Railway Safety Statistical Report 2009

June 2010

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Executive Summary

This is the first 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), as amended by S.I. No 61 of 2008 European Communities (Railway Safety) Regulations 2008, which requires that the RSC operates in an open, non-discriminatory and transparent manner. This report provides background statistics to a number of key 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 generally positive. However there were two exceptional events in 2009, the first being the partial collapse of the Broadmeadows Viaduct on the Iarnród Éireann network just north of Malahide Station and the second being the Dublin Bus / Luas tram crash operated by Veolia on O'Connell Street. These two accidents could have had much more serious consequences. Fortunately there were no fatalities in either incident and the RSC are actively engaging with both Iarnród Éireann and Veolia to ensure similar incidents do not reoccur.

Available data indicates that Iarnród Éireann's continuing investment in assets and safety management systems is delivering significant safety benefits. However, imported risk, i.e., from third parties interfacing with the railway, continues to be an issue. While there were no passenger fatalities or serious injuries in 2009, one employee and three trespassers lost their lives. The employee fatality occurred to a contractor involved in the building of the Dunboyne (M3) Commuter Rail line and this accident is subject to a Health & Safety Authority (HSA) investigation. In terms of train operations, there was a moderate increase in the number of Signals Passed at Danger and broken rails. The number of bridge strikes (114) was the same as that in 2008. However, on a positive note, there were decreases in the number of train collisions, derailments and a continued reduction in the number of rolling stock incidents.

The LUAS safety performance, excluding the O'Connell Street accident has been very positive. There were no fatalities in 2009, but four people were seriously injured due to

the O'Connell Street accident. The number of road traffic accidents involving a tram was 23, a decrease on the 2008 figure by some 28%. In 2009, tram/pedestrian accidents also reduced by 10% which is encouraging.

Bord Na Móna experienced two derailments in 2009 at level crossings and neither resulted in any injury, with circa 30 minute delays to road traffic being the only negative. There was just one notable accident reported by a heritage railway: a train derailed on the Tralee-Dingle Railway at very low speed and no injuries were sustained.

2009 was a good year overall in terms of railway safety with the exception of the Broadmeadows Viaduct and O'Connell Street accidents. Nonetheless, the RSC continues to foster and encourage railway safety within the railway industry and whenever possible with third parties and the public.

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Glossary of Terms

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

1 Introduction

This is the first annual safety statistical report of the Railway Safety Commission (RSC) prepared for the general public in line with section 9(A) of 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 key performance indicators with discussion when appropriate.

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 to other European railways clearly 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 2009. Chapter 5 concerns Railway Accident Investigation Unit (RAIU) recommendations made following its investigations. The status of each recommendation is explained together with details of work done to date.

1.2 The Railway Safety Commission

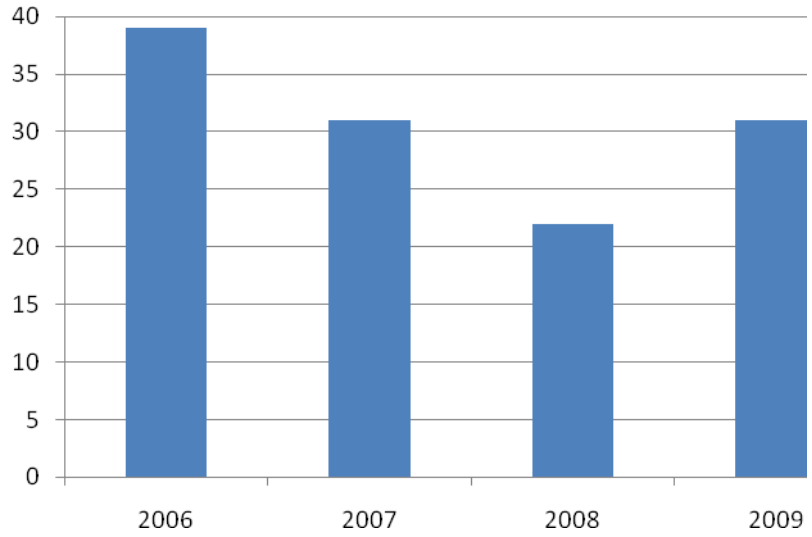
The RSC was established on 1st January 2006 under provision of the Railway Safety Act 2005, with responsibility for railway safety regulation and investigation. It is a small, professional organisation with a flat reporting structure. Its mission is to *"assure, through education, guidance and balanced regulation, the safety of railway services and affected persons."* This regulatory responsibility is without prejudice to the fact that the national railway operator, Iarnród Eireann, 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.

2 Public Representations

The RSC see the public, passengers and others, as our principal customer and at all times we encourage them to bring railway safety concerns to our attention. Where these issues relate to service rather than safety, we direct the representation to the appropriate authority. Where the matter involves railway safety, we try, wherever possible, to deal with the matter directly. If we are unable to do so, we seek the necessary information from the appropriate railway company that enables us to provide a full response.

In 2009, we received thirty-one direct or indirect public representations relating to a range of heavy and light rail infrastructural and operational matters. None of these gave immediate or specific cause for safety concern but all were responded to and when necessary investigated. 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

Representations in 2009 were more varied than previous years, ranging from audibility of door alarms to general station safety. There was an increase in the number of complaints or representations received by the RSC regarding Iarnród Éireann's (IÉ) trains, all of which were responded to with the assistance of IÉ when necessary.

3 Safety Trends in Ireland

3.1 Iarnród Éireann Casualty Statistics

The following 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 2005 to 2009.

Railway operations and track maintenance: fatal injuries	**2005**	**2006**	**2007**	**2008**	**2009**
Fatal injury to person due to a train accident, not at level crossing	0	0	0	0	0
Fatal injury to passenger travelling on a train, other than in train accident	0	0	0	0	0
Fatal injury to passenger attempting to board or alight from train	0	0	0	0	0
Fatal injury to customer, no train involved	0	0	1	0	0
Fatal injury due to railway accident at a level crossing	0	0	1	1	0
Fatal injury to employee at a level crossing due to train in motion	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
Other fatal injury to employee on the railway	0	0	0	0	0
Fatal injury on railway or level crossing where trespass or suspicious death was indicated	8	7	5	8	3
Railway operations and track maintenance: injuries					
Injury to passenger due to a train accident not at level crossing	12	0	0	0	2
Injury to passenger travelling on train, other than in a train accident	73	41	35	22	40
Injury to passenger attempting to board or alight from train	48	55	50	43	17
Injury to passenger in station or visitor to premises	105	69	84	74	88
Employee injury involving train movement or train accident	4	15	8	9	13
Employee injury while working on railway	100	69	78	79	65
Employee injury at level crossing	1	2	4	0	0
Person injured in railway accident at level crossing	0	0	1	0	0
Passenger injury in railway accident at level crossing	0	0	0	0	0
Level crossing user injured	4	0	1	1	1
Injury to other person	3	5	1	2	0

Table 1: IÉ Operational fatality and Injury Statistics

3.1.1 Fatal Injuries

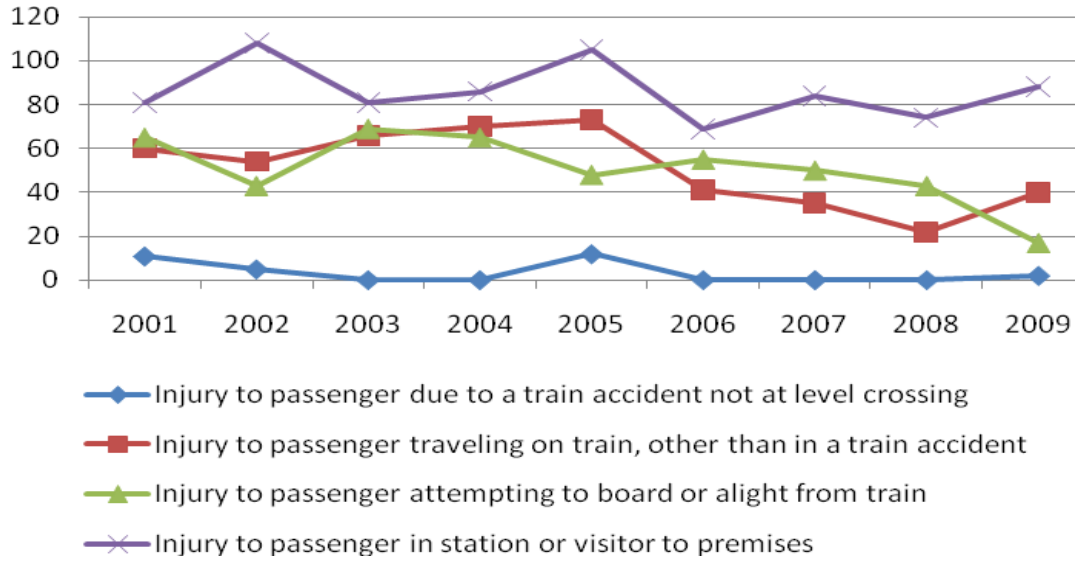
In terms of fatal injuries, 2009 was similar to previous years with zero fatalities caused by train movements. Similarly, there were no fatalities at level crossings which is encouraging particularly since it is internationally recognised that level crossings pose a very significant risk to railway operations.

There was, however, one fatal injury to an employee on a railway under construction, which did not involve the movement of trains. This occurred to a contractor involved in the building of the Dunboyne (M3) Commuter Rail line. This construction related accident is subject to a Health & Safety Authority (HSA) investigation.

There were also three[1] fatal injuries on the railway where trespass or suspicious death was indicated. One incident occurred near Thurles and two occurred in the Dublin area. The RSC uses a coroner's verdict, when available, to assist in classifying a fatality.

3.1.2 Passenger Injuries

There is a prevalence of injuries to passengers in stations or visitors to premises. Slips, trips and falls continue to dominate. IÉ have improved a number of stations around the country in terms of accessibility. Nonetheless, the general surface condition and the management thereof in stations is an issue particularly in wet or icy conditions.



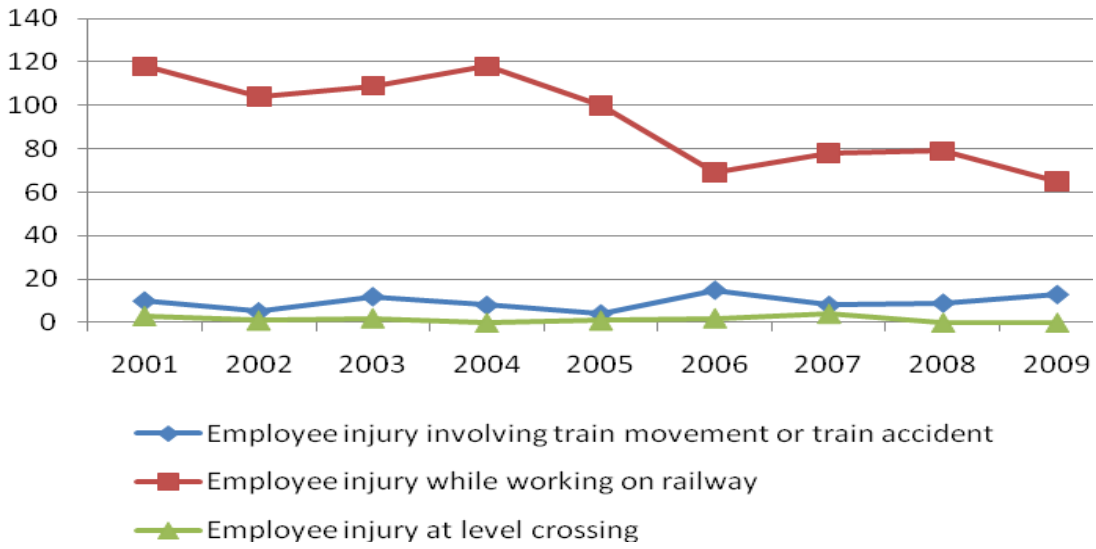
Graph 2: Passenger Injury statistics by year

[1] This corrects the RSC's 2009 Annual Report where five fatal incidents were recorded in this category.

Regarding injury to passengers travelling on a train, many of the incidents involve people catching a foot, an arm or their bags in closing doors and such injuries are all of a minor nature. Potentially more serious are injuries to passengers attempting to board or alight from a train. The greatest risk to passengers in this category is falling between the train and the platform and in 2009 there were 7 such incidents at various stations around the network.

3.1.3 Employee Injuries

In 2009, there were 13 employee injuries involving train movement: all were of a minor nature with the exception of two instances where members of IÉ train crew staff were assaulted by passengers. Two involved maintenance staff. The remaining nine injuries involved either train drivers or shunting staff who sustained minor injuries e.g., twisting ankles.



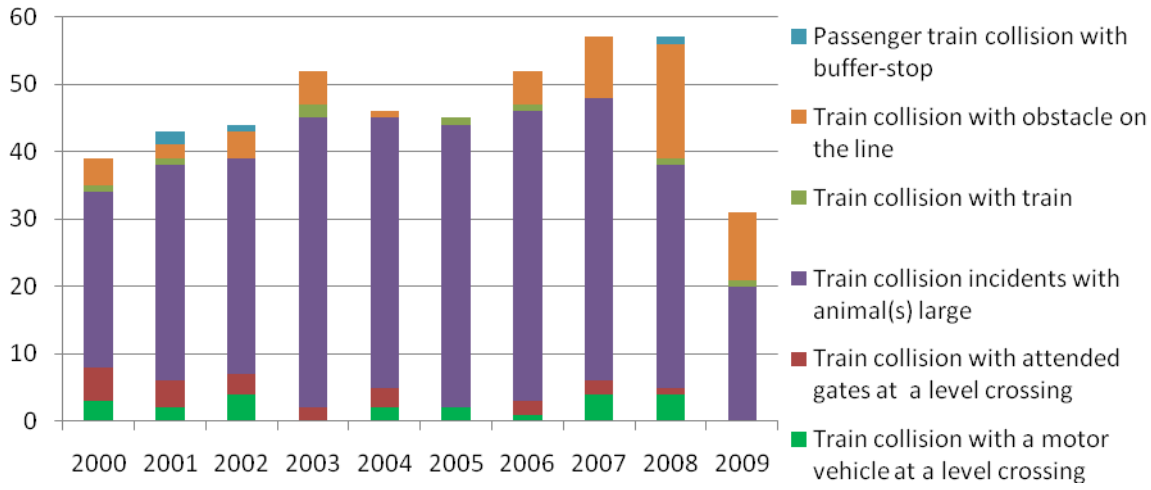
Graph 3: Employee Injury statistics by year

Regarding employee injuries while working on the railway, there were 65 such occurrences in 2009 representing a decrease of 18% on the 2008 figure. The majority of these accidents were as a result of manual handling, slips, trips and falls, tool related accidents. Of more concern, there has been an increase in the number of assaults on staff. IÉ have engaged an outside security firm to travel on trains and also have a presence in major stations; it is hoped that this will see a reduction in such occurrences.

3.2 Iarnród Éireann Incident Statistics

3.2.1 Train Collisions

Train collisions can pose a significant risk to passengers, train crew and third parties (if applicable) and have the potential to cause considerable damage to rolling stock. IÉ's fleet is one of the newest in Europe and has been designed to international standards that provide an enhanced level of safety to passengers and train crew should a train be involved in a collision. Graph 4 illustrates the trend over the past 10 years.

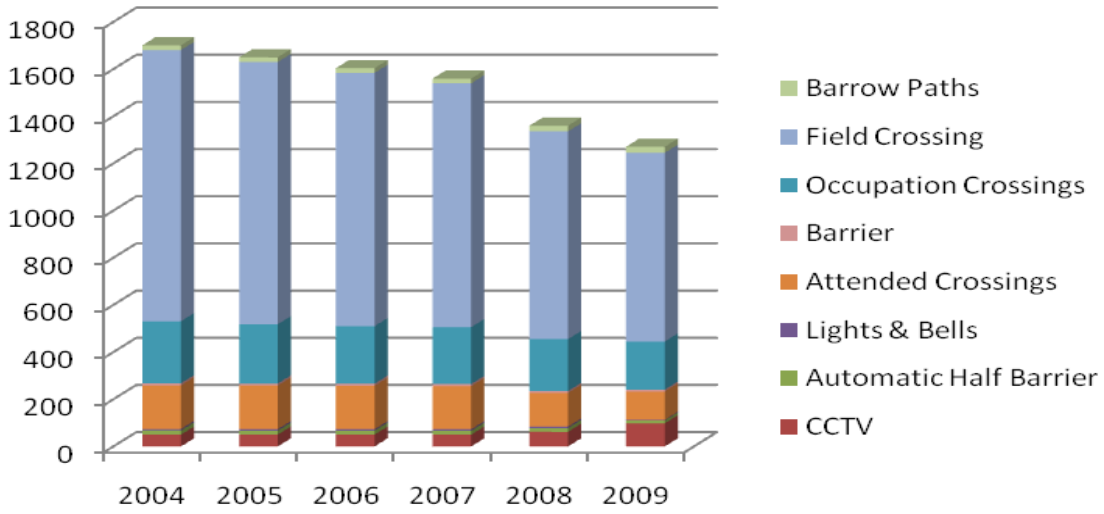


Graph 4: Train Collision Statistics by year

Regarding collisions with obstacles on the line there were 10 such incidents in 2009. These were attributed to collisions with trees and branches, a maintenance trolley, steel objects such as bars and a super market trolley.

Collisions with animals can, in some instances, cause considerable damage to trains particularly large animals such as cattle or deer. In 2009 there were 20 such occurrences and, fortunately, none resulted in significant damage to trains. IÉ has invested significant resources in recent years upgrading the railway boundary and the benefit is now being realised with a decrease in animal strikes of circa 50% in the last 3 years.

Train collisions with other trains are infrequent and most often than not occur at low speed within stations. One such incident was reported for 2009, where a locomotive was in collision with a train during a shunting movement.



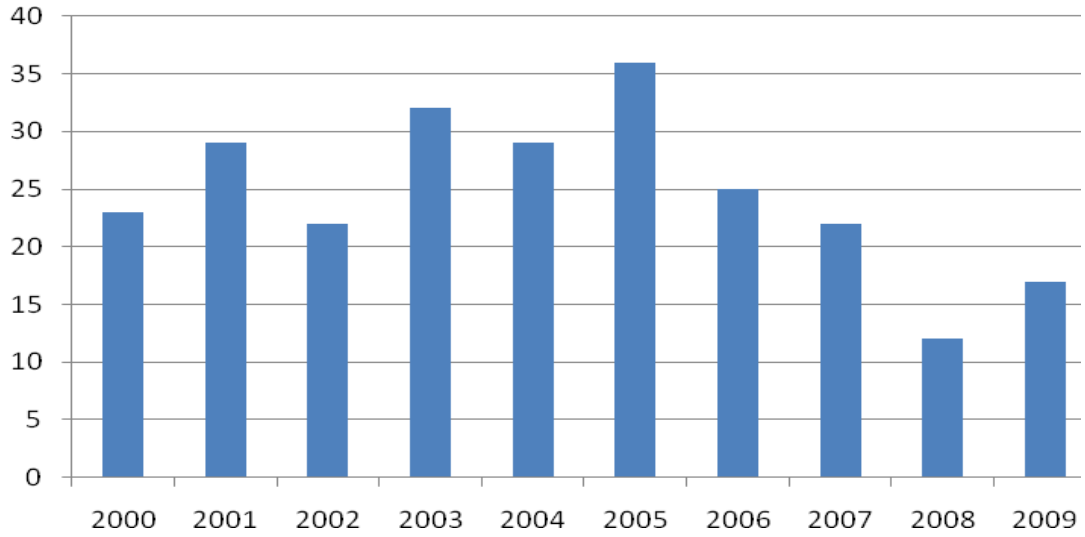
Graph 5: Number of level crossings by type by year (Total number inc. closed lines)

Train collisions with level crossing gates are infrequent and there were no such incidents in 2009. There was one accident in December 2008, when a locomotive crashed through the gates at Bridgetown Level Crossing, on the Waterford to Rosslare line. Clearly such occurrences have the potential to result in multiple injuries and the RSC has focused its attention on these types of accidents.

Similarly there were no train collisions with motor vehicles at level crossings in 2009. Level crossings are a significant risk to the railway and to any third parties who use them. By way of background, there were, as of December 31st 2009, 1271 level crossings on the national network (of which 1073 were on the operational network) and through the Governments Safety Investment Programme, IÉ have closed in excess of 400 level crossings in the past five years (see graph 5). Work also included, upgrading and automation, improved crossing signage and line-side visibility.

3.2.2 Signals Passed at Danger (SPAD)

A SPAD may be 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 which is encouraging. In 2009, IÉ introduced a new ranking tool to measure risk potential. Regardless of severity, all SPADs are investigated to determine if there are lessons to be learnt.



Graph 6: Main (running) signal passed at danger where warning was given in time

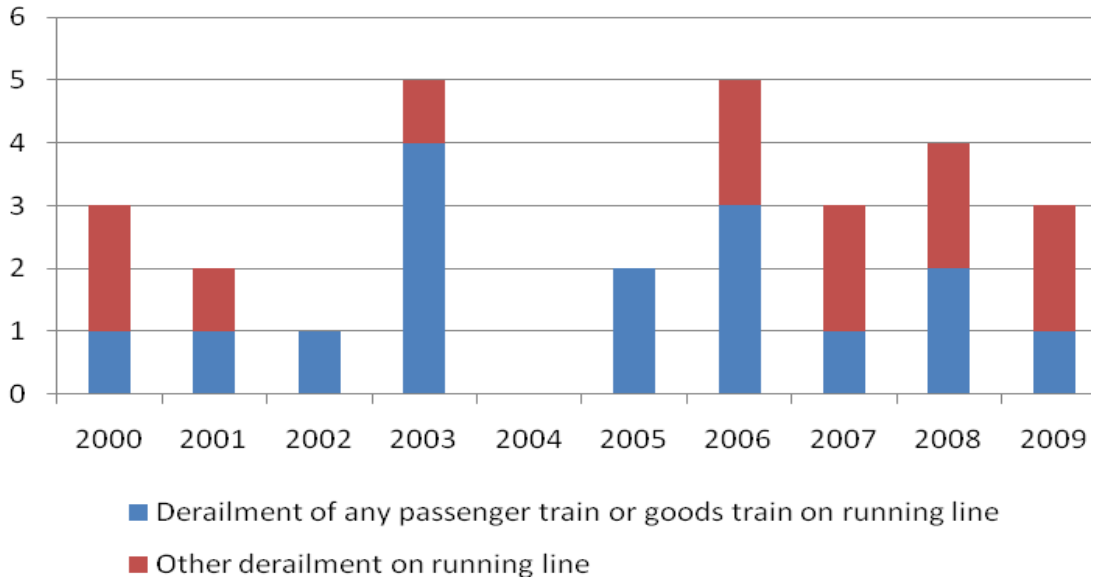
In 2009, there were a total of 17 SPADs on running lines, i.e., not including those that occurred in sidings or depots. IÉ use a ranking tool to determine whether each SPAD had the potential to cause an accident. IÉ collate a significant amount of information relating to the SPAD. Using this information IÉ determine a weighted numeric score for each one. SPADs are allocated a score between zero (no risk) and 28 (high risk) and the score dictates the level of internal investigation. SPADs are grouped into one of 3 severity bands, i.e.,

- ⇨ those scoring 0 to 15 are classified as not a significant risk
- ⇨ those scoring 16 to 19 are classified as potentially significant; and
- ⇨ those scoring 20 and above are classified as potentially severe.

As previously stated there were 17 SPADs in 2009 and, of these, there were no potentially severe incidents and just 5 were categorised as potentially significant.

3.2.3 Train Derailment

Train derailments remain at low levels and continued track and rolling stock maintenance, in conjunction with targeted renewals of track, should ensure that the numbers remain small.



Graph 7: Train Derailments

In 2009, there were 3 derailments, one of which was a passenger train derailment just south of Wicklow station. It occurred after an empty train transiting to Gorey to commence its morning service collided with a landslide. The train stayed upright and the train driver was not injured. The train sustained some superficial damage. The other two derailments on the running lines were an on-track machine that derailed at Limerick Junction and a special trolley used to move the new Shannon Bridge beams into place both of which happened during engineering possessions.

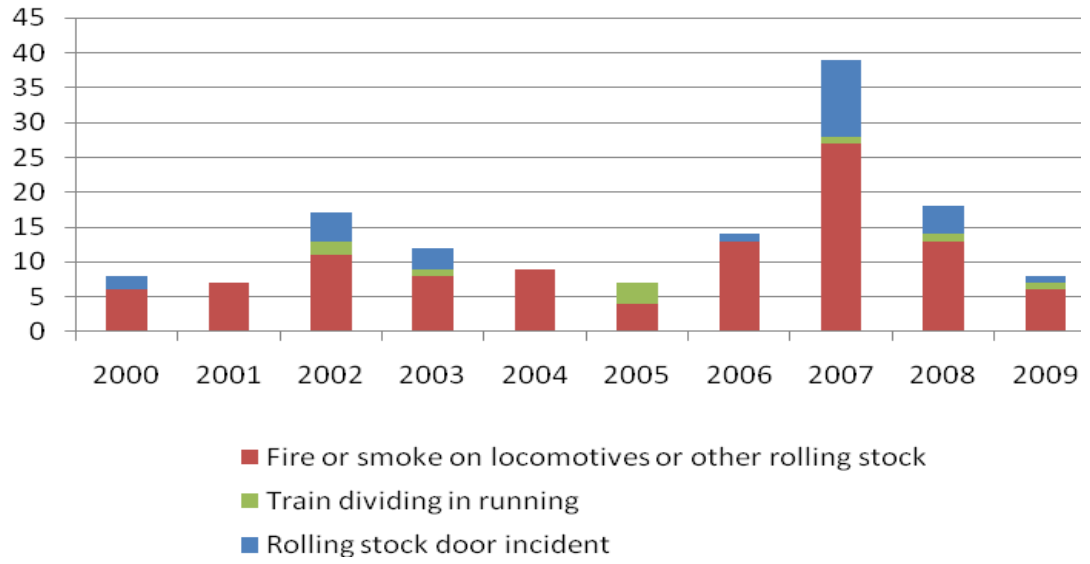
3.3 Iarnród Éireann Rolling Stock Incidents

IÉ's rolling stock (trains) fleet is one of the newest in Europe and significant investment has been made in recent years. The newest fleet, the 22000 series Intercity railcars introduced in 2007, is now operating over the majority of the network. As with anything new there are often warranty issues and this has been the case for the 22000 trains.

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

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

Graph 8 (on next page) illustrates the trends for these statistics in recent years.



Graph 8: Rolling Stock Incidents

There has been a recent prevalence of fire or smoke incidents on diesel multiple unit trains, a number of which were due to engine component failures. Iarnród Éireann, the train manufacturers and their suppliers have been addressing this issue. In 2009 there were six 'fire and/or smoke' occurrences. All were of a minor nature with on board automatic fire suppression systems functioning as expected.

A train divide is an occurrence where a train splits into two. The split would occur between carriages. In 2009 there was one train divide. It occurred to a 22000 unit in Portlaoise. The 6 carriage train, made up of two, 3 carriage trains coupled together split as it crossed from one track to another. The train was not in service and there were no passengers on board. Both the Railway Accident Investigation Unit (RAIU) and IÉ commenced an investigation into the divide and the cause will be made known in due course.

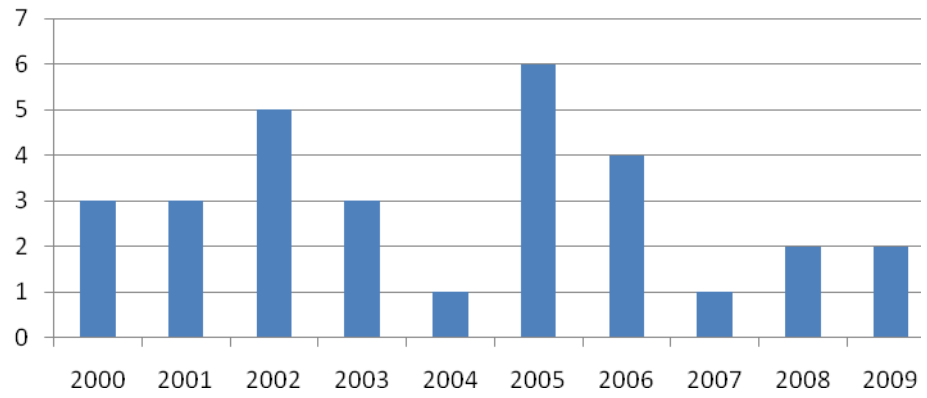
In terms of door issues, from the peak in 2007 the rate of incidents has all but disappeared. Maintenance, reliability and other vigilance systems are ensuring door incidents are low. There was just one such incident in 2009 and this occurred when a broken spring on a door had necessitated that the door be locked off prior to the trains departure from Heuston. Whilst en route, the train host noted the locked off door and, not being aware of the reason, unlocked it whilst approaching Thurles. The door opened and the train host, on seeing this, reclosed the door.

3.4 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 frequencies.

3.4.1 Broken rails

There are 2141 track kilometres (km) on the IÉ service network meaning there is circa 4300 rail km that must be inspected. IÉ 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.

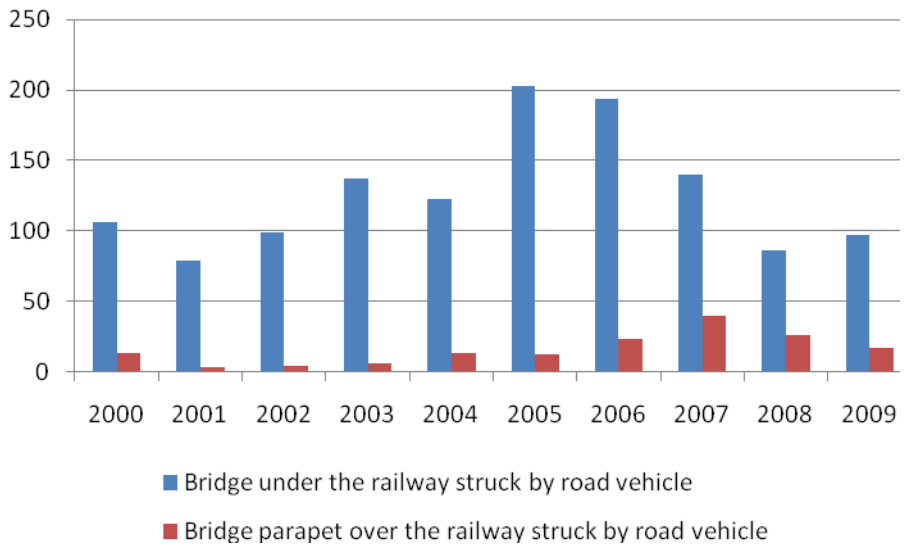


Graph 9: Broken rails on Passenger lines

The number of broken rails on passenger lines did not increase in 2009 and none resulted in a train accident. The figures remain consistently low and IÉ remain focused on improving its early detection rate through introducing new technologies and testing regimes.

3.4.2 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 the 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 10: Railway Bridges struck by road vehicles

The total number of bridge strikes, i.e., under-bridge and over-bridge, in 2009 was the same as that for 2008. These figures represent a significant fall from the highs of 2005 and 2006 nonetheless the numbers remain high. IÉ categorise each strike depending on the severity and the breakdown for 2009 is illustrated in table 2.

Category	Unspecified	Not Serious	Potentially Serious	Serious	Total
UB Strikes	19	75	4	0	98
OB Strikes	6	6	3	1	16
Total Strikes	25	81	7	1	114

Table 2: 2009 Bridge Strikes by category

In 2009, there was one serious bridge strike where a section of the wall on the approach to the bridge collapsed as a result of being struck by a road vehicle. Fortunately this incident occurred to an over-bridge on the closed Athenry to Tuam section of the network.

IÉ has erected bridge identification plates on almost all of its bridges and the installation of advance warning signs and road diversions has proved beneficial.

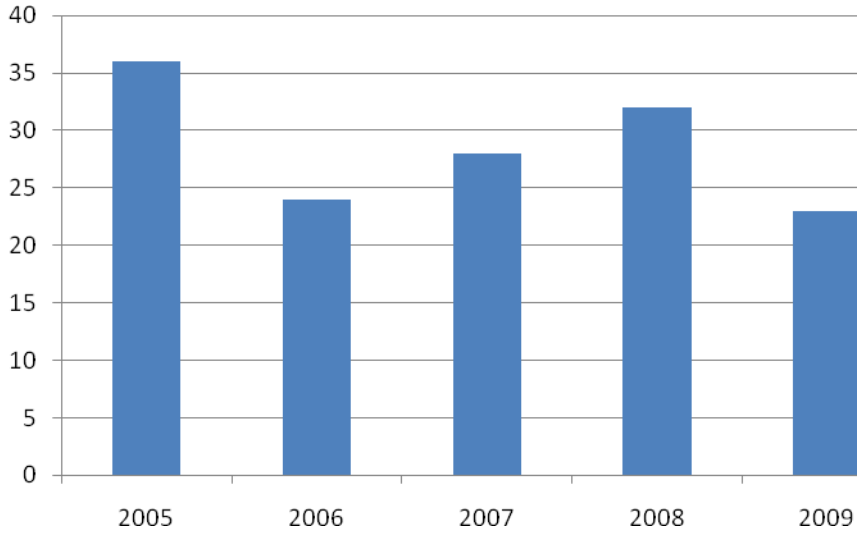
3.5 Veolia (Luas) Statistics

Veolia (formally Connex) have been operating the Luas since it commenced operation in June 2004. Passenger numbers remain of the order of 23 million annually and the safety record has to date been extremely good in comparison to other light railways in Europe.

Nonetheless the RSC actively monitors Luas operations under its supervision regime. Below are a number of key statistics for salient safety indicators.

3.5.1 Road Traffic Accidents.

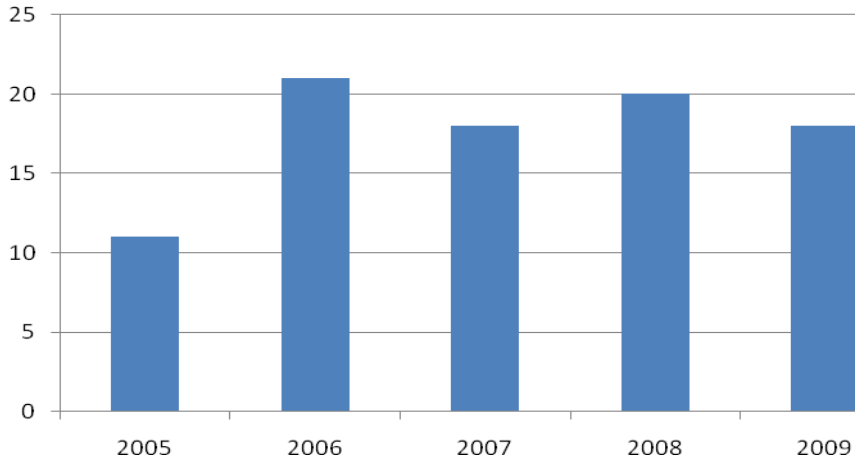
The Luas by its very design interfaces with the public and road traffic along significant sections of its alignment. The Luas operates by 'line of sight' and is no different in its operation to the majority of light rail systems around the world. However, given that the Luas shares sections of the carriageway with road vehicles, accidents will occur. The statistics show that the trend is downward with a 28% decrease in the number of road traffic accidents (RTA) in 2009 compared to 2008.



Graph 11: Road Traffic Accidents involving a tram

Dublin City Centre, predictably, is the area where the majority of the road traffic accidents, 80%, are occurring. The most notable of the RTAs in 2009 was the Luas collision with a Dublin bus on O'Connell Street in September where the tram driver and three bus passengers sustained significant injuries. This accident is subject to an RAIU investigation and it is therefore not appropriate to comment further at this time.

3.5.2 Tram / Pedestrian Contact



Graph 12: Tram/Pedestrian coming into contacts

As with RTAs, the vast majority of contact incidents between trams and pedestrians occur in and around the city centre, with a significant proportion occurring along Abbey Street. Indeed the Abbey Street / O'Connell Street intersection accounts for 60% of all contacts. There have, to date, been 4 incidents where people have been required to attend hospital. One of these subsequently died due to their injuries. There were no confirmed serious injuries in 2009. One of the Table 3 provides further detail.

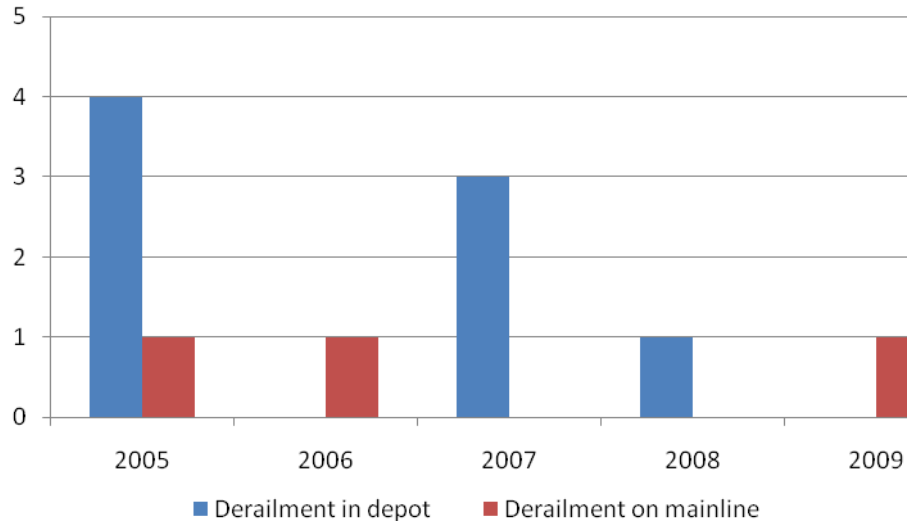
Year	Total number of tram-pedestrian contact incidents	Taken to hospital	Confirmed serious injury
2005	11	6	0
2006	21	5	0
2007	18	7	2
2008	20	3	2
2009	18	1	0

Table 3: Tram – Pedestrian Contact Statistics

3.5.3 Tram Derailments

Since 2005, there have been a total of 11 tram derailments, eight in Luas depots and the remaining three occurring in passenger service. The three in service derailments all occurred at low speeds while a tram was traversing over points and crossings. Given there has been 13.351 million total tram-kilometres run, between January 2005 and the end of 2009, this represents one in-service tram derailment every 4.45 million tram-kilometres.

The total tram-kilometres run in 2009 was 2.695 million (with 1 million on the Green Line and 1.7 million km on the Red Line), a decline of about 2% compared to 2008. 25.4 million passenger-journeys were completed in 2009, a drop of about 7% compared to 2008.

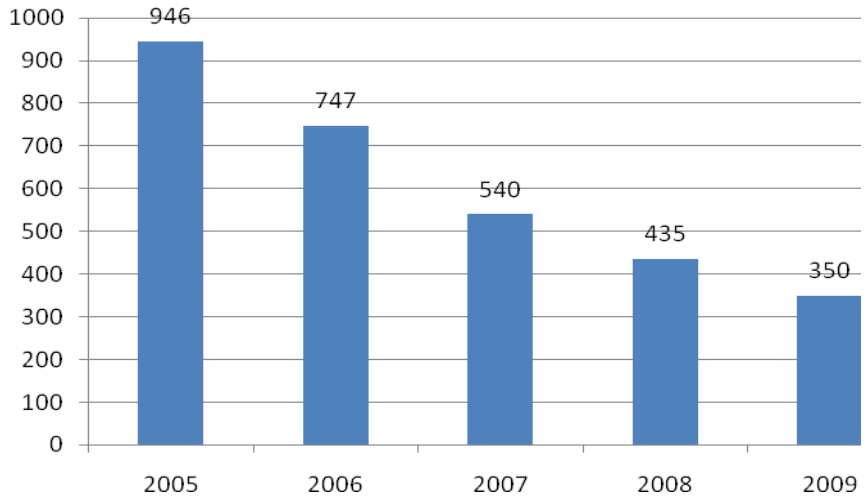


Graph 13: Tram Derailments

In 2009 one tram derailed while in passenger service. This occurred while a tram was traversing a set of points at a very low speed (approximately 15 kph) departing Connolly stop. It was caused by an item of clothing that had become wedged in the points. There were no injuries.

3.5.4 Tram Emergency Brake Applications

A useful accident precursor indicator is the number of emergency brake (EB) applications made. The LUAS trams have three types of brakes and an EB application is provided when all three work together to slow or stop a tram. 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.



Graph 14: Emergency Brake Applications

There are approximately 120 tram drivers employed by Veolia and the 2009 figure of 350 EB applications demonstrates a consistent improvement and suggests that the public are more aware of the trams and tram drivers are more aware of potential incidents.

3.6 Bord Na Móna 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 or under the railway. In terms of key infrastructure statistics there is 710km of track, 98 level crossings, 50 underpasses, of which 47 are under roads and 3 are under Iarnród Éireann rail lines.

In 2009 BNM suffered two derailments, both at the same level crossing. The level crossing, known as Noggus level crossing is located on the Cloughan to Ferbane road which is a regional road in county Offaly.

The RSC undertook a post-incident inspection of the site and the reasons for the derailments became evident. The gates are connected to a deliberate derailment mechanism which, when closed across the railway, prevents a train from striking the gates and/or entering the road. BNM have now designed, manufactured and fitted a new gate locking mechanism to the gates at Noggus and there have been no incidents since then.

3.7 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 9 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
- Railway Preservation Society of Ireland

In 2009 there was one accident reported to the RSC and this was a derailment that occurred on the Tralee Dingle Railway. The incident occurred on Monday August 3rd 2009 when the driver experienced a slight shudder/movement in the train cab. The driver immediately brought the train to a halt and passengers were dismounted and escorted back to the nearby platform. There were no injuries as a result of this incident. It should also be noted that the line-speed of this operation does not exceed 10mph and the risk of injury is low. The cause of the incident was defective wooden sleepers that have since being replaced.

4 Safety Trends in Europe

In European terms the RSC are defined as the National Safety Authority (NSA) 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. The ERA produces a biennial report, the most recent being for 2006 and 2007. Figures for 2008 and 2009 will be available in the next report due in mid 2010. 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, 2009), data was supplied by 24 National Safety Authorities (NSA) and the Channel Tunnel Safety Authority. The tables below present the most recent coherent data set which is for 2007. 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) 2007**	**EU 2007**	**IE Performance**
Train-km (million)	*16.3*	*4225*	
	IE rate per 100 million train-km	EU rate per 100 million train-km	
Collisions of Trains	6.1	8.2	Average
Derailment of Trains	0.0	13.4	Very good
Level crossing Accidents	6.1	30.6	Good
Accidents to persons caused by rolling stock in motion	12.3	39.5	Good
Passenger Fatalities	0.0	1.7	Good
Level Crossing User fatalities	6.1	12.6	Good
Passenger Serious Injuries	0.0	6.7	Very good
* Resulting in death or serious injury or damage more than €150000 or line closure for more than 6 hours			

Table 4: EU Accident Statistics for year 2007

In 2007 Ireland still had 28% more level crossings per track-kilometre than the European average. However, as previously stated in section 3.2.1, IÉ has an ongoing level crossing upgrade and closure programme which has undoubtedly been reaping safety benefits.

Table 5 presents the number of accident precursors which is another useful indicator in terms of measuring our 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) 2007**	**EU 2007**	**IE Performance**
Track-km (thousand)	*2.164*	*312.5*	
	IE rate per thousand track-km	EU rate per thousand track-km	
Broken Rails	0.5	18.5	Very good
Track Buckle	0.5	12.2	Very good
Train-km (million)	*16.3*	*4225*	
	IE rate per 100 million train-km	EU rate per 100 million train-km	
Wrong side signalling failure	6.1	90.8	Very good
Signals Passed at Danger (SPAD) (including shunting signals)	190.2	174.6	Average
Broken Train Wheels	0.0	4.1	Good
Broken Train Axles	0.0	2.4	Good
* Forerunner events with potential to cause serious accidents			

Table 5: EU Accident Precursor Statistics for year 2007

From the above tables it is evident that Iarnród Éireann (IÉ) is performing well in most categories. However, Ireland's record of SPADs is just average in European terms and there is good scope for improvement here. In similar vein, the train-to-train collision record is not much better than average. As mentioned in section 3.2.2, IÉ investigates all SPADs and has driver monitoring and mentoring procedures in place.

4.2 Major Accidents in other Member States

A number of major incidents occurred in 2009 in other EU countries and below is a brief synopsis (based on ERA and NSA information) of some of these.

The 2009 Viareggio train accident was the derailment of a freight train and subsequent fire which occurred on 29 June 2009 in the railway station of Viareggio, Tuscany (Central Italy). Twenty-six people were injured, and as of 22 December 2009, 32 people were confirmed as having died.

The 2009 Rudine train derailment occurred on July 24, 2009 near the village of Rudine in southern Croatia, on the Zagreb-Split railway line. The accident happened when the two-carriage tilting train derailed after the front carriage hit the sides of a steep cutting. It is understood that the train lost braking ability on a downhill part of the track.
Shortly after the crash, a railway service vehicle coming to the site of the accident to assist in the recovery, also lost braking and at excessive speed nearly hit emergency workers. The initial accident caused the deaths of 6 people, and 55 people were reported as injured.

The Lößnitzgrundbahn head-on collision was a railway accident on 12 September 2009 in Saxony, Germany. It involved two steam hauled passenger trains of the narrow gauge heritage Radebeul–Radeburg railway. One hundred and twenty-one people were injured, four of them seriously. Substantial damage was sustained by the locomotives and rolling stock.

5 Safety Recommendations (From the RAIU)

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 incident 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 improve 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 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. RAIU's investigations are carried out in accordance with the Railway Safety Act 2005 and European Railway Safety Directive 2004/49/EC.

5.1 RAIU Active Investigations

In 2009, the RAIU initiated 8 investigations and they are listed in table 6. The RAIU may, depending on its findings, issue reports on these incidents and make recommendations that the RSC will consider for implementation.

Date of Incident	Details
29th March 2009	Train collision at Plunkett Station, Waterford
3rd July 2009	On Track Machine derailment at Limerick Junction
16th July 2009	Luas tram derailment at Connolly
24th July 2009	Freight train derailment at Thurles
21st August 2009	Broadmeadows Viaduct (Malahide) partial collapse
2nd September 2009	Near Miss Incident at Ferns Lock Automatic Half Barrier
16th September 2009	Luas Tram / Bus Collision on O'Connell Street, Dublin
16th November 2009	Landslide causing train derailment near Wicklow Station

Table 6: RAIU investigations initiated in 2009

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 2009, the RAIU published 5 investigation reports and they are listed in table 7. As a consequence of these reports the RAIU made a total of 13 recommendations which are discussed in section 5.3.

Date Report Published	Title of Report	No. of recommendations made
2nd March 2009 **(Report A)**	Report into the Fatality at Level Crossing XX 032 between Ballina and Manulla Junction on the 28th of February 2008	4
6th April 2009 **(Report B)**	Report into the derailment of a Tara Mines freight train at Skerries on the 10th of January 2008	2
11th May 2009 **(Report C)**	Near miss at Ballymurray level crossing on the 14th of June 2008 between Athlone and Westport	2
29th July 2009 **(Report D)**	Collision between a train and a road vehicle at level crossing XN125, Cappadine, on the Ballybrophy to Killonan line on the 31st of July 2008	2
1st December 2009 **(Report E)**	Collision of a train with the gates of level crossing XH066, Bridgetown, on the Limerick Junction to Rosslare Strand line on the 2nd December 2008	3

Table 7: RAIU Investigation Reports published in 2009

5.3 RAIU Recommendations

The RAIU, through their investigations identify, whenever possible, the immediate cause, causal factor and contributory factors. Having established these, the RAIU can make recommendations and in 2009, 13 were made in conjunction with 5 investigations. In accordance with the Railway Safety Directive the RAIU can 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 RAIU are required by law to produce an annual report and submit it to the European Railway Agency (ERA). This report must outline the investigations that have been undertaken and the current status of recommendations made, i.e., implemented, in the process of being implemented, or not implemented. What follows is a summary of the actions taken in relation to the five RAIU Investigation Reports published in 2009.

Report A - Report into the Fatality at Level Crossing XX 032 between Ballina and Manulla Junction on the 28th of February 2008.	
Summary: On the 28th of February 2008 at approximately 11.07 hours the 10.50 hours service from Ballina to Manulla Junction passenger train collided with a car at user operated level crossing XX 032, which is located on the Ballina branch line, approximately 500 yards beyond the 153 milepost in the townland of Knockshanbally, County Mayo. The sole occupant of the car was fatally injured. There were no other injuries. The leading vehicle of the train was damaged but the train was not derailed	
Number of recommendations made	4
Recommendation 1	The Railway Safety Commission (RSC) should carry out a review of the suitability of this type of level crossing on public roads. This review should include, but not be limited to, factors such as continual misuse, signage, user mobility, environmental and human factors.
Action/s taken / in progress	The RSC review is underway.
Recommendation 2	Iarnród Éireann (IÉ) should, taking into account the close proximity of the three level crossings, close or upgrade some or all of these crossings
Action/s taken / in progress	A scheme has been prepared for an Under Bridge to close the three level crossings. The planning process is underway.
Recommendation 3	IÉ must identify crossings that are regularly misused and take proactive action to manage the increased risk created by the misuse.
Action/s taken / in progress	Level crossings that are misused are known to IÉ and action is taken to address this. The RSC is following up on this.
Recommendation 4	IÉ are to put in place procedures that will capture and manage near miss reports.
Action/s taken / in progress	IE confirm that 'Near misses' are reported by drivers etc and are recorded in a database. These are reviewed by IÉ management personnel and appropriate action plans are developed.

Report B - Report into the derailment of a Tara Mines freight train at Skerries on the 10th of January 2008	
Summary: At 22.53 hours on the 10th of January, 2008, a Tara Mines freight train operated by Iarnród Éireann consisting of a locomotive and eleven wagons derailed south of Skerries station on the Dublin to Belfast line. The first wagon of the train suffered a burnt off axle journal due to a catastrophic bearing failure, it derailed at the 17 ½ milepost and continued to travel a further 230 yards, damaged crossover SK 244 resulting in the derailment of five further wagons before the train came to a stop. There were no injuries.	
Number of recommendations made	2
Recommendation 1	IÉ should put in place a risk based process to ensure ongoing review of the suitability of the temperature settings of the train 'Hot Axle' detection equipment
Action/s taken / in progress	IÉ have completed its review and have changed the temperature settings to provide earlier indications of potential issues.
Recommendation 2	IÉ are to identify the necessary maintenance requirements for all Class D bearings, including producing detailed maintenance procedures taking into account their operational conditions and allowing for traceability of safety critical components, with assistance being sought from the Original Equipment Manufacturer where appropriate.
Action/s taken / in progress	IÉ have revised their maintenance processes ensuring traceability of safety critical components such as bearings.

Report C - Near miss at Ballymurray level crossing on the 14th of June 2008 between Athlone and Westport	
Summary: On the 14th of June 2008 at 8.50 hours an empty Diesel Multiple Unit, travelling from Manulla Junction to Dublin, passed through the raised barriers of Ballymurray level crossing, XM 075. Approximately two seconds prior to the Diesel Multiple Unit passing, a car crossed through the level crossing and as Diesel Multiple Unit crossed the crossing another car approached but came to a stop. There were no injuries and there was damage to infrastructure.	
Number of recommendations made	2
Recommendation 1	IÉ should ensure all safety critical staff have undertaken safety critical communications training and that their ongoing competency management systems specifically monitors the quality of safety critical communications.
Action/s taken / in progress	IÉ have introduced new training in safety critical communications and have a programme of training in place.
Recommendation 2	IÉ should put in place safe work methods for the maintenance of automatic half barrier type level crossing, these methods should include risk assessments for any hazards identified in the maintenance of AHBs.
Action/s taken / in progress	New standards for the maintenance of level crossings have been issued. Safety notices have been issued and briefed to maintenance staff. All key personnel have attended a briefing course on rules with particular emphasis on communications.

Report D - Collision between a train and a road vehicle at level crossing XN125, Cappadine, on the Ballybrophy to Killonan line on the 31st of July 2008	
Summary: On the 31st of July 2008 at approximately 17.20 hours, a Diesel Multiple Unit train collided with a road vehicle at level crossing XN125, Cappadine. The train involved was the 16.45 hours Iarnród Éireann service from Limerick to Ballybrophy. As the train approached the Level Crossing, located in the townland of Cappadine in County Tipperary, the train driver saw a road vehicle stopped with its front protruding onto the railway line. The train driver sounded the horn and made an emergency brake application. The train struck the road vehicle, a Toyota Corolla car, and then continued to travel approximately 130 metres past the level crossing before coming to a stop. There were no injuries, the front of the car was extensively damaged and there was minor damage to the train.	
Number of recommendations made	2
Recommendation 1	IÉ should assess the risks relating to road users' behaviour in identifying a safe stopping position at User Worked Level Crossings and based on the outcome of this risk assessment, Iarnród Éireann should introduce measures to allow safe use of this type of level crossing;
Action/s taken / in progress	Work has commenced with an initial task being the roll-out of new clearer level crossing signage being installed on all user worked level crossings.
Recommendation 2	IÉ should carry out risk assessments on level crossings that fail to meet the viewing distances specified in the Railway Safety Commission guidance and implement appropriate measures in order to meet this guidance as a minimum.
Action/s taken / in progress	A programme is being implemented to improve viewing distances at user worked level crossings.

Report E - Collision of a train with the gates of level crossing XH066, Bridgetown, on the Limerick Junction to Rosslare Strand line on the 2nd December 2008	
Summary: On the 2nd of December 2008 at 09.40 hours an infrastructure maintenance train approached level crossing XH066 at Bridgetown when the level crossing gates were closed across the railway line. The train driver had expected them to be open based upon his statement reporting that he had a proceed signal. However, the gates were closed across the railway and the train struck the gates and came to a stop approximately thirty-nine and a half metres beyond the level crossing. The gatekeeper suffered shock and the gates of XH066 were destroyed. There were no other injuries.	
Number of recommendations made	3
Recommendation 1	Iarnród Éireann should review the training and competency management of gatekeepers and signalling maintenance personnel
Action/s taken / in progress	A competence based database for Signalling staff is currently being developed. Specific competencies for signalling front line staff have been allocated. Trial of the new system for SET is expected to begin in June 2010.
Recommendation 2	Iarnród Éireann should review the design of signal indicators to ensure their design encourages correct interpretation
Action/s taken / in progress	A review of the signal indicator has been undertaken. The repeaters are geographically positioned and have been labelled.
Recommendation 3	The RSC should audit IÉ's training and competency management system to verify its effectiveness
Action/s taken / in progress	The RSC have finalised its 2010 annual audit programme and the first of two audits was completed in May 2010. The second audit will be completed by the end Q3 2010.

6 Conclusions

In the main, the safety performance of both Iarnród Éireann and Veolia improved in 2009. Unfortunately, 2009 will more than likely be remembered for the near-catastrophic incident at the Broadmeadows Viaduct in north county Dublin. The Dublin Bus / Luas tram crash on O'Connell Street was also a low point in terms of railway safety. Fortunately, there were no fatalities in either accident and the RSC are actively engaging with both Iarnród Éireann and Veolia to ensure similar accidents do not reoccur.

Apart from the abovementioned incident, the available data indicates that Iarnród Éireann's safety performance improved in 2009. While there was a moderate increase in the number of Signals Passed at Danger and broken rails, there were no passenger fatalities or serious injuries in 2009, the number of bridge strikes (114) was the same as that in 2008 and there were decreases in the number of train collisions and derailments and a continued reduction in the number of rolling stock incidents.
In the European context, Iarnród Éireann has a good safety record and compares well against other countries in the vast majority of categories. It is fair to say that, more often than not, Iarnród Éireann is a top 5 performer in terms of European railway safety.

The LUAS safety performance, with the exception of the O'Connell Street accident, was positive in 2009. There were no fatalities in 2009 and the number of road traffic accidents reduced, as did the number of tram/pedestrian incidents.

The RSC will, in its role as safety regulator, continue to work closely with the railway companies to strive for safer railways in Ireland with an ultimate goal of zero accidents.

7 References

RSC (2009), “Annual Report”, Railway Safety Commission, Dublin.

(ERA, 2009), “Railway Safety performance in the EU” , European Railway Agency, Valenciennes