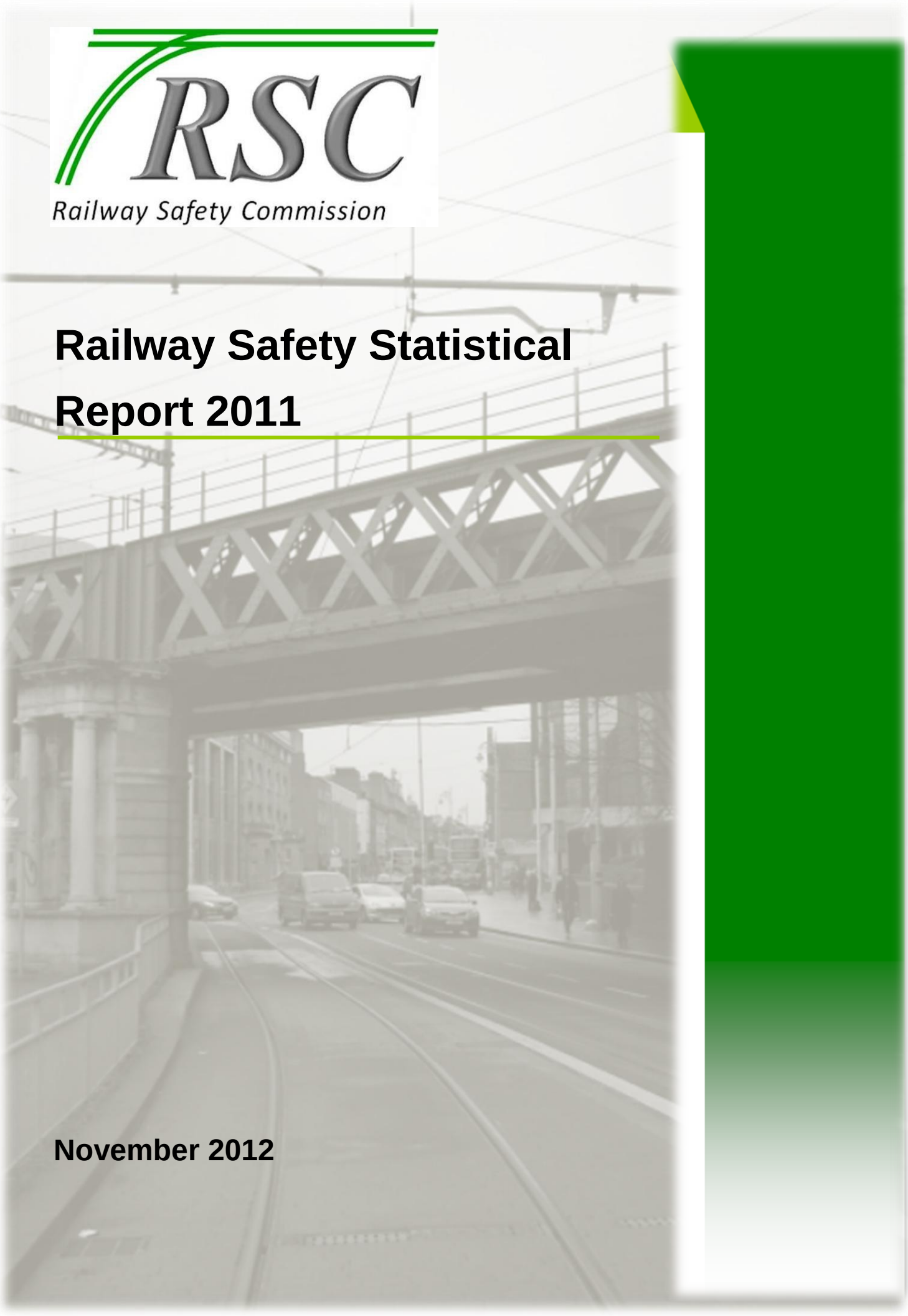
RSC

Railway Safety Commission

Railway Safety Statistical Report 2011



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Foreword

It is my privilege as the Head of Supervision & Enforcement to present the RSC Annual Safety Performance Review for 2011.

2011 like 2010 has been a challenging year for the rail industry in Ireland, due to the current fiscal situation. The railway sector in Ireland, both for mainline and light rail services, compares well to its counterparts in other EU countries. However in order to maintain, and indeed advance railway safety requires continuous monitoring by duty holders and supervision by regulators.

In 2011, the RSC introduced a new supervision regime, comprising of more in depth and rigorous audits of Iarnród Éireann's safety management system (SMS). The number of inspections undertaken by RSC Inspectors also increased and these activities, coupled with regular meetings with duty holder managers, ensures safety is given due priority.

In conclusion, the RSC will continue to focus on its mission "To advance the safety of railways in Ireland through diligent supervision and enforcement". I trust that you will find this report informative and interesting.

Anthony Byrne
Principal Inspector – Supervision & Enforcement

Executive Summary

This is the third separately published annual safety statistical report of the Railway Safety Commission (RSC). It has been prepared for the general public in line with section 9(A) of the Railway Safety Act 2005 (the Act), which requires that the RSC operates in an open, non-discriminatory and transparent manner. This report provides background statistics to a number of safety performance indicators with discussion when appropriate.

The RSC is the independent railway safety regulator in the Republic of Ireland and is responsible for overseeing the safety of all railway companies, including Iarnród Éireann, Veolia (Luas Operator), Bord Na Móna where their railway interfaces with public roads, a number of heritage railways and the approval of projects undertaken by the Railway Procurement Agency (RPA).

The safety performance of both Iarnród Éireann and Veolia is in the main positive, and broadly in line with 2010. However, many challenges remain for both the rail and tram networks, with the operational environment continuing to remain demanding. However, imported risk, i.e., from third parties interfacing with the railway, continues to be an issue. There were no passenger fatalities or serious injuries in 2011. However, two level crossing users and seven trespassers lost their lives. These deaths highlight the danger present on the railway, and the requirement for strong safety management systems surrounding this infrastructure.

In terms of train operations, there was a substantial decrease in the number of Signals Passed at Danger (SPAD), from 14 (2010) to 7 in 2011. Bridge strikes continue to decline since the peak of 2005/06. The number of broken rails was reduced to 1 in 2011 from 5 in 2010. Similarly, there were decreases in the number of train collisions, derailments and a continued reduction in the number of rolling stock incidents. It should also be noted that there were no collisions between trains in 2011.

The LUAS safety performance in 2011 was largely similar to previous years. There was one fatality in 2011, as a result of a pedestrian coming into contact with the tram at Steevens lane. The number of road traffic accidents remained at 30.

In 2011, tram/pedestrian contact accidents decreased from 22 in 2010 to 13 in 2011. Two individuals required hospitalisation in 2010 as a result.

Bord Na Móna reported one derailment last year. This occurred when a level crossing gate collided with a peat wagon. No major harm or damage was reported, and containments were subsequently put in place.

There were no reportable accidents or incidents on heritage railways in 2011.

Ireland's Rail and Tram network continue to have a low incidence of deaths, injury and major damage compared to other European networks.

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Railway Acronyms Used

Term	Meaning / Definition
ERA	European Railway Agency
IÉ	Iarnród Éireann (subsidiary of CIÉ)
HSA	Health & Safety Authority
km	kilometres
RPA	Railway Procurement Agency
RSC	Railway Safety Commission
RTA	Road Traffic Accident
S.I.	Statutory Instrument
SPAD	Signal Passed at Danger

Definitions

The terms accident, serious accident and incident are as defined in Directive 2004/49/EC - the Railway Safety Directive (RSD), i.e.,

*'**accident**' means an unwanted or unintended sudden event or a specific chain of such events which have harmful consequences; accidents are divided into the following categories: collisions, derailments, level-crossing accidents, accidents to persons caused by rolling stock in motion, fires and others;*

*'**serious accident**' means any train collision or derailment of trains, resulting in the death of at least one person or serious injuries to five or more persons or extensive damage to rolling stock, the infrastructure or the environment, and any other similar accident with an obvious impact on railway safety regulation or the management of safety; 'extensive damage' means damage that can immediately be assessed by the investigating body to cost at least EUR 2 million in total;*

***'incident'** means any occurrence, other than accident or serious accident, associated with the operation of trains and affecting the safety of operation;*

*A '**precursor of accident**' includes broken rails, track buckles, wrong-side signalling failures, signals passed at danger and broken wheels and axles on rolling stock in service.*

1. Introduction

This is the third annual safety statistical report of the Railway Safety Commission (RSC) prepared for the general public in line with section 9(A) of the Railway Safety Act 2005 which requires that the RSC operates in an open, non-discriminatory and transparent manner. This report provides background statistics to a number of safety performance indicators with discussion when appropriate. Key performance indicators are guided by the Common Safety Indicators (CSI), as specified in Directive 2004/49/EC and amended by Directive 149/2009/EC.

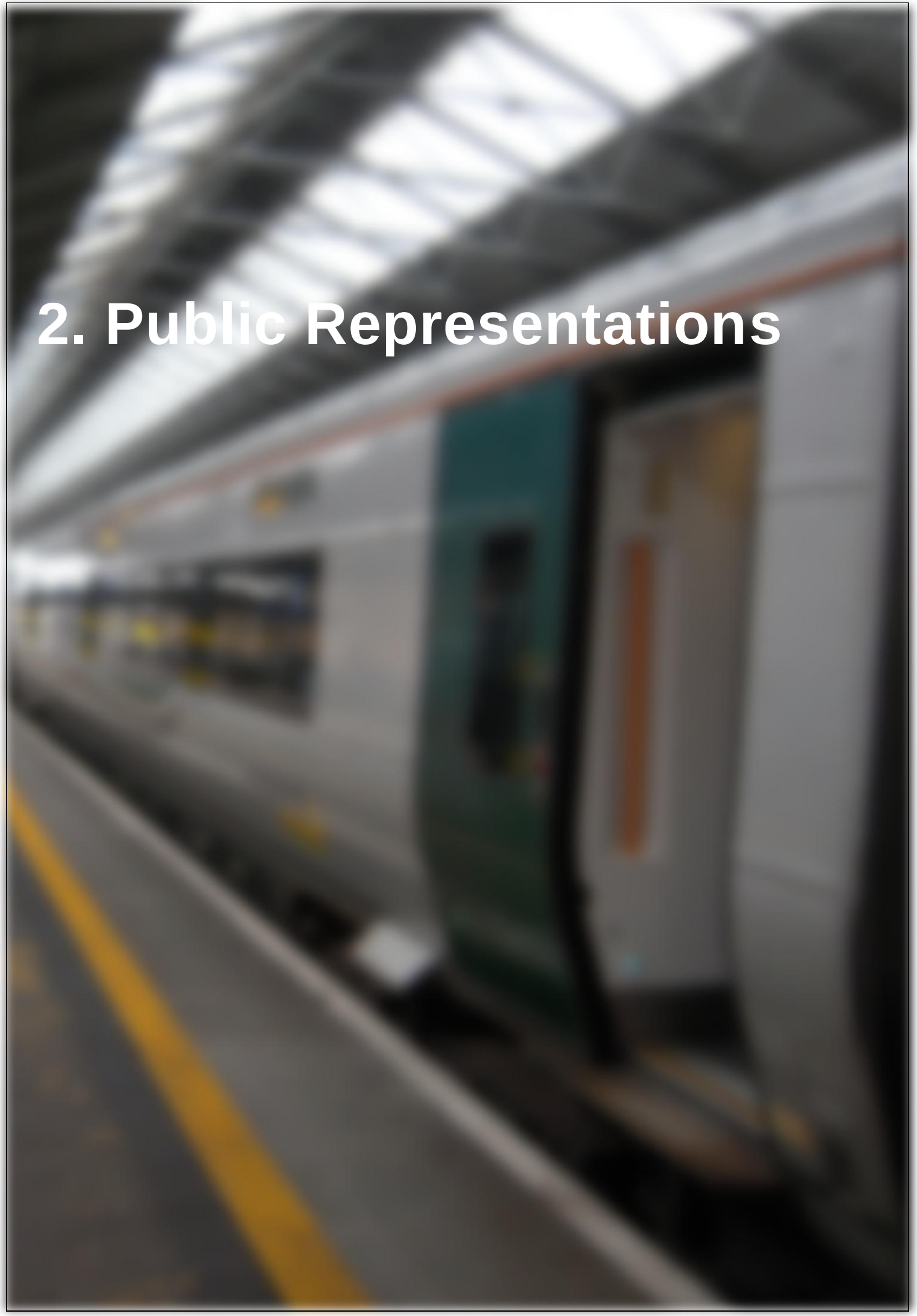
1.1 Overview of Report

In Chapter 2, a brief overview of the public representations received by the RSC is presented. Safety trends in Ireland are presented and discussed in Chapter 3. All types of train accidents are included. In Chapter 4 a high level comparison with other European railways shows where Iarnród Éireann (IÉ) are positioned in terms of railway safety. This includes a brief overview of significant accidents that have occurred in Europe in 2011. Chapter 5 concerns Railway Accident Investigation Unit (RAIU) recommendations made as a result of their investigations. The status of each recommendation is explained together with details of actions taken to date.

1.2 The Railway Safety Commission

The RSC was established on 1st January 2006 under provision of the Railway Safety Act 2005, with responsibility for railway safety regulation and investigation. It is a small, professional organisation with a flat reporting structure. Its mission is to "advance the safety of railways in Ireland through diligent supervision and enforcement". This regulatory responsibility is without prejudice to the fact that the national railway operator, Iarnród Éireann, and the operator of the Dublin light railway, Veolia, each has the primary duty of care regarding the safety of operations and infrastructure.

S.I. No. 61 of 2008 defined the RSC as the National Safety Authority (NSA) in the context of the European Railway Safety Directive 2004/49/EC. It also amended some provisions of the 2005 Act to transpose the Railway Safety Directive. The RSC as NSA has responsibility for approving safety management systems, new rolling stock and infrastructure and monitoring the industry to ensure it is able to manage its own risk effectively. The RSC also co-ordinates and encourages railway safety initiatives between the industry and external stakeholders. Further details may be found on the RSC website. www.rsc.ie.

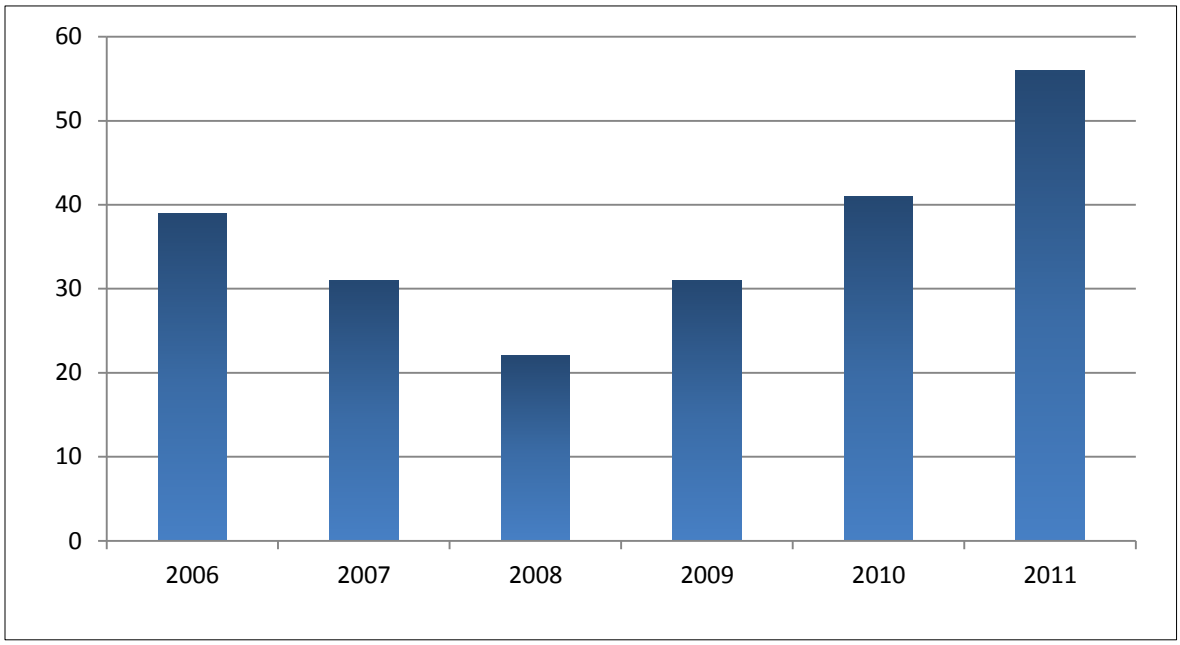


2. Public Representations

2 Public Representations

The RSC value the public, passengers and others as 'additional eyes and ears' and at all times encourage them to bring any railway safety concern to our attention. Where these issues relate to service rather than safety, the RSC directs the representation to the appropriate entity. Where the matter involves railway safety, the RSC endeavours, wherever possible, to deal with the matter directly. If necessary the RSC will seek information from the appropriate railway company for further clarification.

In 2011, the RSC received 56 direct or indirect public representations, an increase of 37% on the 2010 figure. These predominantly related to the Iarnród Éireann rail network with the majority of these relating to operational matters. Some prompted immediate action to control risks while the majority gave no specific cause for safety concern. However, it is RSC policy that all safety related concerns are investigated further. The RSC continues to track representations to identify any recurrence or trends that might indicate a need for intervention in the future.



Graph 1: Public Representations received by the RSC

There was no identifiable theme or trend to the representations received in 2011 with complaints ranging from warning signage to boundary fencing concerns adjacent to the track. A slight increase is noted with issues related to train running and operation. Investigations into all issues were conducted with the co-operation of Iarnród Eireann and Veolia (Luas Operator) as necessary.

3. Railway Safety Trends in Ireland

3 Railway Safety Trends in Ireland

The safety performance of the duty holders in the Republic of Ireland is considered for the four principal railway sectors that the RSC regulates, namely heavy rail, light rail, industrial rail systems where interface with the public highway, and the heritage railways. Each railway operator and infrastructure manager is obliged to notify railway incidents and accidents to the RSC. This data is used for assessing duty holder safety performance among other things.

3.1 Iarnród Éireann

The IÉ network in service remained unchanged from 2010, at 1683 km. Passenger Train-km decreased by 4.1% to 17,008,042.

The number of recorded passenger journeys dropped by 2.22 % to 37.375 million in the year 2011.

3.1.1 Iarnród Éireann Casualty Statistics

Table 1 illustrates the fatalities and lost-time injuries reported for employees and fatalities and injuries to third parties on the national railway network for the years 2006 to 2011.

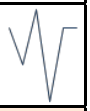
Railway operations and track maintenance: fatal injuries	2006	2007	2008	2009	2010	2011	Trend
Fatal injury to person due to a train accident, not at level crossing	0	0	0	0	0	0	
Fatal injury to passenger travelling on a train, other than in train accident	0	0	0	0	0	0	
Fatal injury to passenger attempting to board or alight from train	0	0	0	0	0	0	
Fatal injury to customer, no train involved	0	1	0	0	0	0	
Fatal injury due to railway accident at a level crossing	0	1	1	0	2	2	
Fatal injury to employee at a level crossing due to train in motion	0	0	0	0	0	0	
Fatal injury to employee due to train in motion (other than at a level crossing)	0	0	0	0	0	0	
Other fatal injury to employee on the railway	0	0	0	0	0	0	
Fatal injury on railway or level crossing where trespass or suspicious death was indicated	7	5	8	3	7	7	
Railway operations and track maintenance: injuries	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**Trend**
Injury to passenger due to a train accident not at level crossing	0	0	0	2	0	0	
Injury to passenger travelling on train, other than in a train accident	41	35	22	40	28	10	
Injury to passenger attempting to board or alight from train	55	50	43	17	64	46	
Injury to passenger in station or visitor to premises	69	84	74	88	27	0	
Employee injury involving train movement or train accident	15	8	9	13	12	9	
Employee injury while working on railway	69	78	79	65	57	45	
Employee injury at level crossing	2	4	0	0	0	0	
Person injured in railway accident at level crossing	0	1	0	0	0	2	
Passenger injury in railway accident at level crossing	0	0	0	0	0	1	
Level crossing user injured	0	1	1	1	0	3	
Injury to other person	5	1	2	0	1	0	

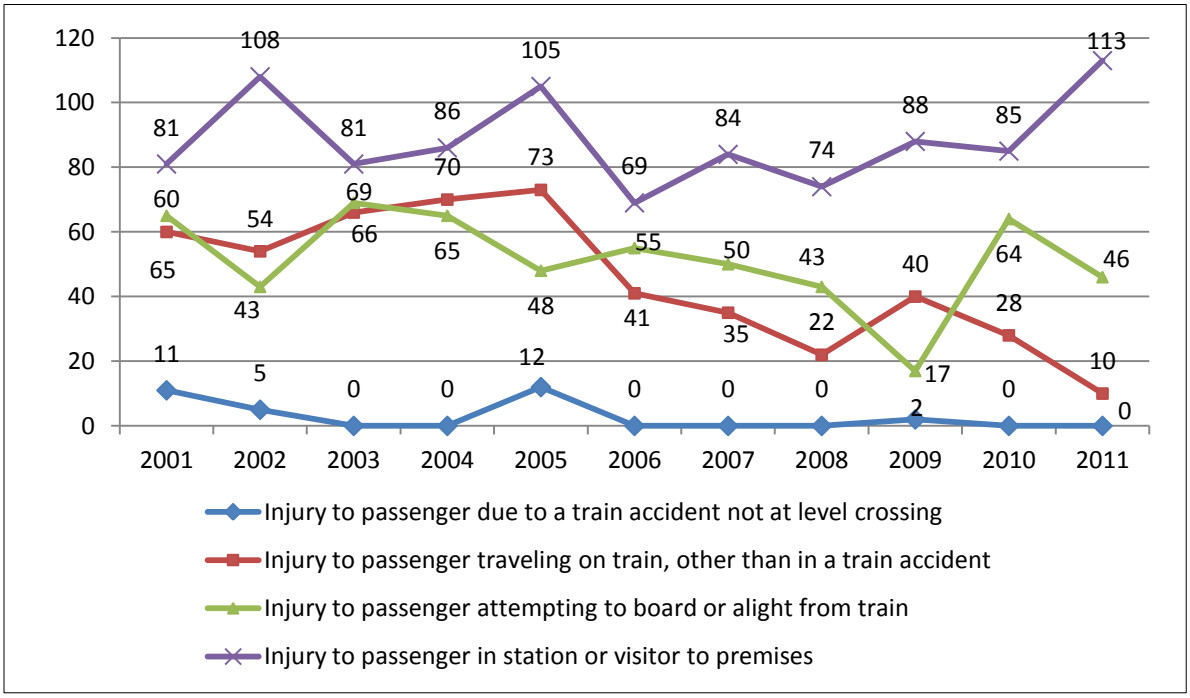
Table 1: IÉ Operational fatality and Injury Statistics

3.1.1.1 Fatal Injuries

There were seven fatal injuries on the railway where trespass or suspicious death was indicated. These incidents occurred at various locations around the railway network. The RSC uses a coroner's verdict, when available, to assist in classifying the circumstances surrounding a fatality.

3.1.1.2 Passenger Injuries

The data indicates the largest proportion of incidences occur to passengers during time spent at stations as opposed to time spent on trains. This is common across many modern railways due to the sedentary nature of passengers when on board a train.



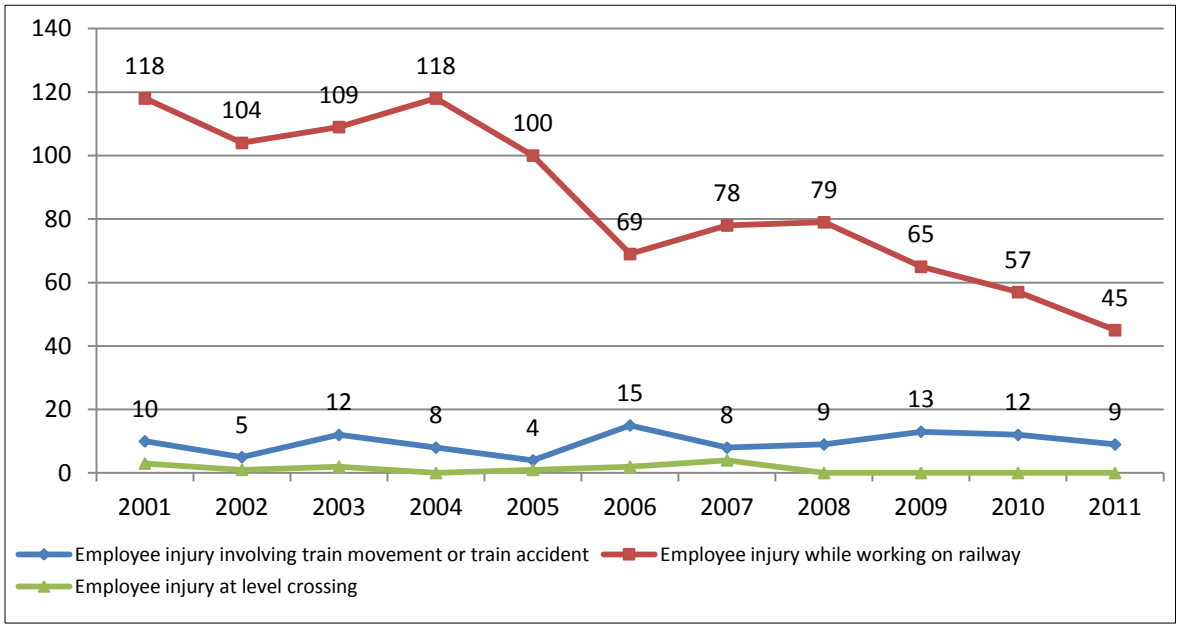
Graph 2: Passenger Injury statistics by year

A significant increase of injuries is noted to passengers or visitors to premises. One major contributory factor to rising figures is the presence of new Safety Management Systems which has improved reporting of such incidents.

When passengers get injured when on board a train, it tends towards incidents involving people catching a foot, an arm or their bags in closing doors. Such instances have contributed to the statistic '*Injury to passenger attempting to board or alight from train*'. 15 instances occurred of this nature in 2011, occurring at a steady rate throughout the year.

3.1.1.3 Employee Injuries

Employee Injuries are in three different categories, as shown in the graph below. The trend indicates injuries are decreasing over a sustained period of time. Systems for managing safety have improved significantly over this period of time and it appears to have had a beneficial effect on employee injury trends.



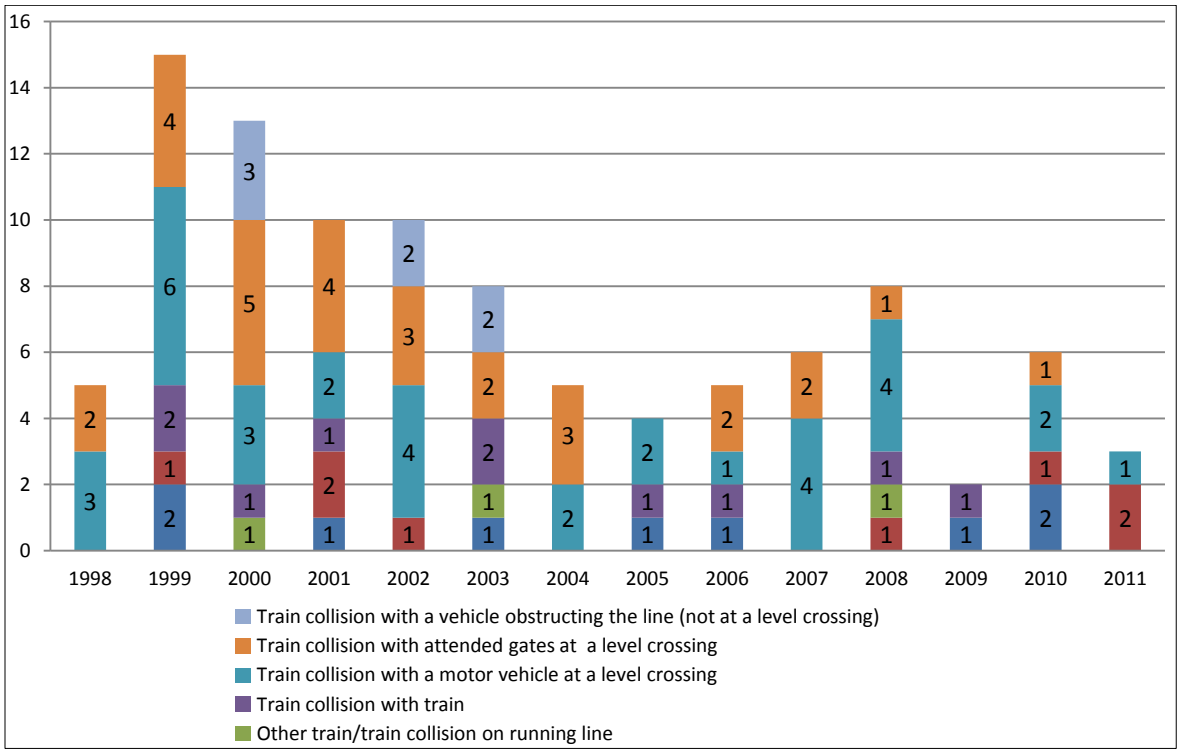
Graph 3: Employee Injury statistics by year

The trend of recent years for decline in Employee Injuries continued in 2011. However, two notable incidents did occur involving on-board staff suffering injury whilst performing duties. Iarnród Éireann is continuing introduced mitigations to moderate such incidents.

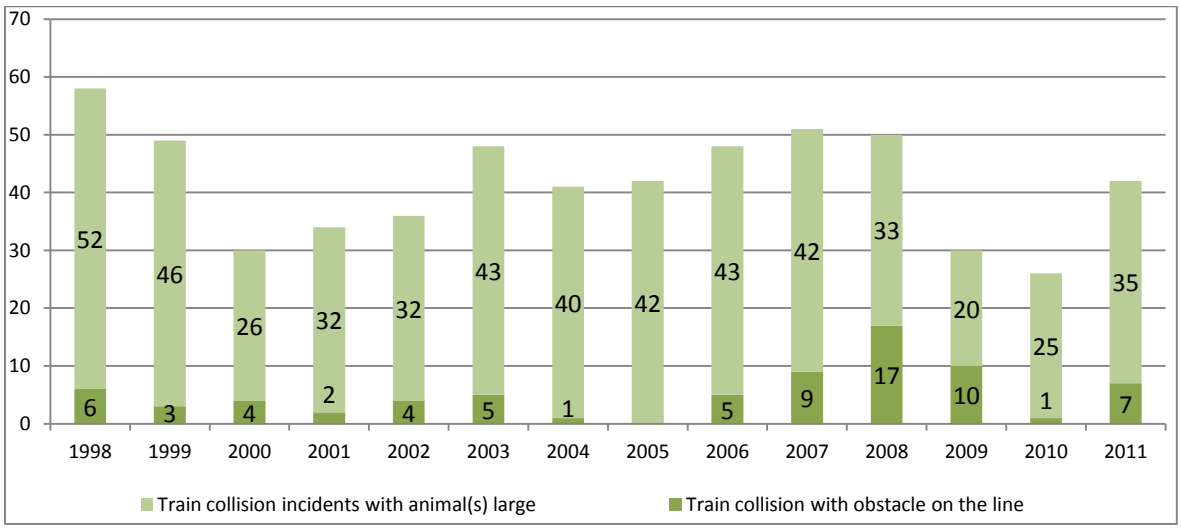
3.1.2 Iarnród Éireann Incident Statistics

3.1.2.1 Train Collisions

Train collisions can pose a significant risk to passengers, train crew and third parties. They have the potential to cause considerable damage to rolling stock. Graph 4 illustrates the trend for collisions since 1998. Graph 4 has split into parts to aid understanding of the data.



Graph 4: Part 1, Train Collision Statistics by year, part 1



Graph 5: Part 2, Train Collision Statistics by year

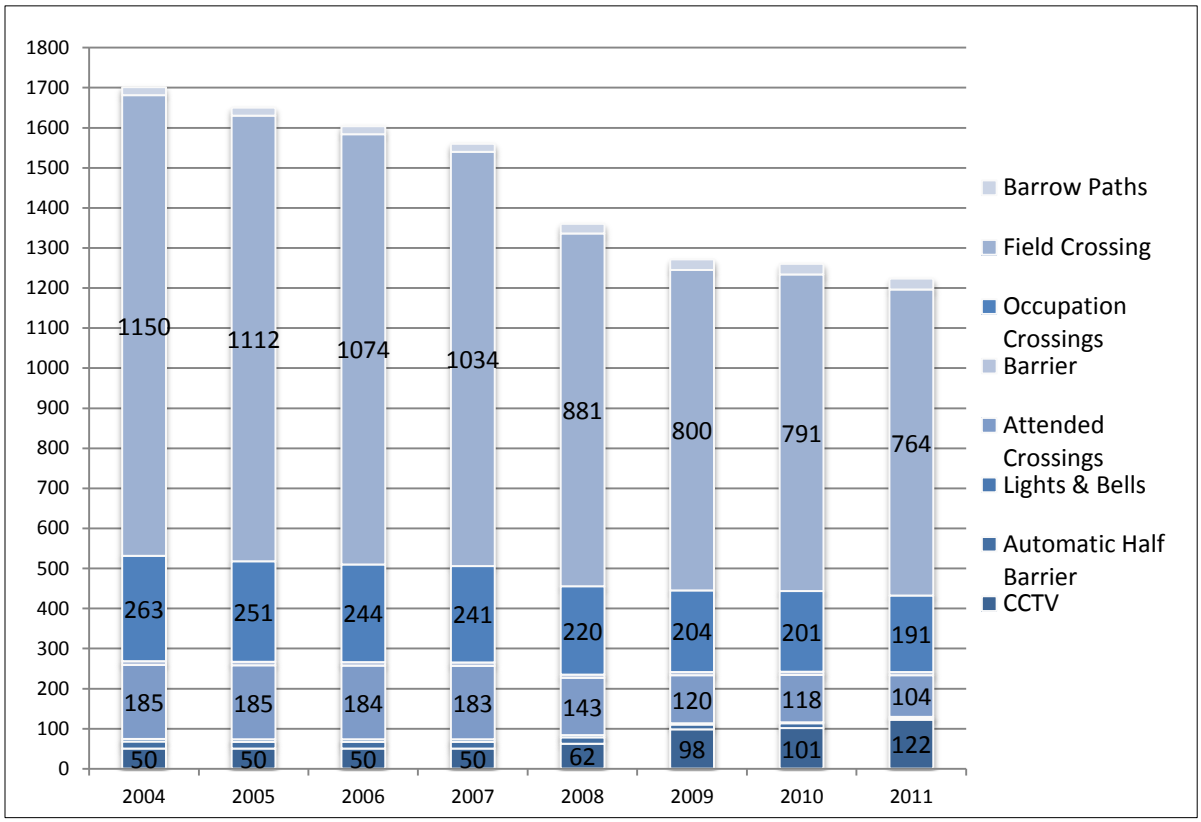
Total collisions took an upward turn in 2011, after two years of decline. This has been caused by collisions with animals, which are up noticeably from 2010 but still below figures in the recent past. Obstacle collisions are from up from 1 in 2010, to 7 in 2011. Incidences include hitting shopping trolleys and metal debris on the line.

Boundary improvement is subject to continued work by Iarnród Éireann. Sustained improvement of line-side boundaries will contribute to lessening collisions in these categories

One collision occurred between a car and train during 2011. This incident arose when the train on the Dublin-Galway route collided with a car which was fouling the railway line at a level crossing. No serious injuries were recorded.

3.1.2.2 Level Crossings

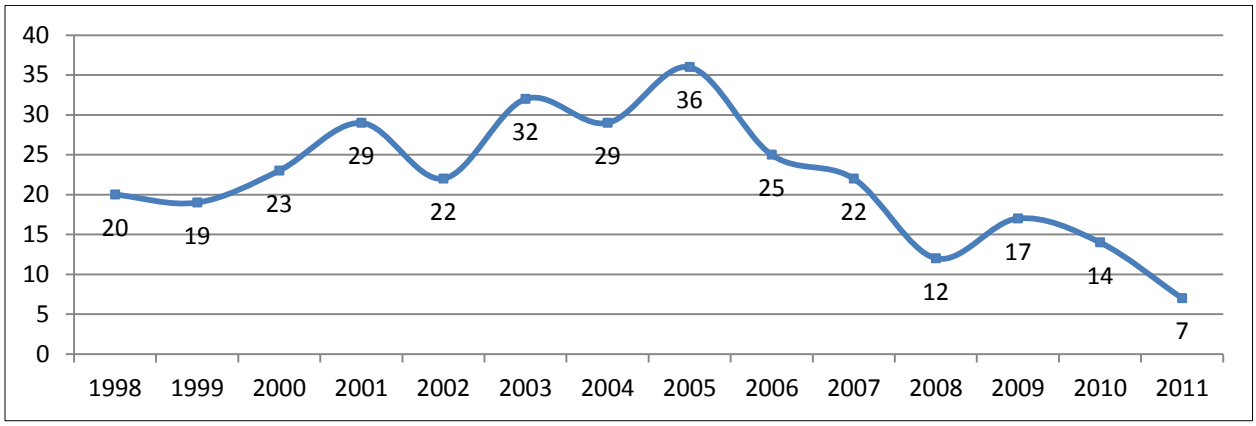
Level crossings are a significant risk to the railway and to any third parties who use them 2011 saw a number of level crossings closed. Iarnród Éireann are now more than mid-way through the Government's third Railway Safety Investment Programme (2009-2013) and work continues to upgrade and whenever possible close level crossings.



Graph 6: Number of level crossings by type by year (Total number inc. closed lines)

3.1.2.3 Signals Passed at Danger (SPAD)

A SPAD is defined as having occurred when a train passes a stop (red) signal. SPADs are particular precursor events that the RSC monitors regularly during its supervisory meetings with IÉ. The trend in recent years shows a steady decline.



Graph 7: Main (running) signal passed at danger where warning was given in time

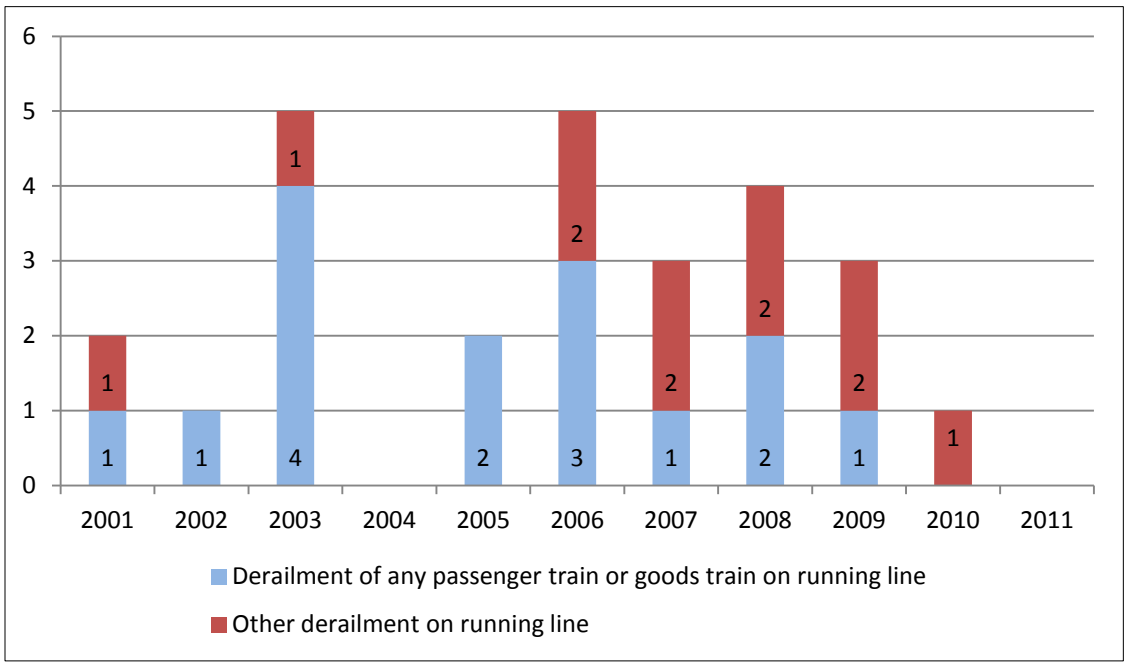
In 2011, there were a total of 7 SPADs on running lines, i.e., not including those that occurred in sidings or depots. IÉ use a ranking tool to determine whether each SPAD had the potential to cause an accident. A significant amount of information relating to each SPAD is collated. Using this information, IÉ determine a weighted numeric score for each occurrence and the score dictates the level of internal investigation. SPADs are grouped into one of 3 severity bands, i.e.,

- ⇨ those classified as not a significant risk
- ⇨ those classified as potentially significant; and
- ⇨ those classified as potentially severe.

As previously stated there were 7 SPADs in 2011 and, of these, 2 were categorised as potentially severe. Regardless of severity, all SPADs are investigated by IÉ to determine if there are lessons to be learnt.

3.1.2.4 Train Derailment

Train derailments remain at low levels. Continued track and rolling stock maintenance, in conjunction with targeted renewals of track, should ensure that this type of incident rarely occurs.



Graph 8: Train Derailments

No running line derailments occurred in 2011. This continues the declining trend from recent years and it is the first time since 2004 where the figure has been zero.

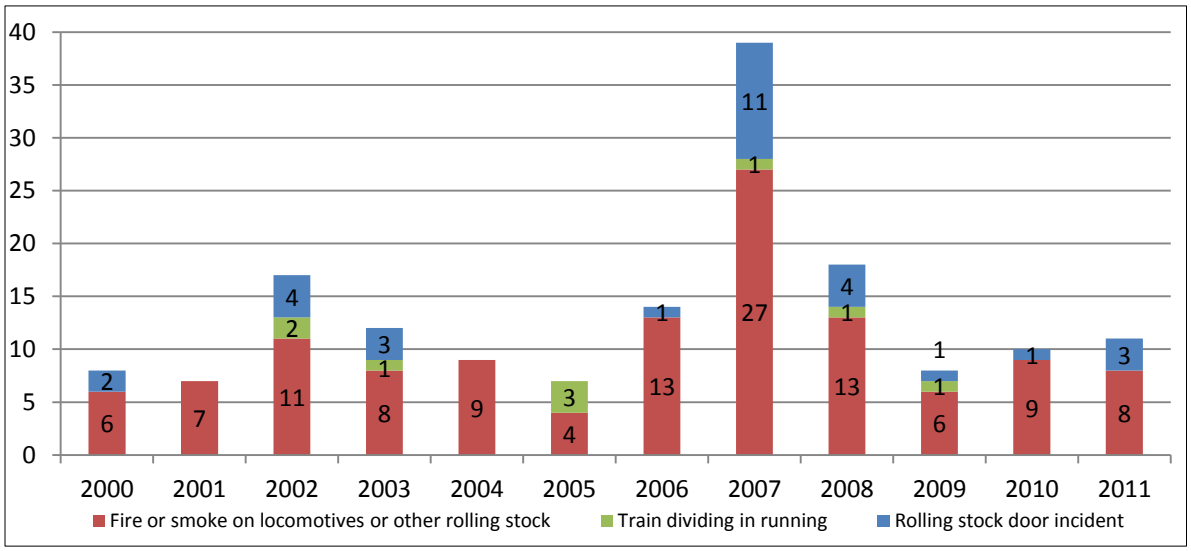
3.1.3 Iarnród Éireann Rolling Stock Incidents

Iarnród Éireann operates several different fleets in provision of rail services. These include:

- Intercity Diesel Multiple Unit (22000 class)
- Diesel Multiple Unit (29000, 2800, 2700, 2600 classes)
- Electrical Multiple Unit (8100, 8200, 8500 classes)
- Locomotives (201, 071 classes)
- Passenger Carriages (Mark IV)
- Freight wagons
- Yellow Plant (Track Maintenance Fleet)

There are a number of key safety statistics pertaining to rolling stock and they are:

- Fire or smoke incidents
- A train dividing (splitting) while in service
- Door issues



Graph 9: Rolling Stock Incidents

2011 saw the number of door incidents rise to three. Two of these consisted of the door opening track side on the unit. Clearly, this is a cause for concern and is being investigated further by the RSC. Another incident resulted in a passenger's hand being caught in the door. A full technical investigation by IE followed, with root causes identified. Maintenance procedures have changed to prevent such an incident re-occurring.

A train divide is an occurrence where a train splits into two. The split would occur between carriages. None occurred in 2011. Incidents of smoke on Rolling Stock decreased slightly to 8 in 2011. In all cases the on board fire suppression equipment behaved as expected. No discernible trend was detected from the data.

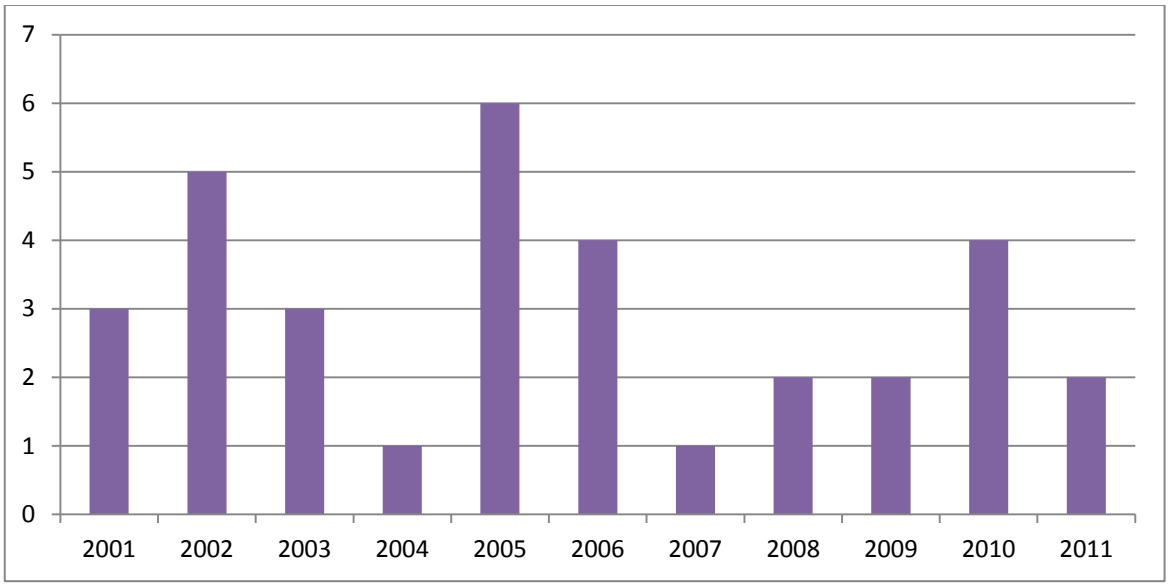
3.1.4 Iarnród Éireann Infrastructure Incidents

IÉ have many thousands of infrastructure assets including track, stations, bridges, culverts, tunnels, level crossings, buildings, cuttings and embankments, points and crossings, signals etc. all of which must be inspected and maintained at varying prescribed frequencies. Invariably assets will fail from time to time and data relating to some of these is now presented.

3.1.4.1 Broken rails

The network extent is 1683 route-km or 2165 track-km, 27% of which is multiple track (double, triple or quadruple).

Iarnród Éireann visually inspects the track at least once per week and rails are ultrasonically tested at least every 2 years, with the vast majority including the main lines being tested annually.

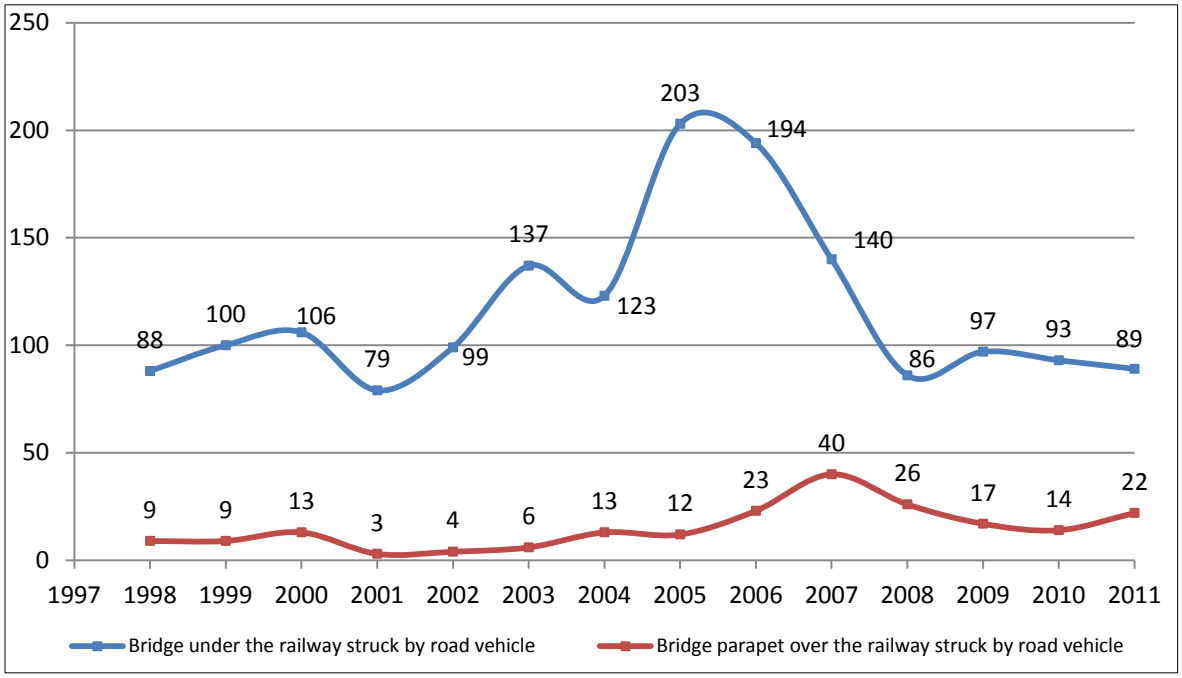


Graph 10: Broken rails on Passenger lines

The number of broken rails on passenger lines decreased in 2011, to 1. Whilst it did not result in a train accident it is an area where IÉ will need to be vigilant. The RSC closely monitors Iarnród Éireann's management of its assets through its regular supervision meetings.

3.1.4.2 Bridge Strikes

A railway bridge may be a road over the railway or carry the railway over a road. A bridge strike is therefore where a road vehicle strikes the parapet or roadside containment of a bridge over the railway or where a road vehicle strikes the underside of a railway bridge. Both types can, in certain circumstances, result in very severe consequences and road users should be mindful of their driving in the vicinity of the railway and, if driving an oversized vehicle, road vehicle drivers should know their vehicle height.



Graph 11: Railway Bridges struck by road vehicles

The total number of bridge strikes, i.e., under-bridge and over-bridge, in 2011 was slightly more than that for 2010, 107 vs. 111. Over a sustained period of time, whilst these figures show the decreasing trend fall from the highs of 2005 and 2006 the numbers still remain high.

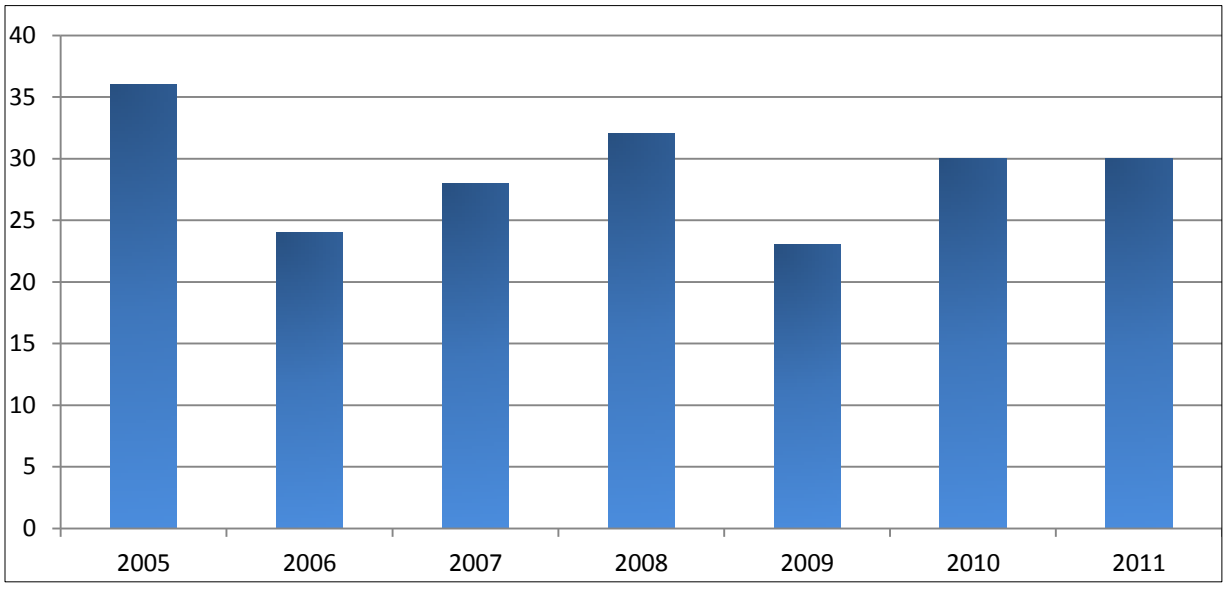
IÉ have introduced new procedures which includes the issuance of remits to investigate any type of technical issue, such as a bridge strike, that happens on the railway. The objective of such an investigation is to try and ascertain root causes, and identify where lessons can be learnt.

3.2 Veolia (Luas) Statistics

Veolia have been operating the Luas since it commenced operation in June 2004. The total tram-kilometres (km) run in 2011 was 3.86 million, representing an increase of approximately 24% compared to 2010. This sharp rise is explained by the opening of extensions to the network. 29.1 million passenger journeys were completed in 2011 compared to 27.6 million passenger journeys completed in 2010.

3.2.1 Road Traffic Accidents

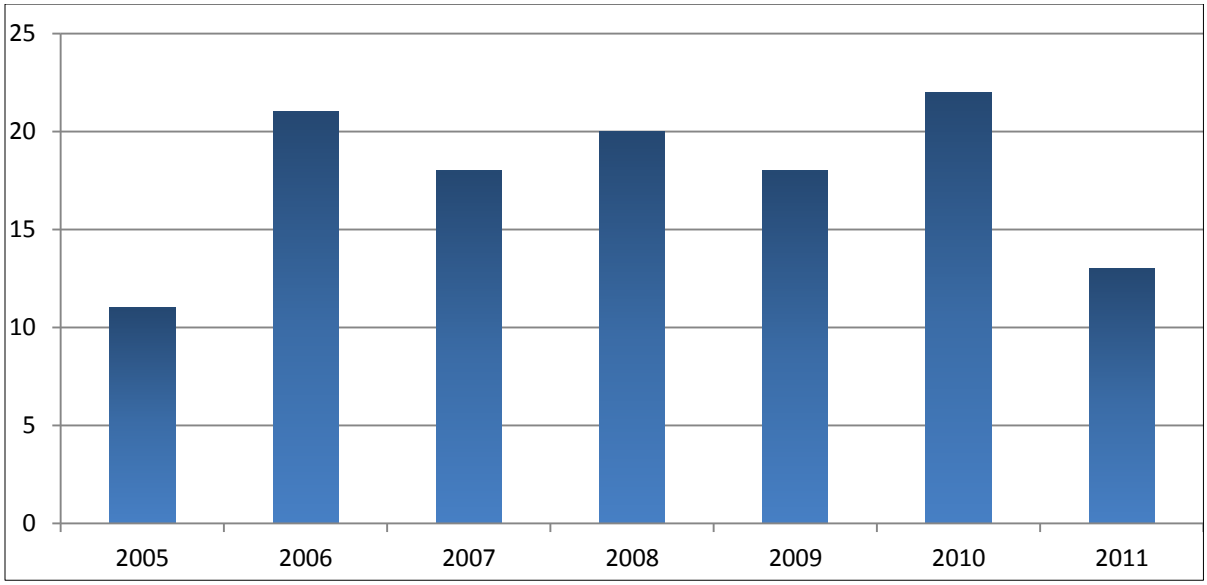
The Luas by its very design interfaces with the public and road traffic along significant sections of its alignment, most notably in the city centre. The Luas operates by 'line of sight' and is no different in its operation to the majority of light rail systems around the world. However, given that the Luas shares sections of the carriageway with road vehicles, road traffic accidents (RTA) can and do occur. The number of RTA's has remained steady at 30, or slightly more than 2 RTA each month. 24 of these have occurred at junctions where road vehicles and the tram meet; 6 occurrences happened in shared running sections, typically in the city centre.



Graph 12: Road Traffic Accidents involving a tram

Non signal controlled junction RTA's have increased significantly, rising from 0 in 2010 to 6 in 2011, whilst shared street running RTA's decreased from 11 to 6. No consistent cause has been identified for these incidents.

3.2.2 Tram / Pedestrian Contact



Graph 13: Tram/Pedestrian coming into contact

As with RTAs, the vast majority of contact incidents between trams and pedestrians occur in and around the city centre. Since services began in 2005, there have been 8 incidents where people have been required to attend hospital, 1 of which occurred in 2011. Table 2 provides further detail.

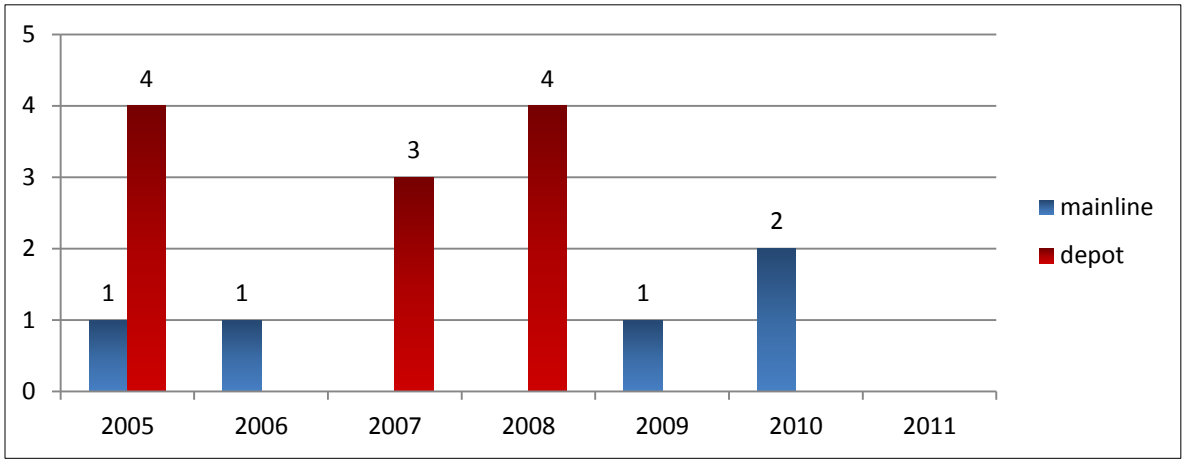
Year	Total number of tram-pedestrian contact incidents	Taken to hospital	Confirmed serious injury	Fatality
2005	11	6	0	0
2006	21	5	0	0
2007	18	7	2	0
2008	20	3	2	1
2009	18	1	0	0
2010	22	5	3	0
2011	13	2	1	1

Table 2: Tram – Pedestrian Contact Statistics

One fatality occurred in 2011. A pedestrian came into contact with an inbound tram on Stevens' lane. One serious injury occurred when a Cyclist entered the tramway from a cycle path as the outbound tram approached and both collided. The cyclist was taken to hospital with head injuries and was later released.

3.2.3 Tram Derailments

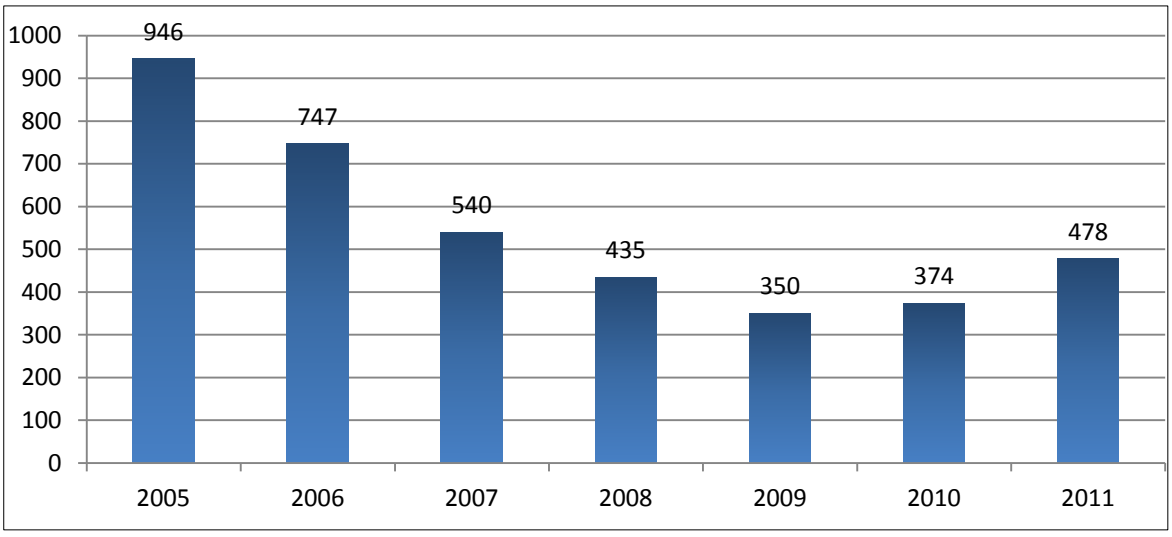
No derailments were reported in 2011.



Graph 14: Tram Derailments

3.2.4 Tram Emergency Brake Applications

A useful precursor event indicator is the number of emergency brake (EB) applications which tram drivers make. In addition to its standard brakes, a tram is fitted with an electromagnetic track brake or EB. Tram drivers are trained in defensive driving techniques and are constantly vigilant of pedestrians, cyclists and road vehicles. However, there are occasions when a driver may need to apply the EB to prevent a collision. Evidence suggests that these EB applications are often made because of acts of commission or omission by the third party, i.e., the road vehicle driver, cyclist or pedestrian may not obey the Rules of the Road.



Graph 15: Emergency Brake Applications

There were 478 EB applications made in 2011 representing a 27% increase on 2010 figures. Operator analysis of this increase indicates it is largely due to the new extensions opened recently, for example Line A1 to Saggart. New routes can introduce new risks as the public adapt to interfacing with the tramway, and tram drivers acquire knowledge of any hazards on the route.

3.3 Bord Na Móna Industrial Railway Statistics

The remit of the RSC in terms of its oversight of Bord Na Móna's (BNM) industrial railway is limited to where it interfaces with public roads. These interfaces are at level crossings and where there are bridges over the industrial railway. In terms of key infrastructure statistics there is 570 km of permanent track, 98 level crossings and 50 underpasses, of which 47 are under roads and 3 are under Iarnród Éireann rail lines.

One derailment was reported in in 2011. This occurred near Blackwater Bog works. A gate opened onto a peat wagon hauling peat to West Offaly Power Station, and derailed the wagon. The gate latching arrangement has since been redesigned and replaced.

There were three reported incidences of road vehicles striking level crossing gates. All occurrences are being treated as road traffic incidents and have been attributed to driver error or inclement weather.

3.4 Heritage Railways

A heritage railway is defined in legislation as *'a person who only operates train services or railway infrastructure of historical or touristic interest..'.* The RSC monitor the operations of 8 self contained heritage railways. They are;

- Cavan and Leitrim Railway
- Difflin Light railway, Oakfield, Raphoe
- Finntown & Glenties Railway
- Listowel Lartigue Monorail
- Irish Steam Preservation Society Stradbally
- Tralee & Dingle Railway
- Waterford & Suir Valley Railway
- West Clare Railway

There were no reported incidents or accidents in 2011 which is consistent with previous year's performance.

3.4.1 Railway Preservation Society of Ireland (RPSI)

In addition to the above operations the RPSI operate steam and diesel hauled trains on the main Iarnród Éireann infrastructure. Because of the nature of its activities, which can import risk to the main railway network, the RPSI is classified as a Railway Undertaking (RU). As an RU it has received safety certification based on the acceptability of its Safety Management System, compliance with which is supervised by the RSC.

4. Railway Safety Trends in Europe

4 Railway Safety Trends in Europe

In European terms, the RSC is defined as the National Safety Authority (NSA) for Rail in Ireland. Each European member state has an NSA which, in accordance with the Railway Safety Directive (2004/49/EC), must send its annual report on railway safety to the European Railway Agency (ERA). The ERA in turn analyses railway safety on a European scale and publish its report. ERA reports do not take into account light rail (Luas) or metro systems. The ERA produces a biennial report, the most recent being published in 2012. Some noteworthy statistics from a European perspective are now presented.

4.1 Key European Statistics

In the most recent 'Railway Safety performance in the EU' report (ERA, 2012), data was supplied by 26 National Safety Authorities (NSA) and the Channel Tunnel Safety Authority. The tables below present the most recent data set, which is from 2010. The figures, normalised by train-km run, serve to illustrate how Ireland is performing when compared against the overall European average performance.

Significant* Accidents	Ireland (IE) 2011	Ireland (IE) 4 Year Average (2007-2010)	EU (Total) 4 Year Average (2007-2010)	IE Performance
Train-km (Million)	17	17.9	4123.4	
		IE rate per 100 million train-km	EU rate per 100 million train-km	
Collision of Trains	0	2.79	4.52	Good
Derailment of Trains	0	1.4	5.65	Very Good
Level crossing Accidents	2	8.37	22.3	Very Good
Accidents to persons caused by rolling stock in motion	1	11.16	38.83	Very Good
Passenger fatalities	0	0	1.57	Very Good
Level Crossing User Fatalities	2	4.19	10	Very Good
Passenger Serious Injuries	0	1.4	6.9	Very Good
*Resulting in death or serious injury or damage more than €150000 or line closure for more than 6 hours				

Table 3: EU Accident Statistics for year 2010

In 2010 Ireland had approximately 25% more level crossings per track-kilometre than the European average. However, as previously stated in section 3.1.2.2, IÉ has an ongoing level crossing upgrade and closure programme which will contribute to increased safety at such locations.

Table 4 presents the number of precursor events which is another useful indicator in terms of measuring safety performance. The figures, normalised by size of network or by train-km run, serve to illustrate how Ireland is performing when compared against the overall European average performance.

Precursor* Incidents	Ireland (IE) 4 Year Average (2006-2009)	EU (Total) 4 Year Average (2007-2010)	IE Performance
Track-km (thousand)	2.12	303.34	
	IE rate per 1000 track-km	EU rate per 1000 track-km	
Broken Rails	1.52	17.68	Very Good
Track buckle	0.47	6.72	Very Good
	IE rate per 100 million train-km	EU rate per 100 million train-km	
Wrong Side Signalling Failure	6.58	22.88	Good
Signals Passed at Danger (SPAD)	110.53	136.88	Average
Broken Train Wheels	0	2.44	Very Good
Broken Train Axles	1.32	1.73	Average
*Forerunner events with potential to cause serious accidents			

Table 4: EU Precursor event statistics for year 2010

From the above tables it is evident that Iarnród Éireann (IÉ) is performing well in most categories. In a EU context Ireland is performing above average in terms of safety performance.

4.2 Major Accidents in other EU Member States

A number of major incidents occurred in 2011 in other EU countries and below is a brief synopsis (based on ERA and NSA information) of some of these.

Finland

A freight train, which had arrived to assist another freight train travelling to Mäntyluoto, Pori, Finland, collided with the rear of another train in Nokia, between Siuro and Suoniemi, at 4.05 am on 21 February 2011. The engine driver of the assisting train was fatally injured in the accident. One wagon and the locomotive, which collided the end of the other train, were badly damaged and had to be scrapped. Additionally, one wagon was badly damaged, but was still repairable. The tracks were undamaged. Traffic at the accident site was interrupted for 14 hours. According to event recorder data, the driver of the train which collided had begun emergency braking, at a speed of 46 km/h, five seconds before the impact. The train speed was 43 km/h upon impact. The maximum permitted speed of the train which collided was 50 km/h.

Germany

At approximately 22:28 on 29 January 2011, a frontal collision between a freight train proceeding towards Oschersleben, and passenger train proceeding towards Halberstadt occurred at the Hordorf crossover [double to single line junction]. At that point, the Magdeburg – Halberstadt line is single track. The passenger train was hit by a freight train proceeding towards Oschersleben and was completely derailed. The freight train was loaded with limestone and hauled by two diesel locomotives. At the time of the accident thirty-two people were in the passenger train. Ten people were fatally injured, amongst them the driver of the passenger train and a train conductor. Twenty-three people were injured, some seriously, including the driver of the freight train. The Passenger train was flung off track by the force of the impact and came to rest, severely damaged, beside the track. The Freight train remained completely on track. After the impact, the leading locomotive of the two on the freight train was pulled off the track and came to rest some 130 m from the track.

United Kingdom

At 00:16 hrs on 5 June 2011, a Manchester Metrolink tram struck and fatally injured a pedestrian. The tram was approaching Piccadilly Gardens, from the direction of Market Street, at a speed of about 9 mph (15 km/h) when a pedestrian ran into its path. The pedestrian appeared to become aware of the tram and tried to stop before reaching the track, but fell directly in front of the tram.

5. Accident Investigations

5 Accident Investigations

The Railway Accident Investigation Unit (RAIU) is a functionally independent organisation which shares some of the administrative resources of the RSC. The RAIU undertakes 'for cause' investigations into accidents and incidents that either meet specific criteria in terms of severity or could have, in slightly different circumstances, resulted in a more serious accident or incident.

The purpose of an investigation by the RAIU is to identify improvements in railway safety by establishing, in so far as possible, the cause or causes of an accident or incident with a view to making recommendations for the avoidance of similar accidents in the future, or otherwise for the improvement of railway safety. It is not the purpose of an investigation to attribute blame or liability. The RAIU's investigations are carried out in accordance with the Railway Safety Act 2005 as amended by S.I. 61 of 2008 and European Railway Safety Directive 2004/49/EC.

5.1 RAIU Active Investigations

In 2011, the RAIU initiated 3 investigations. One investigation was initiated in 2009. All are listed in table 5. The RAIU have or will in due course, issue reports on these incidents and may make recommendations that the RSC will oversee the implementation of recommendations made in these reports.

Date of Incident	Details	Duty Holder
2nd Sept. 2009	LUAS strikes bus on O'Connell	Luas
14th Feb	Car Strike at Morrough Level Crossing	IÉ
29th Sept	Runaway Locomotive Portlaoise	IÉ
18th Oct	Locomotive Bearing Failure	IÉ

Table 5: RAIU investigations in Progress

5.2 RAIU Investigation Reports

In accordance with the Railway Safety Act 2005, the RAIU endeavours to publish an investigation report not later than 12 months after the date of the incident. In 2011, the RAIU published 7 investigation reports and they are listed in table 6. As a result of their investigations the RAIU made a total of 17 recommendations which are discussed in section 5.3.

Date Report Published	Title of Report	No. of recommendations made	Duty Holder
19th January (2011-R001)	Laois Traincare Depot Derailment, 20th January 2010	2	IÉ
5thMay (2011-R002)	Secondary suspension failure on a train at Connolly Station, 7th May 2010	3	IÉ
11thMay (2011-R003)	Tram derailment at The Point Stop, Luas Red Line 13th May 2010	1	Veolia
27th June (2011-R004)	Gate Strike at Buttevant Level Crossing (XC 219), County Cork, on the 2nd July 2010	2	IÉ
18th July (2011-R005)	Person struck at level crossing XE039, County Clare, 27th June 2010	3	IÉ
4th October (2011-R006)	Road vehicle struck at level crossing XM096, County Roscommon, 2nd September 2010	5*	IÉ
19th October (2011-R007)	Car Strike at Knockaphunta Level Crossing (XM250), County Mayo, 24th October 2010	1	IÉ

* Three new safety recommendations, relating to additional observations made during this investigation but not relating to the occurrence, were also made.

Table 6: RAIU Investigation Reports published in 2011

5.3 RAIU Safety Recommendations

The RAIU, through their accident investigations, identify whenever possible the immediate cause, contributory factors and any underlying factors . Having established these, the RAIU may make recommendations and as previously stated, in 2011, 17 recommendations were made as a result of 7 of their investigations. In accordance with the Railway Safety Directive the RAIU should address recommendations to the safety authority (the RSC) and where needed by reason of the character of the recommendation, to other bodies or authorities in the Member State or to other Member States. Member States and their safety authorities shall take the necessary measures to ensure that the safety recommendations issued by the investigating bodies are duly taken into consideration, and where appropriate acted upon.

The RSC categorise the status of recommendations as being either 'Open', 'Complete' or 'Closed'. These are defined as follows;

Open (In progress)	- Feedback from implementer is awaited or actions have not yet been completed.
Complete	- Implementer has advised that it has taken measures to effect the recommendation and the RSC is considering whether to close the recommendation.
Closed	- Implementer has advised that it has taken measures to effect the recommendation and the RSC is satisfied that the work has been completed and has closed the recommendation.

What follows is a summary of the actions taken in relation to the seven RAIU Investigation Reports published in 2011 where recommendations were made, and the status of each recommendation.

2011-R001 - Laois Traincare Depot Derailment 20th January 2010	
Summary: At 15.25 hours on the 20th January 2010 a Class 22000 six carriage train was scheduled to leave Laois Traincare Depot after routine servicing. The intended destination of the train was Heuston Station. The Train Driver performed his pre-departure checks and the Shunter authorised the train to proceed out of Laois Traincare Depot as far as signal PL278, which controls the exit from the depot onto the down loop adjacent to the main line. The Shunter set the number 2A points for the train to leave the depot. The Train Driver stopped at signal PL278 as he was unable to read it due to sunlight shining on the signal and requested that the Shunter walk forward to check the signal aspect. The Shunter had been waiting at the number 2A points for the train to exit the depot in order to reset the points for the headshunt, protecting the down loop. He walked forward until he had a clear view of signal PL278 and advised the driver he had a proceed aspect. The Train Driver moved the train forward checking the aspect displayed when the signal was shaded by the train. The Shunter then walked back towards the depot and as he passed the points handle for the number 2A points, he operated the points. The train was still travelling over the points and derailed.	
Number of recommendations made	2
Recommendation 1	Iarnród Éireann should ensure that the risks relating to use of spring assisted manual points are identified and that appropriate control measures are implemented based on the risks identified.
Action/s taken / in progress	A Risk assessment has been carried out and report has been issued. RSC have sought further information clarifying details within the report.
Status	Open
Recommendation 2	Iarnród Éireann should ensure that the Signal Sighting Committee is informed when train drivers report difficulties viewing a signal and the Signal Sighting Committee should verify that the reported difficulties are addressed effectively.
Action/s taken / in progress	Procedure in place to for Signal sighting committee to address any reported difficulties.
Status	Complete

2011-R002 - Secondary suspension failure on a train at Connolly Station on 7th May 2010	
Summary: At approximately 22:50 on the 7th May 2010 the 21:05 passenger service from Longford to Connolly Station arrived into Platform 1 at Connolly Station in Dublin. The service was operated by a four carriage Class 29000 Diesel Multiple Unit referred to as Unit 10. A member of the contract cleaning staff subsequently observed that there was a problem with one of the carriages and advised Iarnród Éireann personnel. Unit 10 was found to have returned from passenger service with its secondary suspension system over-inflated on one of the bogies of carriage 29310. The over-inflation had led to the failure of the centre pivot retaining plate bolts and the airbags lifting the centre pivot pin out of the bogie centre. Unit 10 had been undergoing maintenance prior to being released for passenger service on the 6th May 2010 and had entered passenger service with the secondary suspension functioning incorrectly on the trailer bogie of carriage 29310.	
Number of recommendations made	3
Recommendation 1	IÉ should ensure all work in rolling stock maintenance depots is carried out in accordance with its control process.
Action/s taken / in progress	100% paper check carried out on all exams and 15% vehicles are physically checked. Maintenance audits are carried out as per Iarnród Éireann Safety Management System.
Status	Complete
Recommendation 2	IÉ should review its process of managing the hazard log in relation to the Class 29000s to ensure the adequacy of this process and verify that implementation of closure arguments in the hazard log is effective.
Action/s taken / in progress	Hazard logs for all fleets are being reviewed for suitability and updated.
Status	Open
Recommendation 3	IÉ should evaluate the risks relating to failure of the centre pivot pin to perform its function due to over-inflation of the secondary suspension and determine if any design modifications are required to avoid future failures.
Action/s taken / in progress	Risks were reviewed and reported by a third party contracted by Iarnród Éireann. Actions from this report have been implemented.
Status	Complete

2011-R003 - Tram derailment at The Point Stop, Luas Red Line, 13th May 2010	
Summary: On Thursday the 13th May 2010 LUAS Tram 3006 was travelling on the shuttle service between Dublin Heuston Railway Station and the Point Stop on the Luas Red line. At 22:10 Tram 3006 proceeded into The Point Stop with the intention of stabling at the Inbound Platform. However Tram 3006 travelled forward a distance of sixty-four metres towards the Event Platform, and not the Inbound Platform as was intended. The Tram Driver stopped Tram 3006 and after communicating with the Controller in the Central Control Room, subsequently changed driving cab ends and drove Tram 3006 outbound, derailing the third bogie on a set of spring points.	
Number of recommendations made	1
Recommendation 1	Veolia should look to introduce a communication protocol, between normal and emergency, for given situations where a clear understanding between a tram driver and CCR are required.
Action/s taken / in progress	Veolia produced a and communicated a Technical Briefing and Instruction Document for Central Control Room staff.
Status	Complete

2011-R004 - Gate Strike at Buttevant Level Crossing, County Cork, on the 2nd July 2010	
Summary: At 10:22, on Friday the 2nd of July 2010, the 08:00 Heuston to Cork passenger service passed through the Buttevant Level Crossing without incident. Approximately thirty seconds later a Track Recording Vehicle approached Buttevant Level Crossing in the opposite direction, as the Gate Keeper was in the process of closing the gates across the railway line. The Track Recording Vehicle struck one of the gates which resulted in damage to the gate and the Track Recording Vehicle. There were no injuries or fatalities as a result of this accident.	
Number of recommendations made	2
Recommendation 1	IÉ should identify similar manned level crossings where human error could result in the level crossing gates being opened to road traffic when a train is approaching; where such level crossings exist, IÉ should implement engineered safeguards, where appropriate.
Action/s taken / in progress	The identification of similar crossings has been carried out and Clonsilla has been identified. It is proposed to install safe guard at Clonsilla in 2012.
Status	Open
Recommendation 2	IÉ should review its risk management process for manned level crossings to ensure that risks are appropriately identified, assessed and managed to ensure that existing level crossing equipment is compliant with criteria set out in IÉ's signalling standards, where appropriate.
Action/s taken / in progress	Assess whether the level crossing equipment is compliant with SET signalling standards by the 30.10.2011. This issue is being managed through the Signalling risk register process. All Risk Assessments for Level Crossing Equipment has been assessed and additional control measures put in place.
Status	Complete

2011-R005 - Person struck at level crossing XE039, County Clare, 27th June 2010	
Summary: At approximately 22:00 on the 27th June 2010 the Train Driver of the 21:45 service from Ennis to Limerick sounded the horn on the approach to user worked level crossing XE039. As the Train Driver was sounding the horn he observed a farmer, 162 metres ahead of the train, pushing a cow through the gates of XE039 onto the railway, approaching the railway line from the Train Driver's right. As the train continued to approach XE039 the Train Driver applied the brake and sounded the horn twice. The Farmer continued to push the cow, the train struck the Farmer and the cow. As the train passed over XE039 the Train Driver heard a noise and saw the cow fall to the left of the train, he was not aware that the train had struck the Farmer. The train stopped 200 metres beyond XE039. The Train Driver went back to XE039 on foot and found both the Farmer and the cow on the side of the track on the opposite side of the track to the one had they approached from. The Train Driver requested the assistance of the emergency services, who were contacted by the Galway Line Signalman. The ambulance service arrived via a bridge over the railway 552 metres from XE039 and was then guided to the access road for XE039. The Farmer was fatally injured and pronounced dead at the scene.	
Number of recommendations made	3
Recommendation 1	IÉ should ensure that risk assessments are produced for all user worked LCs to identify all hazards specific to particular LCs.
Action/s taken / in progress	A review of the Level Crossing Risk Model is being undertaken with a view to establishing any developments required to achieve this recommendation. Following the review, and some ancillary activities such as updated usage counts at user worked crossings, the model will be used to identify reasonably foreseeable hazards that relate to the level crossing infrastructure which is the responsibility of IÉ.
Status	Open
Recommendation 2	IÉ should review their documentation on the measurement of viewing distances at existing user worked LCs to ensure that the viewing distances provide sufficient views of approaching trains to allow LC users cross safely.
Action/s taken / in progress	IÉ documentation has been reviewed and the output of this has been incorporated in to new Technical Standard.
Status	Complete
Recommendation 3	IÉ should review their procedures for the management of accidents to ensure that communication with the emergency services is clear and provides the necessary information to locate an accident site without

	undue delay and access it by the most appropriate point.
Action/s taken / in progress	Asset Management System Facility to be provided to Operations Department where requested.
Status	Complete

2011-R006 - Road vehicle struck at level crossing XM096, County Roscommon, 2nd September 2010	
Summary: At approximately 11:13 on the 2nd September 2010, the 09:30 freight service from Ballina to North Wall was travelling along the left hand curve on the approach to user worked level crossing XM096. As XM096 came into view, the Train Driver observed a tractor stationary on the track at the level crossing. The Train Driver sounded the horn and applied the brake. The Farmer driving the tractor was looking downwards as the train approached and had his arm between his legs in the area of the controls. Just before the train reached XM096 the Farmer looked up at the train. The tractor did not move clear of the railway line and was struck by the train. The train came to a stop 469 metres beyond the level crossing. The Farmer was fatally injured and pronounced dead at the scene.	
Number of recommendations made	5
Recommendation 1	IÉ should put in place a formal process for identifying and communicating with known users of user worked LCs.
Action/s taken / in progress	Signs to be erected at designated crossings. Validation of signage in progress.
Status	Open
Recommendation 2	IÉ should review the effectiveness of its signage at user worked LCs and amend it where appropriate, taking into account the information provided in the LC user booklet. The review should include the information on the use of railway signals, what to do in case of difficulty when crossing the railway and ensuring the signage is illustrated in a clear and concise manner, taking into account current best practice and statutory requirements.
Action/s taken / in progress	Signs to be erected at designated crossings. Validation of signage in progress.
Status	Open
Recommendation 3	IÉ should update its risk management system to ensure that interim control measures are put in place where longer term controls to address risks require time to implement.
Action/s taken / in progress	A review of the risk registers was under taken to ensure that there are no intolerable risks on the register after the appropriate mitigations have been applied.
Status	Open

Recommendation 4	IÉ should review how it determines the safe crossing time for user worked LCs to ensure the safe crossing time allows adequate time for movements and includes a safety margin, over and above the crossing time.
Action/s taken / in progress	New Technical Standard on Level Crossings issued.
Status	Complete
Recommendation 5	IÉ should review its use of disused rail as fencing at user worked LCs to ensure it cannot potentially increase the severity of a collision and where this is the case, replace the disused rail with appropriate fencing.
Action/s taken / in progress	Engineering Review Complete
Status	Complete

2011-R007 - Car Strike at Knockaphunta Level Crossing (XM250), County Mayo, 24th October 2010	
Summary: At approximately 10:50 on Sunday 24th October 2010 as the 10:15 passenger service from Athlone to Westport approached Knockaphunta Level Crossing, the train driver saw a car approaching the level crossing while the level crossing gates were open to the railway. The train driver sounded the horn and applied the emergency brake; however the train struck the car whilst it was trying to reverse away from the level crossing. There were no fatalities or injuries as a result of this accident. There was damage to the front of the car.	
Number of recommendations made	1
Recommendation 1	IÉ should upgrade the Level Crossing to ensure that the operation of the Level Crossing is not reliant on any direct action by the level crossing user.
Action/s taken / in progress	New design and project proposal in progress.
Status	Open

5.3.1 RAIU Recommendations Summary

Table 7 below confirms the current status of all RAIU recommendations made by year up to and including 31st December 2011.

Year	No. of Reports	No. Of Recommendations			
		Open	Complete	Closed	Total
2006	**1**	3	1	10	14
2007	**0**	0	0	0	0
2008	**1**	3	1	3	7
2009	**5**	4	1	8	13
2010	**6**	10	7	9	26
2011	**6**	11	5	1	17
Totals	**19**	**31**	**15**	**31**	**77**

Table 7: RAIU Recommendations Summary

*RSC Recommendations made prior establishment of RAIU

6 References

RSC (2010), “Annual Report”, Railway Safety Commission, Dublin.

(ERA, 2011), “Railway Safety performance in the EU” , European Railway Agency, Valenciennes