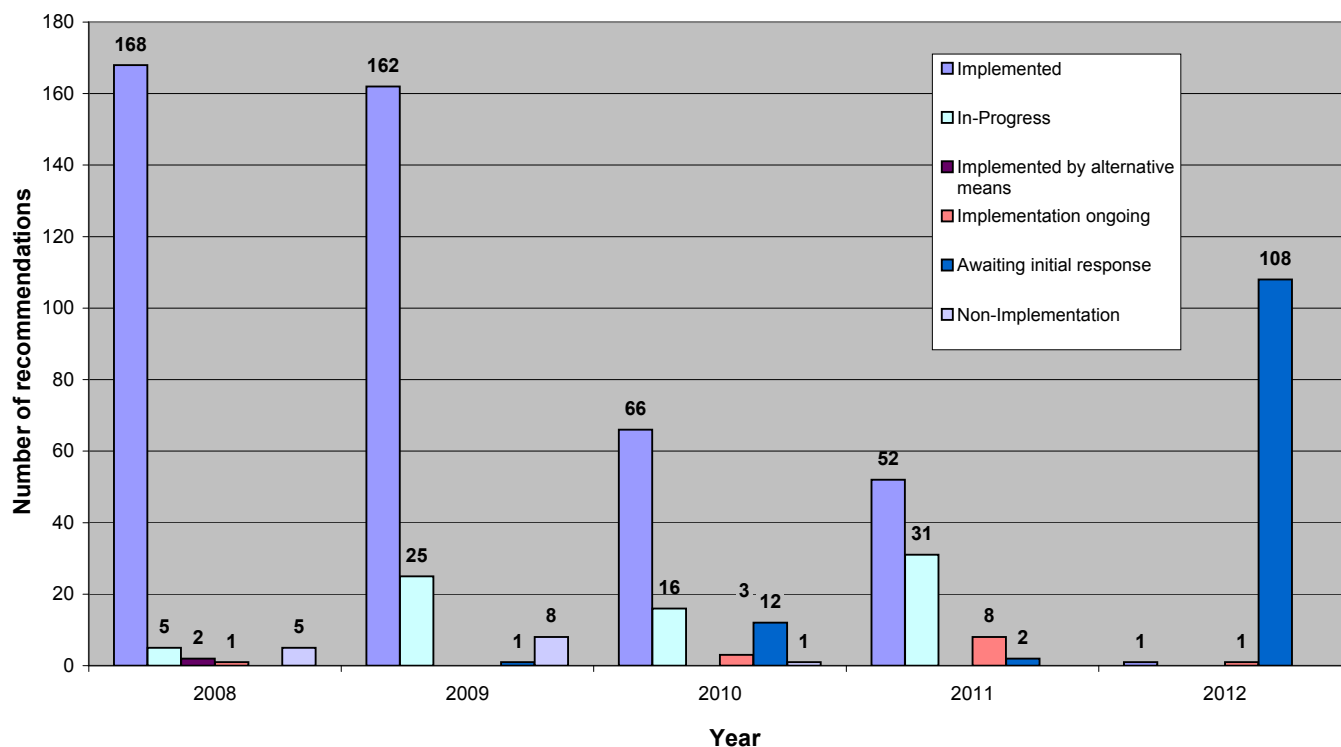


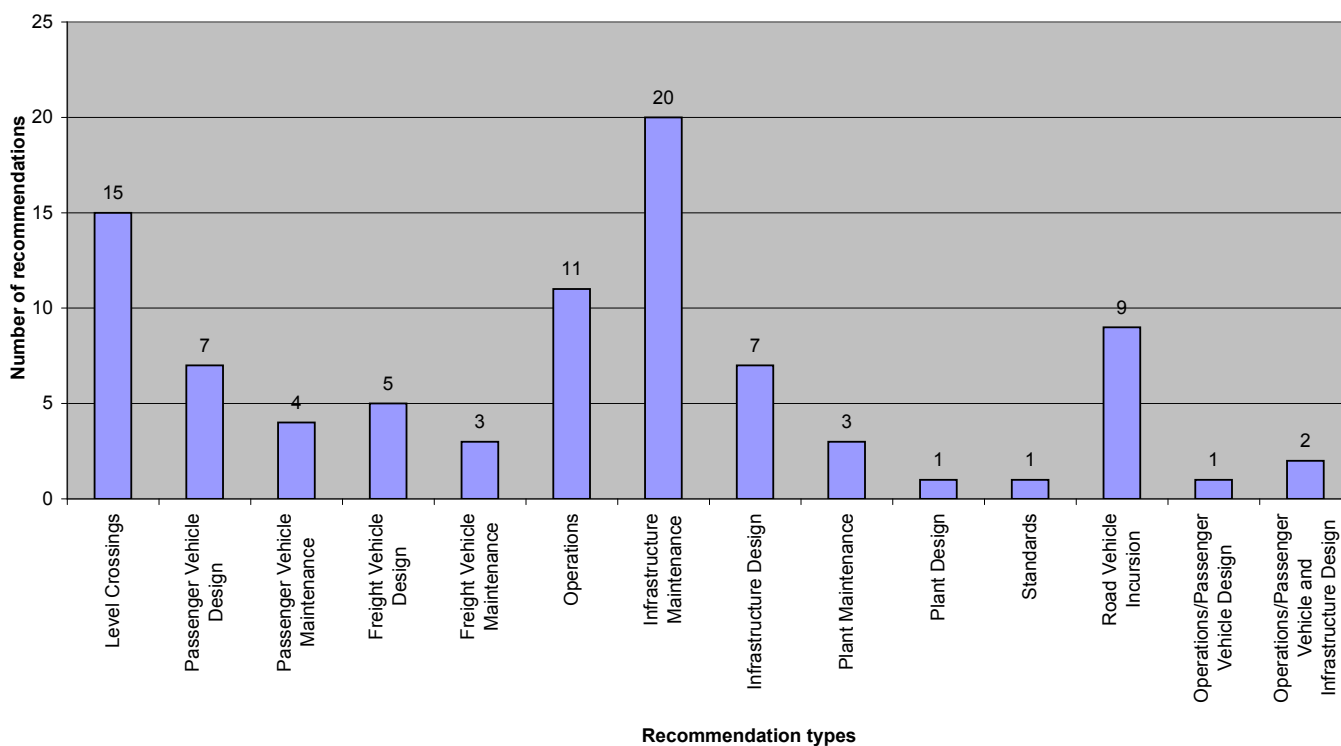
Chart 9 - Metro recommendation implementation status



**Chart 10 - All railway type recommendation implementation status**



**Chart 11 - Types of recommendations made to National Networks in 2012 (Network Rail, Northern Ireland and Channel Tunnel)**



## 5 Identification of important recurrent issues

### 5. Identification of important recurrent issues

Statistics in this section relate to investigations started and reports published between 17 October 2005 (the date that the RAIB became operational) and 31 December 2012. The areas of recommendations highlighted in this section are those which have featured in the RAIB investigation reports that were published during 2012.

Details of the actions taken by the railway industry are primarily based on reports provided by the ORR during 2012.

Throughout this section the RAIB reports are referred to as follows:

*two digit report number/year of publication; location of event*

A full listing of RAIB reports, giving dates of occurrence and the full title is to be found at: [www.raib.gov.uk](http://www.raib.gov.uk).

#### Recurrent themes

Shown in Table 8 are some of the most important recurrent issues identified in the RAIB investigation reports to date and details of recurrences during 2012. The table shows for each theme:

- the number of investigations published before 2012;
- the number of investigations published during 2012 and their titles; and
- the number of investigations ongoing at 31 December 2012 and their titles.

All named investigations have taken place on the national network (N) unless indicated thus:

- (U) London Underground.
- (L) Light rail/tramway.
- (H) Heritage sector (and other minor railways).
- (I) Northern Ireland.
- (M) Metro.

Themes that are highlighted in yellow in Table 8 are of particular interest to the RAIB and are discussed in more detail in the text that follows. These themes have been selected for one or more of the following reasons:

- there are major risk implications [level crossings, track worker safety, platform/train interface];
- there have been some significant events [earthworks];
- factors that have been identified previously have recurred and are still of concern to the RAIB [level crossings, track worker safety, freight trains, track, structures];
- important new information has been provided to the RAIB [switches and crossings, heritage sector]; and
- it is judged to be an emerging theme [stranded trains].

Table 8 – Summary of some recurrent safety themes in RAIB investigations between October 2005 and the end of 2012

RECURRENT THEMES	No. of reports published before 2012 N = National Networks L = Light Rail H = Heritage U = Underground I = Northern Ireland M = Metro	No. of reports published during 2012	Report reference (bulletins shown in italics)	No. of investigations ongoing at 31 Dec. 2012	Details of investigations ongoing at 31 Dec. 2012 (bulletins shown in italics)
<b>Level crossings</b>	Level Crossing N = 20 (+ 2 class investigations + 2 bulletins) L = 3 H = 3 (+ 1 bulletin) I = 1 <b>Total = 32</b>	7	Collision between a train and tractor at White House Farm User Worked Crossing, RAIB report 06/2012. Fatal accident at Mexico footpath crossing (near Penzance) RAIB report 10/2012. Incident at Llanbadarn Automatic Barrier Crossing (Locally Monitored), near Aberystwyth, RAIB report 11/2012. Fatal accident at Gipsy Lane footpath crossing, Needham Market, Suffolk, RAIB report 15/2012. Collision between a train and a lorry and trailer on Llanboidy automatic half barrier level crossing, RAIB report 20/2012. Fatal accident at a footpath crossing near Bishop's Stortford, RAIB report 27/2012. Near miss incident at Ufton automatic half barrier level crossing, Berkshire, RAIB report 28/2012.	4 (+1 bulletin)	Investigation into a dangerous occurrence at Lindridge Farm, near Bagworth in Leicestershire, RAIB Report 11/2013. Fatal accident at Kings Mill No.1 level crossing, Mansfield, RAIB report 01/2013. <i>Near-miss at Four Lane Ends level crossing, near Burscough Bridge Lancashire, RAIB bulletin B01/2013.</i> Fatal accident at Bayles and Wylies footpath crossing, Bestwood, Nottingham 28/11/12 (L). Fatal accident at Beech Hill level crossing near Finningley 04/12/12.
<b>Risk management and inspection at level crossings</b>	N = 16 (+ 1 class investigation+ 1 bulletin) H = (1bulletin) <b>Total = 19</b>	2	Fatal accident at Gipsy Lane footpath crossing, Needham Market, Suffolk, RAIB report 15/2012. Fatal accident at a footpath crossing near Bishop's Stortford, RAIB report 27/2012.	1	Fatal accident at Kings Mill No.1 level crossing, Mansfield, RAIB report 01/2013.

## Identification of important recurrent issues

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## 5

## Identification of important recurrent issues

RECURRENT THEMES	No. of reports published before 2012 N = National Networks L = Light Rail H = Heritage U = Underground I = Northern Ireland M = Metro	No. of reports published during 2012	Report reference (bulletins shown in italics)	No. of investigations ongoing at 31 Dec. 2012	Details of investigations ongoing at 31 Dec. 2012 (bulletins shown in italics)
Error by signaller or crossing keeper at level crossings	N = 4 (+ 1 bulletin) H = 1 <b>Total = 6</b>	3	Collision between a train and tractor at White House Farm User Worked Crossing, RAIB report 06/2012. Incident at Llanbadarn Automatic Barrier Crossing (Locally Monitored), near Aberystwyth, RAIB report 11/2012. Near miss incident at Ufton automatic half barrier level crossing, Berkshire, RAIB report 28/2012.	(+1 bulletin)	<i>Near-miss at Four Lane Ends level crossing, near Burscough Bridge Lancashire, RAIB bulletin B01/2013.</i>
Unintentional misuse/error by level crossing users	N = 11 (+ 1 class investigation) L = 2 I = 1 <b>Total = 15</b>	4	Collision between a train and tractor at White House Farm User Worked Crossing, RAIB report 06/2012. Fatal accident at Mexico footpath crossing (near Penzance) RAIB report 10/2012. Fatal accident at Gipsy Lane footpath crossing, Needham Market, Suffolk, RAIB report 15/2012. Fatal accident at a footpath crossing near Bishop's Stortford, RAIB report 27/2012.	3	Fatal accident at Kings Mill No.1 level crossing, Mansfield, RAIB report 01/2013. Fatal accident at Bayles and Wylies footpath crossing, Bestwood, Nottingham on 28/11/12. Fatal accident at Beech Hill level crossing near Finningley on 04/12/12.
Road vehicle incursions	N = 4 (+ 1 bulletin) <b>Total = 5</b>	1	Road vehicle incursion and subsequent collision with a train, at Stowmarket Road, Suffolk, RAIB report, 25/2012.	0	

RECURRENT THEMES	No. of reports published before 2012 N = National Networks L = Light Rail H = Heritage U = Underground I = Northern Ireland M = Metro	No. of reports published during 2012	Report reference (bulletins shown in italics)	No. of investigations ongoing at 31 Dec. 2012	Details of investigations ongoing at 31 Dec. 2012 (bulletins shown in italics)
Staff working on lines that are still open to traffic (Red Zone working)	N = 9 L = 1 Total = 10	(+1 bulletin)	<i>Track worker struck by passing train near North Kent East Junction, RAIB bulletin B01/2012.</i>	2	Near miss involving track workers at Roydon, Essex, RAIB Report 07/2013. Track worker struck by a train at Bulwell, Nottingham on 6/08/12.
Work activities in and around an engineering possession (including train movements)	N = 6 (+ 1 bulletin) Total = 7	3	Tamper driver struck by a train at Tonworth level crossing, RAIB report 02/2012. Two incidents involving track workers between Clapham Junction and Earlsfield, RAIB report 03/2012. Track worker struck by a train at Stoats Nest Junction, RAIB report 16/2012.	2	Fatal accident involving a track worker at Saxilby, Lincolnshire on 04/12/12. Dangerous occurrence involving engineering possession, near Dunblane, RAIB report 05/2013.
Safety of track workers, safety leadership and the supervision of track workers	N = 15 (+ 1 bulletin) L = 1 Total = 17	2 (+1 bulletin)	Two incidents involving track workers between Clapham Junction and Earlsfield, RAIB report 3/2012. Track worker struck by a train at Stoats Nest Junction, RAIB report 16/2012. <i>Track worker struck by passing train near North Kent East Junction, RAIB bulletin B01/2012.</i>	2	Near miss involving two track workers at Roydon, Essex, RAIB Report 07/2013. Fatal accident involving a track worker at Saxilby, Lincolnshire on 04/12/12.

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## Identification of important recurrent issues

RECURRENT THEMES	No. of reports published before 2012 N = National Networks L = Light Rail H = Heritage U = Underground I = Northern Ireland M = Metro	No. of reports published during 2012	Report reference (bulletins shown in italics)	No. of investigations ongoing at 31 Dec. 2012	Details of investigations ongoing at 31 Dec. 2012 (bulletins shown in italics)
<b>Track quality, maintenance &amp; inspection</b>	N = 13 L = 4 H = 3 I = 1 U = 1 <b>Total 22</b>	1	Derailed at Bordesley Junction, Birmingham, RAIB report 19/2012.	2	Freight train derailment at Reading West Junction, RAIB report 02/2013. Broken rail incidents on the East Coast Main Line on 14/09/12.
<b>Switches and crossings (S&amp;C)</b>	N = 4 (+ 2 bulletins) L = 4 H = 2 U = 1 <b>Total = 13</b>	1	Derailed at Princes Street Gardens, Edinburgh, RAIB report 18/2012.	1	Derailed of a freight train at Shrewsbury, RAIB Report 08/2013.
<b>Road rail vehicles</b>	N = 3 I = 1 <b>Total = 4</b>	0		1	Investigation into the collision of a road-rail vehicle with a buffer stop at Bradford Interchange station, RAIB Report 09/2013.
<b>Use of trolleys</b>	N = 2 (+ 1 bulletin) I = (+ 1 bulletin) U = 2 <b>Total = 6</b>	1	Incident involving a runaway track maintenance trolley near Haslemere, Surrey, RAIB report 14/2012.	0	
<b>Defective freight wagons/load and train preparation</b>	N = 15 (+ 4 bulletins) <b>Total = 19</b>	2	Container train accident near Althorpe Park, Northamptonshire, RAIB report 17/2012. Derailed at Bordesley Junction, Birmingham, RAIB report 19/2012.	2	Investigation into the derailment of a container train at Reading West Junction, RAIB report 02/2013. Investigation into a dangerous occurrence involving an engineering train at Blatchbridge Junction, near Frome in Somerset, RAIB report 15/2013.



RECURRENT THEMES	No. of reports published before 2012 N = National Networks L = Light Rail H = Heritage U = Underground I = Northern Ireland M = Metro	No. of reports published during 2012	Report reference (bulletins shown in italics)	No. of investigations ongoing at 31 Dec. 2012	Details of investigations ongoing at 31 Dec. 2012 (bulletins shown in italics)
Runaway trains (excluding RRVs and trolleys)	N = 5 L = 1 (+ 1 bulletin) H = (1 bulletin) U = 1 <b>Total = 9</b>	0		0	
Fatigue	N = 7 <b>Total = 7</b>	1	Two incidents involving track workers between Clapham Junction and Earlsfield, RAIB report 3/2012.	0	
Low adhesion	N = 3 (+ 1 bulletin) H = 1 <b>Total = 5</b>	0		0	
Safety management, compliance with rules and asset management on heritage and other minor railways	H = 8 (+ 4 bulletin) <b>Total = 12</b>	1	Boiler incident on the Kirklees Light Railway, RAIB report 4/2012 (H).	1	Signal passed at danger (SPAD), near Stafford, RAIB report 16/2013 (H).

## 5

## Identification of important recurrent issues

RECURRENT THEMES	No. of reports published before 2012 N = National Networks L = Light Rail H = Heritage U = Underground I = Northern Ireland M = Metro	No. of reports published during 2012	Report reference (bulletins shown in italics)	No. of investigations ongoing at 31 Dec. 2012	Details of investigations ongoing at 31 Dec. 2012 (bulletins shown in italics)
<b>Accidents involving passengers and moving trains at stations (Platform Train interface)</b>	N = 2 (+ 1 bulletin) L = 1 U = 1 <b>Total = 5</b>	4	Person trapped in doors and pulled along platform at King's Cross station, London, RAIB report 09/2012. Train departed with doors open, Warren Street, Victoria Line, London Underground, RAIB report 13/2012(U). Fatal accident at James Street station, Liverpool, RAIB report 22/2012. Person trapped in train door and dragged at Jarrow station, Tyne and Wear, RAIB report 26/2012 (M).	1	Investigation into an accident in which a passenger fell between a train and the edge of a platform at Charing Cross (main line) station in London, RAIB Report 10/2013.
<b>Failures of structures or deficient inspection/assessments</b>	N = 6 <b>Total = 6</b>	1	Partial failure of Bridge 94, near Bromsgrove, RAIB report 05/2012.	1	Partial failure of a structure inside Balcombe tunnel, RAIB Report 13/2013.
<b>Earthworks</b>	N = 6 <b>Total = 6</b>	(+ 1 bulletin)	<i>Derailment at Claborough tunnel, near Refford, Nottinghamshire, RAIB bulletin B02/2012.</i>	3	Accidents due to landslides at Loch Treig (near Tulloch), Falls of Cruachan, Rosyth and St Bees during the summer of 2012. Train runs over washed-out track formation at Knockmore, Northern Ireland, RAIB Report 14/2013. Derailment of a freight train at Barrow upon Soar, Leicestershire on 27/12/12.

## Topics of concern to the RAIB

### Level crossings

The RAIB notes that the UK's mainline railway has a good overall level crossing safety record relative to the other European Union Member States. However, by 31 December 2012 the RAIB had had cause to investigate 44 level crossing accidents or incidents, and had published 39 related reports (this includes investigation reports, bulletins and two class investigations). These level crossing accidents resulted in a total of 20 fatalities (and seven serious injuries) on the national network, one fatality on Northern Ireland Railways and two fatalities on a tramway (light railway). During 2012 the RAIB published seven reports concerning accidents/incidents at level crossings. These accounted for three fatalities and two serious injuries.

### Investigations published during 2012 related to level crossings

Relevant investigations published by the RAIB in 2012 were:

06/2012; White House Farm (25/09/11)	A signaller gave permission for a tractor driver to cross the railway before establishing that the train had passed.
10/2012; Mexico (3/10/11)	A pedestrian was struck and fatally injured by a train on Mexico footpath crossing, near Penzance in Cornwall.
11/2012; Llanbadarn (19/06/11)	A train passed over Llanbadarn crossing while the barriers were raised and the crossing open to road traffic (near miss).
15/2012; Gipsy Lane (10/09/2011)	A pedestrian was struck and fatally injured by a train on Gipsy Lane footpath crossing, near Needham Market in Suffolk.
20/2012; Llanboidy (19/12/11)	A train struck a lorry and trailer on Llanboidy automatic half barrier (AHB) level crossing, near Whitland in Wales.
27/2012; Bishop's Stortford (28/01/12)	A train struck and killed a pedestrian who was using Johnson's footpath crossing, in Bishop's Stortford, Hertfordshire.
28/2012; Ufton (04/09/2011)	A train went over Ufton level crossing at speed while the barriers were in the raised position and the red road traffic signals were not flashing.

## 5 Identification of important recurrent issues

### Investigations ongoing at 31 December 2012 related to level crossings

On 22 March 2012 near-miss at Lindridge Farm user worked level crossing, near Bagworth in Leicestershire (report 11/2013 published July 2013).

On 2 May 2012 a cyclist was struck and killed at Kings Mill No 1 bridleway crossing, Mansfield (report 01/2013 published in January 2013).

On 28 November 2012 a 13 year-old girl was struck and killed at Bayles & Wylies footpath crossing, Bestwood, Nottingham.

On 4 December 2012 a train struck a car at Beech Hill automatic half barrier (AHB) level crossing (near Finningley, between Gainsborough and Doncaster). One of the occupants of the car, a four year old child, was killed.

*On 28 September 2012 a train passed over Four Lane Ends level crossing (Lancashire) when the barriers were open (bulletin 01/2013, published in March 2013).*

### Recurrent factors related to level crossings

The RAIB has concerns about the following recurrent factors:

#### User behaviour at level crossings

The railway industry attempts to influence user behaviour at level crossings by various means including active measures such as warning lights and passive measures such as signage. Other factors influencing human behaviour (eg distraction) can result in these measures becoming ineffective. The RAIB has considered the ways in which the safety measures might better influence the behaviour of crossing users, and made recommendations accordingly.

Twelve RAIB investigations have found the actions of pedestrians to have been a factor and in another 13 the actions of a road vehicle driver were found to be a factor.

Out of a total of 39 published RAIB investigations into accidents at user worked, footpath and station level crossings, 19 have found the design of the crossing, the sighting of approaching trains or the position of signs to be a factor (three of which were on a heritage line).

A safety issue identified by the RAIB in five crossing investigations is the positioning of signs relative to the location at which the user is required to make their final decision to cross the line (the decision point). The position at which the user should have adequate sighting of approaching trains is not marked and in some cases may be counter intuitive. Therefore, this is a particular issue at those locations where the best sighting of trains is not obtained from the existing gate and/or sign. The implications of this, and the potential solutions, were discussed in a class RAIB investigation (report 13/2009, UWCs) examining the safety of User Worked Crossings, published in 2009.

In only three of the accidents investigated has it been proved that the accident was caused by deliberate violation of the rules associated with the use of the crossing. In six other investigations it was found that a deliberate violation could have played a part in the causation of the accident. However, it should be noted that the RAIB's policy is, generally, only to investigate accidents that are caused by reckless behaviour or deliberate violation if there are significant safety lessons for the railway industry.

The RAIB's investigations have identified a range of other local factors that might influence the actions of crossing users. These include:

- local obstructions to the sighting of trains;
- environmental conditions such as traffic noise and visibility at night;
- gates left open at User Worked Crossings;
- anxiety to cross the line to catch a train (station crossings);
- visibility of road traffic signals (eg impact of sunlight); and
- the audibility of train horns.

Infrastructure managers need to take such factors into account in order to manage risk at level crossings. The RAIB welcomes the continued development of the railway industry's tool that is designed to help risk assessors identify factors of this type and evaluate potential mitigating measures (the Level Crossing Risk Management Toolkit<sup>16</sup>).

### Inspection and risk assessment at level crossings

The term 'inspection' describes the process of checking that the crossing is in good condition and compliant with relevant railway standards and legal requirements. The term 'assessment' is a parallel process that the industry has implemented to assess risk at crossings in the UK and to identify any reasonably practicable measures for improvement.

In 21 of the 39 RAIB level crossing investigations it was found that the application of the inspection and/or risk assessment process had been deficient and/or the findings of the inspection/assessment had not been fully implemented. The RAIB findings include:

- errors made during data collection and risk assessments (eg incorrect collection of data);
- inadequate consideration of local factors at individual crossings;
- competence of risk assessors and crossing inspectors;
- actions not being taken in response to inspection and risk assessments at level crossings; and
- insensitivity of the All Level Crossing Risk Model to certain inputs (eg sighting times).

<sup>16</sup> This document is developed and maintained by RSSB and can be found at <http://www.lxrmk.com/>

## 5 Identification of important recurrent issues

### Types of level crossings that feature in RAIB investigations

The number of investigations completed by the type of crossing involved is shown below:

Table 9 – Type of Level Crossing

Type of Level Crossing	Number of investigations
Automatic half barrier	4
Automatic open (locally monitored)	3
Automatic barrier (locally monitored)	2
Manually controlled barrier	2
Manually opened gates	4
Tramway road crossing protected by road traffic lights	1
Footpath (including tramways)	10
User Worked Crossing	10
Open crossing protected only by signs	2 (both heritage)
Crossings at/near stations	1
Total	39

### Areas of RAIB recommendations related to level crossings

Issues that are the subject of RAIB recommendations published during 2012 include:

- A review of the safety of existing arrangements for providing a warning to pedestrians at level crossings currently provided with whistle boards (report 10/2012, Mexico).
- Enhancement of the data captured in the railway industry's Safety Management Information System (SMIS) to allow an evaluation of the risk impact of trains sounding only the low tone of the train horn when approaching level crossings (report 10/2012, Mexico).
- Development of a standard national approach for the identification, marking and signing of the optimum decision point<sup>17</sup> for pedestrians at footpath and user worked crossings (report 10/2012, Mexico).
- A change to railway standards to mandate the testing of train horns in an objective manner following accidents and incidents (report 10/2012, Mexico).
- The provision of an additional engineered safeguard at Automatic Open Crossings on lines fitted with the European Rail Traffic Management System (ERTMS) (report 11/2012, Llanbadarn).
- Actions to improve the accuracy and consistency of data collected at level crossings during site visits, including:
  - counts of crossing users;
  - identification of vulnerable users;
  - location of whistle boards; and
  - physical dimensions such as traverse distance;
 (report 15/2012, Gipsy Lane).

<sup>17</sup> The 'decision point' is a term to describe the point at which intending users should make their final decision to cross the line.

- Implementation of short term risk mitigation measures when the warning of approaching trains is found to be deficient (report 15/2012, Gipsy Lane).
- Changes at an Automatic Half Barrier Crossing to reduce the apparent misalignment of the road over the crossing relative to the approaches (so reducing the risk of a motorist encountering a closed barrier as they exit the crossing) (report 20/2012, Llanboidy).
- Updates to existing ORR guidance relating to the alignment of crossings relative to the road on the approach, and the need to take into account the escape route beyond the crossing (report 20/2012, Llanboidy).
- Reducing the risk of parked vehicles obstructing the escape route for level crossings (report 20/2012, Llanboidy).
- Review of risk mitigation measures already identified in RSSB research and, in particular, the conspicuity of miniature stop lights currently used at footpath and user worked crossings (report 27/2012, Johnson's).
- Improvements to the ergonomic design of signallers visual display units and the planning of signaller's workload, to reduce the risk of error when automatic level crossings are under local control (report 28/2012, Ufton).
- Clarifying existing instructions to staff who will take local control of an automatic level crossing (report 28/2012, Ufton).

### The railway industry's response to level crossing issues as reported during 2012

A range of actions reported by the ORR<sup>18</sup> as taken by Network Rail in response to RAIB recommendations are described in the Annual Report for 2011. During 2012 the ORR provided additional information concerning the measures taken by the railway industry to implement RAIB recommendations. These included the following:

- Network Rail has reported that it has established, and is further developing, a broad programme of initiatives aimed at improving the safety of crossings, which takes account of RAIB recommendations, and which will run until 2015. The programme includes a revision of how crossings will be risk assessed, closures, of high risk crossings, the upgrade of equipment and the recruitment and training of staff dedicated to crossing safety management. Each of these managers will be responsible for applying Network Rail policies and procedures for the management of risk at all crossings within a designated area and will be trained accordingly. This will include data gathering visits, light remedial works, inspections, risk assessments using the railway industry's All Level Crossing Risk Management (ALCRM) tool and the identification of reasonably practicable measures for improvement. In this way Network Rail intends that individual managers will develop a detailed appreciation of the safety issues at each level crossing and take full responsibility for the safety of them.
- RSSB and Network Rail are working together to review the ALCRM tool. This review is intended to encompass a number of suggestions from industry on how the tool can be enhanced. The review will also include a number of issues that have been raised in previous RAIB investigations, such as the ability of the tool to predict the risk impact of short warning times and the previous history of the crossing.

<sup>18</sup> In accordance with Regulation 12(2)(b) of the Railways (Accident Investigation and Reporting) Regulations 2005.



## 5 Identification of important recurrent issues

- Network Rail has developed and is now testing technology to enable signallers to identify the location of a train in a long signal section. Such technology will enable signallers to locate the position of a train relative to a user worked crossing when phoned by an intending user. If successful, this solution will reduce the time that users have to wait, thereby reducing the potential for users to misuse the crossing. It will also reduce the risk of error by a signaller when asked to authorise the use of a crossing.
- RSSB is carrying out a programme of research to examine the safety of footpath crossings and potential measures for improvement. This will include an examination of how the decision point should be marked (this has been a concern of the RAIB since the investigation into a fatal accident at Tackley in 2009; report 09/2009).
- Halkirk level crossing, the site of an accident in which three occupants of a road vehicle were killed has been upgraded by the installation of half barriers (reference recommendation 3 of report 16/2010, Halkirk).
- The British Transport Police, in consultation with Network Rail, has introduced a level crossing enforcement van. This vehicle can be deployed to crossings where there is known to be a problem with the behaviour of level crossing users, can record the movements of vehicles and enable prosecution of offenders. Its presence is also designed to act as a deterrent to anyone about to offend and a warning to those who regularly misuse crossings. A number of these vehicles have already been deployed and more are planned (reference recommendation 4 of report 12/2011, AOCL Class investigation).

The RAIB notes that Network Rail is continuing to work to close high risk level crossings wherever possible, or to prevent their use by road vehicles where full closure is found to be impracticable.

Level crossing improvements are often very expensive and can take time to implement. With regard to cost, the RAIB has noted that Network Rail's Strategic Business Plan, covering the period 2014-19 includes reference to a ring-fenced fund of £67 million for expenditure at crossings (this fund is in addition to the normal budget provision for the management and renewal of crossings) and a commitment to work towards the closure of at least 30 high risk crossings and the installation of 200 level crossing enforcement cameras. The RAIB is also pleased to see that concerted efforts are being made to develop low-cost solutions to some well established safety problems. These solutions include the use of a local warning system, triggered by the approach of a train, to sound an audible warning at level crossings where users would otherwise have only a limited warning of the approach of a train and where reliance is placed on users listening for a train horn (this is linked to a recommendation in report 10/2012, Mexico, that an alternative means of warning pedestrians should be provided at crossings where sighting is limited and train horns may be inaudible).

Although the ORR has reported that Network Rail is addressing many of the issues identified, and we recognise that it is the industry's responsibility to prioritise work according to risk, the RAIB has ongoing concerns regarding the length of time taken to implement some key recommendations. The average length of the time taken between publication of level crossing related reports and ORR's notification that the recommendations have been implemented was 21 months (based on level crossing accident reports published between October 2005 and December 2012).



## Road vehicle incursions

The incursion of road vehicles onto the railway line at locations other than level crossings is also a significant risk to the railway. In most cases such accidents do not result in any significant damage to a train. However, the accident at Great Heck in 2001, which killed ten people, showed the potential for serious harm if the incursion of a road vehicle results in a train becoming derailed (the same is true of the accident that occurred at Ufton Nervet level crossing in 2004, killing seven). During 2010, a cement mixing lorry fell from a bridge at Oxshott, onto a passing passenger train. The train derailed and a passenger suffered serious injuries (RAIB report 13/2011).

### Investigations published during 2012 related to road vehicle incursion

25/2012; Stowmarket Road (30/11/2011)	Car left road at corner then drove through fence and onto a railway line; it was subsequently struck by a passenger train.
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### Investigations ongoing at 31 December 2012 related to road vehicle incursion

None.

### Areas of RAIB recommendations related to road vehicle incursion

Issues that are the subject of RAIB recommendations published during 2012 include:

- the need for an independent review by a local highway authority of the actions taken to address deficiencies in its process for the management of road vehicle incursion risk (report 25/2012, Stowmarket Road);
- improvements to the flow of information to parish and district councils, and the police, on matters related to road incursion risk (report 25/2012, Stowmarket Road);
- a review of the current data on road vehicle incursion sites (report 25/2012, Stowmarket Road);
- improvements to the way road vehicle incursion risk, and the actions taken in response, are monitored by local authorities and the Department for Transport (report 25/2012, Stowmarket Road); and
- the need to clarify which body has regulatory and enforcement responsibility relating to the management of road vehicle incursion risk (report 25/2012, Stowmarket Road).

### The railway industry's response to road vehicle incursion issues

Industry's response will be recorded in the RAIB's Annual Report 2013.

## 5

## Identification of important recurrent issues

**The safety of track workers**

During track engineering activities it is vital that those with responsibility of the safety of the workers are well trained and have the qualities needed to exercise leadership. The RAIB investigations have shown the following factors to be central:

- the ability of the leader to exercise authority and influence;
- the need for the leader to understand the task;
- the need for planning and effective communications between all parties;
- the need for the leader to possess the right personal qualities; and
- the need for clear instruction and procedures.

One or more of these factors have been identified in no less than 22 investigations (20 on the national railway network, one on a light rail system and one on the Docklands Light Railway).

The second half of 2012 saw two accidents on lines that were open to traffic, one causing serious injury and the other fatal (the former at Bulwell on 06/08/2012 and the latter at Saxilby on 04/12/2012). The year also saw a very serious near miss at Roydon on 16 July 2012 that arose due to there being insufficient sighting of approaching trains. From the three events it is possible to identify some common features:

- poorly planned systems of work; and
- non-compliance with laid down safety systems.

In all three cases it is doubtful that the system of work that was initially planned was capable of being safely implemented. Despite this, none of the systems of work were challenged by the staff involved. The RAIB recognises that changes to human behaviour may take a long time to achieve, but believes that the industry must do its utmost to persuade its staff to challenge and report unsafe activities.

#### Investigations published during 2012 related to track workers, safety leadership and supervision

Relevant investigations published by the RAIB in 2012 were:

03/2012; Clapham & Earlsfield (08/03/2011)	Two gangs of Network Rail staff were working on the track (in a 'red-zone prohibited' area) while trains were running, without protection.
16/2012; Stoats Nest (12/06/2011)	Train struck track worker who was working too close to a line that was open to traffic (serious injury).
B1/2012; North Kent East Junction (02/02/2012)	Track worker struck by passing train near North Kent East Junction.

#### Investigations ongoing at 31 December 2012 relating to track workers, safety leadership and supervision

On 16 July 2012 there was a near miss involving two track workers at Roydon, Essex (report 07/2013, published in June 2013).

On 4 December 2012 a train struck and killed a track worker at Saxilby, Lincolnshire.

### Areas of RAIB recommendations related to track workers, safety leadership and supervision

Issues that are the subject of RAIB recommendations published during 2012 include:

- the provision of safety information to the crews of on track machines and engineering trains before entering a work site (report 02/2012, Torworth);
- review of the arrangements that apply for track workers when working in an engineering possession but outside a work site; and when more than one team are protected with a single blockage of the line (report 03/2012, Clapham & Earlsfield);
- identifying ways of helping track maintenance teams to manage the pressure to reopen the line to traffic (report 03/2012, Clapham & Earlsfield);
- review of the way that the competence of track maintenance staff is assessed and the consequent workload imposed on line managers, in particular, Track Section Managers (report 03/2012, Clapham & Earlsfield);
- delivery of practical competence in skills or situations that are encountered infrequently (report 03/2012, Clapham & Earlsfield);
- improvements to the effectiveness of pre-use checks of trolley brakes (report 14/2012, Haslemere);
- improvements to the process for the design, risk assessment, approval and introduction of work plant (report 14/2012, Haslemere);
- the need for suppliers to provide adequate operational and maintenance instructions (report 14/2012, Haslemere);
- improved information, documents and training for those responsible for the maintenance of work plant (report 14/2012, Haslemere); and
- the need for a time bound plan for the delivery of activities designed to improve safety culture and qualities of leadership (report 16/2012, Stoats Nest).

### The railway industry's response to track workers, safety leadership and supervision

The RAIB is aware that the railway industry has taken the following actions:

- The Railway Rule Book now includes a definition of what should be considered to be an approaching train when establishing a safe system of work.
- Network Rail is changing its process for managing the competence of track workers (Assessment in the Line). As at December 2011, three phases of change were being proposed:
  - A change in the competence review frequency and a renewed emphasis on the importance of site surveillance by line managers.
  - An organisational change in mid-2012 to deliver 'Local and Route ownership for delivery and compliance', coupled with the replacement of work experience log books with self-declarations of work completed.
  - The introduction of new technology (software and hardware) in 2013.
- Network Rail has introduced a new competence standard, NR/L2/CTM/223, 'Managing Site Safety', which includes behavioural indicators to be used when making assessments of competence (full compliance is planned for June 2014).

## 5 Identification of important recurrent issues

- It is providing linked '*Managing Site Safety*' training for approximately 2,800 team leaders<sup>19</sup>, with the following aims:
  - to raise awareness and understanding amongst team leaders about their roles as leaders of site safety;
  - to develop new ways of thinking and behaving in the role; and
  - to plan for, deliver and review safe and effective working environments and work practices by applying safety leadership behaviours and competencies.
- It has introduced behavioural pre-requisites to encourage Line Managers to appoint individuals who have the appropriate capabilities to the role; and has made changes to Controller of Site Safety (COSS) training and assessment to increase the focus on the non-technical skills and behavioural elements of being a COSS.

As part of Network Rail's drive to improve safety culture, in 2012 it issued a document to all staff entitled the 'Safety Leadership Pack' ([www.networkrail.co.uk](http://www.networkrail.co.uk)). This document is designed to communicate to staff Network Rail's safety vision, its safety commitments and a series of high level safety rules designed to guide staff when making key decisions. The Safety Leadership Pack and the Lifesaving rules contained therein were developed following wide consultation and are now being actively briefed and promoted by Network Rail. It is designed to communicate to all workers, including track workers, a set of principles that should encourage safe behaviour and the commitment of Network Rail, and all of its staff, to promote safety. These commitments cover some important areas that have been identified as factors in RAIB investigations.

### Red Zone working

In previous Annual Reports the RAIB has expressed concerns about the extent to which staff work on lines that are still open to traffic. This form of working, sometimes referred to as 'Red Zone' working although this term is no longer used in the Rule Book, is usually reliant on warnings provided by a member of staff who looks out for approaching trains.

The RAIB remains particularly concerned about the safety implications of staff working 'Red Zone' in the following circumstances:

- in proximity to junctions (Tinsley Green 43/2007, Ruscombe 04/2008 and Cheshunt 06/2011);
- on lines with high speeds (Grayrigg 20/2008); and
- in connection with moving sites of work; eg during patrolling (Leatherhead 19/2008).

In the period 2009 to 2011 the proportion of work undertaken under Red Zone conditions fell from about 50% to about 27%. It remained at that level during 2011 before increasing slightly during 2012 to about 30%. The RAIB notes that the ORR is continuing to press for a reduction in the extent of Red Zone working and Network Rail has committed to strive for further reductions. In particular, Network Rail has indicated that it plans, by 2015, to prohibit Red Zone working with unassisted lookouts at following types of higher risk location:

- within 200 metres of a junction;
- where the line speed exceeds 100 mph; and
- moving worksites.

<sup>19</sup> This was due to complete during 2013.

## Freight trains

By 31 December 2012 the RAIB had published a total of 21 reports into accidents involving the design, maintenance, preparation or loading of freight trains.

### Investigations published during 2012 related to freight trains

Relevant investigations published by the RAIB in 2012 were:

17/2012; Althorpe Park (18/07/11)	A partially detached metal panel on a container train struck the cab of a passing track maintenance vehicle.
19/2012; Bordesley Junction (26/08/11)	A freight train derailed at Bordesley Junction.

### Investigations ongoing at 31 December 2012 related to freight trains

On 28 January 2012 a container train derailed at Reading West Junction due to a combination of an off-set load and track twist (report 02/2013, published in January 2013).

On 19 March 2012 the under-slung control cab of an engineering train, at Blatchbridge Junction, was found to be detached and outside of the train's normal gauge (report 15/2013, published in September 2013).

### Recurrent factors related to freight trains

The table below indicates where the same factors have played a part in more than one incident or accident that the RAIB has investigated:

Table 10 – Factors related to Freight Trains

Factors related to Freight trains	No. of investigations in which the factors have been identified (some investigations feature more than one factor)
Defective wagon	13
Poor train preparation before departure	12
Design deficiencies/approvals	8
Twisted frame	3
Uneven/insecure loading	3
Operation and management of freight yards	8

### Areas of RAIB recommendations related to freight trains

Issues that are the subject of RAIB recommendations published during 2012 include:

- the need for competent assessment and approval of the adequacy of bolted joints used to secure exterior attachments to containers that are to be transported (report 17/2012, Althorpe Park);
- the need for the International Maritime Organization to assess the need for an update to the International Convention for Safe Containers to include requirements for the integrity of all exterior attachments to containers (report 17/2012, Althorpe Park);
- review of operating procedures and conditions of carriage for containers to assess the adequacy of controlling the risk of external components becoming detached (report 17/2012, Althorpe Park);
- the management of the risk of continuing to operate a fleet of wagons once a fleet wide problem is discovered (report 19/2012, Bordesley Junction);

## 5 Identification of important recurrent issues

- modifications to the suspension of PHA wagons to reduce the risk of the suspension 'locking up' and causing derailment on twisted track (report 19/2012, Bordesley Junction); and
- review of how the suspension of PHA wagons should be maintained (report 19/2012, Bordesley Junction).

### The railway industry's response to freight train issues as reported during 2012

A range of actions reported by the ORR<sup>20</sup> as taken by Network Rail in response to RAIB recommendations are described in the Annual Report for 2011. During 2012 the ORR provided additional information concerning the measures taken by the railway industry to implement RAIB recommendations. These included the following:

- The rail freight operators have undertaken to review their processes for checking the effective operation of handbrakes which are required to hold a train stationary when it is stabled. The outcome of this review is to be captured in a change to existing guidance (reference report 07/2011, Ashburys).
- A major owner of wagons has checked and updated its maintenance plans with a view to checking whether the latest manufacturer's recommendations are properly taken into account (reference report 07/2011, Ashburys).
- Owners and operators of wagons fitted with SAB/Haldex slack adjustors have reviewed their maintenance plans to check that they are consistent with the manufacturer's recommendations (reference report 07/2011, Ashburys).
- Rail freight operators have reviewed their procedures for checking the efficacy of handbrakes during routine inspections (reference report 07/2011, Ashburys).
- Maintenance requirements for privately owned wagons have been reviewed and updated to reduce the likelihood that pedestal suspension will lock up (02/2009, Ely Dock Junction and 19/2012, Bordesley Junction).

There are a number of issues that remain of concern to the RAIB. These include:

- The number of container wagons that are still fitted with deficient spigots. As a consequence, and as was shown in report 12/2009, some containers are vulnerable to being blown off container wagons in certain types of high wind conditions. Although the RAIB is aware of operational measures that are in place to manage this risk, such as the pinning down of containers, it continues to urge that a technical solution to the problem is implemented (this was originally the subject of recommendation 3 in report 12/2009, Cheddington & Hardendale).
- The impact of off-set loads on derailment risk; (report 16/2008, Duddleston Junction and report 10/2009, Santon and report 02/2013, Reading West Junction).

The RAIB has been concerned about the safety of freight train crews when entering and leaving engineering work sites. A previous RAIB recommendation that Network Rail and freight operators should implement measures to ensure that all train crew entering engineering possessions are given a suitable safety briefing<sup>21</sup> had not been effectively implemented prior to a tamper driver being struck by a train at Torworth (report 02/2012, Torworth). It is likely that full implementation of this recommendation would have averted the accident.

<sup>20</sup> In accordance with Regulation 12(2)(b) of the Railways (Accident Investigation and Reporting) Regulations 2005

<sup>21</sup> Recommendation 7 of the report into a fatal accident involving a freight train driver at Deal in 2006 (report 14/2007)



## Defective track, including switches and crossings (S&C)

The integrity of track is vital to the safe operation of trains on the network. The primary types of track failure likely to cause derailment of a train are as follows:

- poor alignment and geometry (eg track twist);
- incorrect distance between the rails (eg gauge widening);
- broken rails or joints; and
- a worn railhead profile.

Switches and crossings (S&C) (otherwise known as points) are designed to enable the safe routing of trains from one line to another. Defects in these may not be detected by the signalling system, and can create the possibility of a train being misrouted or even derailed.

### Investigations published during 2012 related to defective track, including S&C

Relevant investigations published by the RAIB in 2012 were:

- 18/2012; Princes Street Gardens (27/07/11) An empty passenger train derailed on a set of points.
- 19/2012; Bordesley Junction (26/08/11) A freight train derailed at Bordesley Junction.

### Investigations ongoing at 31 December 2012 related to defective track, including S&C

On 28 January 2012 a freight train derailed and then re-railed at Reading West Junction due to a combination of an offset load and track twist (report 02/2013, published in January 2013).

On 7 July 2012 a freight train derailed north of Shrewsbury station. All wheels of the leading bogie derailed as it travelled over a set of facing points (report 08/2013, published in July 2013).

The RAIB is investigating a number of broken rails that occurred on the East Coast mainline during 2012.

### Recurrent factors related to defective track

By 31 December 2012 the RAIB had published a total of 23 reports into accidents involving poor track condition (other than S&C). Factors identified have included:

Table 11 – Factors related to poor track condition

Factors related to poor track condition	No. of investigations in which the factors have been identified (some investigations feature more than one factor)			
	National network	Light Rail	Heritage	London Underground
Track gauge	3	2	1	1
Track twist	9		3	
Inadequate inspection and maintenance	13	4	3	1

By 31 December 2012 the RAIB had published a total of 14 reports into accidents involving defective S&C (seven of which occurred on the national network, four on light rail systems, one on London Underground and two on heritage lines). One of these accidents resulted in a fatality (derailment at Grayrigg in February 2007).

## 5 Identification of important recurrent issues

Factors identified in investigations associated with defective S&C have included:

Table 12 – Factors related to defective S&C

Factors related to defective S&C	No. of investigations in which the factors have been identified (some investigations feature more than one factor)			
	National network	Light Rail	Heritage	London Underground
Poor switch rail condition (incorrect profile)	4	1	-	-
Undetected degradation of components	2	3*	1	1
Incorrectly installed/adjusted	3	-	1	-

\* 2 involved the same set of S&C on the Croydon tramway

### Areas of RAIB recommendations related to track integrity

Issues that are the subject of RAIB recommendations published during 2012 include:

improved guidance on maintenance intervention limits for worn switch rails (report 18/2012, Princes Street Gardens);

- the need for a thorough technical review of the standard applicable to the inspection and maintenance of switch rails (report 18/2012, Princes Street Gardens);
- potential improvements to the gauges used by staff undertaking inspections of points to provide a more accurate and objective method for assessing the acceptability of worn profiles (report 18/2012, Princes Street Gardens);
- extending the use of lubricators near switches that are difficult to access (report 18/2012, Princes Street Gardens);
- the need to review the actions taken following previous derailments at S&C, and the subsequent RAIB recommendations (report 18/2012, Princes Street Gardens); and
- improved briefings to those controlling work undertaken by on-track machines (such as tampers) to include an indication of the relative priority of different parts of the task (report 19/2012, Bordesley Junction).

### The railway industry's response to issues associated with the defective S&C at Grayrigg in February 2007

During 2012 the ORR continued to report progress with actions taken by Network Rail in response to the RAIB's recommendations following its investigation into the derailment of an express passenger train at Grayrigg, Cumbria, in February 2007. The status of those recommendations that are particularly relevant to the design and management of S&C (the linked recommendations in the Grayrigg investigation report are shown in square brackets) is as follows:

- Network Rail is carrying out a review of the design of existing S&C with fixed (ie non-adjustable stretcher bars) [1]. As part of this review it is seeking to identify:
  - the forces that such S&C are subject to;
  - their performance in service; and
  - potential modifications.



- Linked to the above, Network Rail has developed a modified design of stretcher bar and a roll out strategy has been developed (this is based on an improved understanding of potential high risk failure modes). It has also made amendments to its processes for the installation, inspection and maintenance of S&C components. These have included:
  - changed instructions on the set-up of supplementary drives;
  - changed instructions on the installation and maintenance of stretcher bars; and
  - improved criteria for the reporting of faults and the decision criteria for repairs.

Network Rail is also to conduct a review of the original analysis that was carried out on the failure modes and effects of stretcher bar failure [1 & 3].

- Network Rail has introduced new processes for the collection and analysis of data on the performance of S&C (eg the recording of defects observed by maintainers and the actions taken) [2].
- Network Rail has analysed the risks at S&C in order to understand the criticality of the various precursors. It has put in place a structured means of incorporating that knowledge into its maintenance standards [4].

There are two recommendations (1 and 10), made to Network Rail, concerning the fundamental design, management and maintenance of its S&C assemblies that have still to be closed by ORR.

It had been agreed between ORR and Network Rail that full implementation of recommendation 1 would take place by July 2012. Recommendation 1 requires Network Rail to carry out a detailed review of its non-adjustable stretcher bar assembly design so as to understand the relationships between the design, loading, usage and the inspection and maintenance regimes, and implement appropriate modifications to the design or the inspection or maintenance regimes. ORR has still to conclude that the actions taken in response to parts of recommendation 10<sup>22</sup> are sufficient.

The RAIB is pleased to note the progress that has been reported. In all key areas related to the design of S&C (and the associated inspection and maintenance), Network Rail appears to be taking substantive actions, or has concrete plans to do so.

ORR has informed the RAIB that it accepts that Network Rail is adopting best practice principles in its current S&C engineering safety management and is continuing to monitor the actions taken in response to the Grayrigg recommendations. The RAIB has noted that the ORR has committed to review the actions taken by Network Rail in response to recommendations 1-19 to confirm that they are aligned with engineering safety management principles [20].

<sup>22</sup> Recommendation 10 is concerned with the management of basic visual inspections.

## 5

## Identification of important recurrent issues

**Failure of structures and earthworks**

Eight investigations undertaken by the RAIB have involved the failure of a structure and/or an examination of the process for the management of structures. In five of the eight cases the failure resulted in the derailment of a train.

The unusually wet conditions from May 2012 have contributed to a large number of earthwork failures. Such failures can either block the line, or result in a loss of support for the track, increasing the risk of derailment.

Investigations published during 2012 related to structures and earthworks

Relevant investigations published by the RAIB in 2012 were:

05/2012; Bridge 94 Bromsgrove (06/04/11)	The line became unsafe because of partial failure of the under-track structure (Bridge 94).
B02/2012; Clarborough (27/04/2012)	<i>Train ran into a landslip as it left Clarborough tunnel.</i>

Investigations ongoing at 31 December 2012 related to structures and earthworks

On the 23 September 2011 a train driver observed that a metal structure inside Balcombe tunnel had failed. A subsequent inspection confirmed that there was a risk that the structure would collapse and the line was closed to enable emergency repairs (report 13/2013 published in August 2013).

During the summer of 2012 accidents due to landslides occurred at Loch Treig (near Tulloch), Falls of Cruachan, Rosyth and St Bees.

On 28 June 2012 a train ran over washed-out track formation at Knockmore, Northern Ireland (report 14/2013, published September 2013).

On 27 December 2012 a freight train derailed at Barrow upon Soar, Leicestershire.

Areas of RAIB recommendations related to the management of structures and earthworks

Issues that are the subject of RAIB recommendations published during 2012 include:

- marking the position of all track-supporting structures that are not apparent from the surface so that those responding to an incident are aware of their presence (report 05/2012, Bromsgrove);
- identification of ways of carrying out visual examinations at locations where access is constrained (eg due to confined spaces) (report 05/2012, Bromsgrove); and
- enhancement of the accuracy and effectiveness of the review of structure examination reports (report 05/2012, Bromsgrove).

The railway industry's response to issues associated with the management of structures and earthworks, as reported during 2012

The actions taken by the railway industry bodies concerned and reported by ORR include:

- Network Rail has reviewed its arrangements for the reporting of precursor defects associated with earthworks.

- A new standard has been developed to cover the inspection of drainage and improved guidance to track maintenance staff on the identification of precursors to earthwork failures.
- Network Rail has carried out a comprehensive survey of its drainage assets and defined the routine inspection arrangements. These inspection arrangements are informed by modelling to identify areas that are susceptible to concentrations of water and therefore more vulnerable to failure.
- Network Rail has reviewed the way that it balances the risk of earthwork failure in a cutting as compared to an embankment.
- Network Rail has undertaken a programme of improvements to drainage at the crest of cuttings.
- Network Rail has modified its process for the re-examination of earthworks such that examiners are now required to positively confirm the accuracy of all associated data.
- Network Rail is recording sites where vegetation clearance is required before detailed examinations can be carried out.
- Network Rail has modified its inspection processes to clarify the requirements in respect of slopes that comprise a mix of soil and rock, and to better enable examiners and examining engineers to give their judgement on the condition of earthworks.
- Network Rail has reviewed the way that it prioritises works to improve the stability of earthworks – a higher priority is now given to rock and soil slopes.

### Note

Steps taken to address the risk of structural failure were described in the RAIB Annual Report for 2011.

The railway industry has also taken action to try to predict areas of high risk and has developed plans to deal with extreme weather events. Despite these efforts, a number of recent earthwork failures have given rise to actual, or narrowly avoided derailments. Of these, five are being considered as part of a RAIB investigation. Although it is probable that all five will be linked to the unusually wet weather during 2012, it is already possible to identify some recurrent themes:

- the management of earthwork risk associated with neighbouring land (a factor in three out of the five failures);
- the railway's reliance on drainage that is remote from its own property (a factor in three out of the five failures); and
- the impact of short term but intense levels of rainfall (a factor in four out of the five failures).

In order to manage the above issues in an unpredictable climate the industry needs to give careful consideration to the ways it: derives weather forecasts; identifies the areas most at risk from extreme weather events; and the steps it takes in response to predicted weather events. It also needs to consider the ways by which it identifies that an extreme weather event has already taken place in a given locality, and the actions taken in response to this event.

## 5 Identification of important recurrent issues

### Accidents to passengers at station platforms (platform train interface)

By 31 December 2012 the RAIB had published a total of eight reports and one bulletin into accidents to passengers associated with the movement of trains or trams at station platforms. Of these, five involved trains on the national network, two involved London Underground, one involved a tram and one a train on the Tyne & Wear metro system. Of the total, two accidents involved people falling between the train and platform, four involved people who were trapped in train doors and dragged for a distance as the train departed, one involved a person who was trapped and dragged and then fell between the train and the platform, and two involved mismanagement of train doors.

The RAIB does not investigate all accidents at the platform train interface. However, it will sometimes choose to do so if it judges that there is potential for new safety learning for the rail industry.

#### Investigations published since November 2011 of accidents to passengers at station platforms

Relevant investigations published by the RAIB since November 2011 were:

19/2011; Brentwood (28/01/2011)	Passenger fell down gap between train and platform. Shortly afterwards the train departed causing minor injuries to the passenger.
13/2012; Warren Street (11/07/2011)	Train departed with doors open.
09/2012; Kings Cross (10/10/2011)	Passenger was trapped in train doors. Shortly afterwards the train departed causing minor injuries to the passenger.
22/2012; James Street (22/10/2011)	Young person was leaning against the side of a train when the guard signalled to the driver to start the train. As the train left the station the young person fell between the train and the platform, and was fatally injured.
26/2012; Jarrow (12/04/2012)	Person was trapped in a train door and as train departed was dragged at Jarrow station. No significant injury sustained.

#### Investigations ongoing at 31 December 2012 related to accidents to passengers at station platforms

On 24 November 2012 a passenger fell between a train and the edge of platform 3 at Charing Cross (main line) station in London. The train subsequently left the station causing the person life changing injuries (report 10/2013 published in July 2013).

#### Areas of RAIB recommendations related to the platform train interface

Issues that are the subject of RAIB recommendations include:

- Periodic assessments of CCTV monitors that are used by drivers when supervising train dispatch, including checks on their alignment and position relative to stop boards (report 19/2011, Brentwood).

- Guidance on surveillance of the closing of train doors during train dispatch (report 19/2011, Brentwood).
- Analysis of driver only train dispatch and subsequent enhancements to training and competence management arrangements (report 19/2011, Brentwood).
- Re-briefing the importance of the train safety check prior to starting the train (report 19/2011, Brentwood).
- A review of the design of train doors on 'Networker' trains in order to assess the practicability of modifying the seals on the edges of doors to reduce the risk associated with trapping of objects and people (report 09/2012, Kings Cross).
- An evaluation of equipment and operational arrangements for train dispatch on the Merseyrail system. This is to include consideration of measures to allow staff to observe the platform and train without interruption for as long as possible, and to stop the train directly and quickly in an emergency (report 22/2012, James Street).
- An evaluation of equipment and methods that reduce the likelihood of a person falling through the gap between a train and the platform edge on the Merseyrail system (eg platform edge gap fillers and vehicle body side panels) (report 22/2012, James Street).
- Railway industry guidance on:
  - enhancing the surveillance of trains during dispatch;
  - equipment and methods to stop trains in an emergency; and
  - adaptation of trains and infrastructure to reduce the size of the platform edge gap when this is possible and appropriate, for example in connection with investment in new trains and infrastructure.

### The railway industry's response to issues associated with the platform train interface

The actions taken by the railway industry bodies concerned and ORR include:

- The module of the railway rule book which deals with the dispatch of trains from stations (module SS1) has been rewritten, and the rules relating to dispatch have been strengthened and clarified. The guard is now required to remain in position at the door controls until a departing train has passed clear of the platform.
- On 27 March 2013 RSSB and ORR jointly hosted a workshop on the management of the platform/train interface (PTI), which was attended by a large number of industry representatives. RSSB is working with the railway industry to develop guidance on PTI issues, based on the ideas put forward in the James Street report and at the workshop for improving safety in this area.
- A proposal for research into the design and use of devices to reduce the train/platform gap is being developed by RSSB. Such devices include gap fillers attached to the edge of the platform, and additional panels on train body sides.

## 6

## Emerging themes

## 6. Emerging themes

**Safety management in the heritage sector**

By 31 December 2012 the RAIB had published reports into seven accidents on heritage and minor railways that involved:

- the absence of an adequate Safety Management System (SMS);
- or where it was found that
- the management arrangements described in the SMS were not translated into the day to day operation of the railway.

Findings of the RAIB investigations into accidents in the heritage sector have included:

- non-implementation of the specific requirements of the SMS relating to the monitoring of track and the checking of rolling stock following maintenance (report 07/2010, Severn Valley Railway);
- non-compliance with documented engineering safety arrangements (report 18/2009, Ffestiniog Railway);
- lack of an adequate documented SMS (report 14/2008, Lydney DFR; report 22/2007, Bronwydd Arms; report 04/2012, Kirklees Light Railway);
- the absence of competent advice on matters related to safety (report 14/2008, Dean Forest Railway);
- non-compliance with a railway's own SMS with regard to the issuing of the rule book and the competency of staff (bulletin B01/2011, Foxfield);
- a weak process for the management of risk at level crossings (bulletin B05/2011, Wensleydale Railway);
- insufficient knowledge of assets to manage risk effectively (report 04/2007, North York Moors Railway; reports 07/2007 and 32/2007, Ravenglass and Eskdale Railway; report 13/2010, Great Orme Tramway; bulletin B04/2010, Bure Valley Railway; bulletin B06/2010, Welshpool and Llanfair Railway);
- inadequate system for assessing the competence of steam locomotive drivers (report 04/2012, Kirklees Light Railway); and
- scope for improvement of a competence management system for guards and shunters (report 23/2012, North Yorkshire Moors Railway).

The ORR has indicated to the RAIB that it recognises that in the past there have been issues with the establishment and implementation of a SMS in some heritage railways. Consequently, the ORR has increased the resource available for the oversight of safety, and the taking of enforcement action where serious shortcomings are exposed, on heritage and other minor railways. In addition, the ORR has been working with the Heritage Railway Association (HRA) to promote the importance of developing, documenting and implementing a SMS that is sufficient to manage the risk. The ORR and the HRA have provided guidance to its members on how this is best addressed, and hosted a number of seminars that were attended by representatives of all member railways.

As a result of the actions taken, the ORR has informed the RAIB that the level of compliance with the requirement for a SMS has improved in the sector. ORR proposes to continue its monitoring of safety management in the sector during 2013/14.



### The management of incidents involving stranded passenger trains

On 23 May 2012 the RAIB published its report into a dangerous incident involving a stranded passenger train (report 07/2012, Kentish Town). The report recorded that at around 18:26hrs on Thursday 26 May 2011, a First Capital Connect service from Brighton to Bedford lost traction power and became stranded between St. Pancras and Kentish Town stations. Almost three hours elapsed before the train, with its passengers still on board, was assisted into Kentish Town station. During the period that the train was stranded, conditions for passengers became increasingly uncomfortable and passengers started to detrain.

Eventually, the driver over-rode a safety system in order to move the train. At the time when the train moved a short distance for the driver to test that it was properly coupled, some passengers were still alighting from the train to the track. When the train subsequently moved into Kentish Town, it did so with at least two doors open.

The investigation found that options for evacuating passengers, other than the use of an assisting train, had either been discounted or had not been briefed to those staff responsible for developing the rescue strategy on the day. There had been very little communication with passengers during the incident because the public address system on the train failed about 45 minutes after the train became stranded. Previous incidents of a similar nature had been investigated by First Capital Connect, but actions had not been taken on the findings.

The RAIB has made:

- one recommendation to First Capital Connect in relation to its management processes for emergency preparedness;
- one recommendation to Network Rail and the train operators on developing a set of principles for dealing with stranded trains; and
- one recommendation to Network Rail and the train operators to review their processes for undertaking incident reviews so that safety lessons are captured, tracked to closure and shared with other industry stakeholders.

The RAIB investigation into the above incident included a review of a number of other recent incidents involving stranded trains, the causes of which ranged from signalling failure and technical failures of the train, to cable theft and passenger-related incidents. Each of these incidents arose due to a unique set of circumstances. Nevertheless, they all demonstrate the potential for passengers to be exposed to harm when stranded on a train for an unusually long time. The risks to passengers and staff in these circumstances may include:

- overheating or lack of fresh air in the train interior, or in a tunnel;
- dehydration;
- exposure to cold if stranded on a train that has no power;
- struck by a moving train when detraining;
- electric shock due to contact with the conductor rail when detraining;
- slips, trips and falls when detraining;
- mental distress or panic; and
- verbal and physical assaults.

# 6

## Emerging themes

As evidenced by recent guidance issued by the Association of Train Operators, the industry has recognised the potential safety risk associated with stranded trains and that this can be greatly exacerbated if the situation is not effectively managed. The RAIB urges that the industry continues to work to identify ways of limiting the extent of disruption, and where this cannot be achieved, to develop effective strategies for dealing with the immediate consequences such that the potential for harm to the passengers and staff involved is minimised. In particular, it is hoped that the industry will seek to explore the opportunities to enhance its communications with passengers and the use of technology to support effective decision making by railway staff and managers.



## 7. Budget

In common with all government departments it has been necessary for the RAIB to reduce its costs. The RAIB's budget for 2012 - 13 was £4.88 million, a reduction of 1.9% from the previous year. This includes savings made by relocating its southern office to the site shared with the Air Accidents Investigation Branch near Farnborough. The RAIB has reduced its budget by £0.98 million (16.7%) relative to the financial year 2009 – 2010.

## Annexes

### Annex A - Glossary of abbreviations and acronyms

AHBC	Automatic Half Barrier Crossing
AOCL	Automatic open crossing, locally monitored
COSS	Controller of Site Safety
ERA	European Railway Agency
ERA SIS	European Railway Agency Safety Information System
LUL	London Underground Ltd
LX	Level Crossing
ORR	Office of Rail Regulation
RRV	Road Rail Vehicle
RSSB	Rail Safety & Standards Board
S&C	Switches & Crossings
SMS	Safety Management System
SPAD	Signal Passed At Danger
UWC	User Worked Crossing

## Annex B - Glossary of terms

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

Adhesion	Describing the friction produced between a rail and a rail wheel. Therefore, loss of adhesion is the absence of this friction and the inability to make any forward progress.*
All Level Crossing Risk Model (ALCRM)	A computer model on a central database used to compute the risk at level crossings, and to evaluate reasonably practicable improvements to reduce the risk.*
Automatic level crossing	Any level Crossing where the warning to highway users is given automatically, triggered by the approach of a train.*
Automatic half barrier crossing	An automatic level crossing fitted with half barriers, traffic lights on the highway and a telephone to the relevant signal box.*
Automatic open crossing (locally monitored)	A level crossing without barriers, that is equipped with a flashing white light which is observed by the train driver to confirm that the road lights are functioning before the train proceeds over the crossing.*
Automatic barriers (locally monitored)	A level crossing with barriers, that is equipped with a flashing white light which is observed by the train driver to confirm that the road lights are functioning before the train proceeds over the Crossing.*
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.*
Manually Controlled Barriers	A manned level crossing with full barriers operated locally from a signal box or level crossing box.*
Open crossing	A type of level crossing with no barriers, gates, warning system (apart from a Whistle board) or monitoring.*
Points	An assembly of Switches and Crossings designed to divert trains from one line to another.*
Possession	A period of time during which one or more tracks are blocked to trains to permit work to be safely carried out on or near the line.*
Road Rail Vehicle	Any vehicle adapted to operate equally well on road and rail.
Red Zone	An area that is on or near a line where trains are running normally.*
Rule Book	(Network Rail) Railway Group Standard (RGS) GE/RT8000, which is the publication detailing the general responsibilities of all staff engaged on the railway system, and the specific duties of certain types of staff such as train drivers and signallers.*

## Annexes

Spigot	A device attached to the floor of a freight wagon to secure a container in case of derailment or high wind.
Stretcher Bar	A bar that links the two switch rails in a set of switches (points) and maintains their correct relationship, eg one is open when the other is closed.*
Switch	An assembly of movable rails (the switch rails) and fixed rails (the stock rails) and other components used to divert vehicles from one track to another.*
Switch Rail	The thinner movable machined Rail Section that registers with the stock rail and forms part of a switch assembly.*
Switches & Crossings	See definition of Points above.
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 will be provided to contact the signaller.*

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