Railway Safety Performance in Ireland



Commission for Railway Regulation
21/12/2017

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Contact Details

Website	www.crr.ie
Email	info@crr.ie
Phone	+353 1 2068110
Address:	Commission for Railway Regulation,
	Temple House,
	Blackrock,
	County Dublin,
	Ireland

Prepared By:	Approved By
Aidan Langley CEng	Anthony Byrne CEng

Foreword

Presenting safety reports is always bitter-sweet. On the positive side, the safety performance of our principal railway organisations in 2016 was, on the whole, positive particularly given the backdrop of increased passenger numbers on both the Iarnród Éireann and on the LUAS rail/ light-rail networks.

Focusing on Iarnród Éireann, there were no passenger or level crossing user fatalities in 2016 and there was a slight decrease in the number of signals passed at danger (SPAD). The number of derailments, collisions and other safety indicators remained low.

Sadly, however, there were 5 fatalities on our railways, all as a result of apparent self-harm. Additionally, there were two attempted suicides in 2016.

2016 again saw a prevalence of incidents in train depots and sidings which, while pose less of a safety risk to the general public, suggest internal monitoring by railway organisations might be in need of improvement.

In terms of the LUAS operation, safety performance remains consistent with that for 2015. There were a small number of infrastructure failures and road traffic collisions remained consistent with previous years.

Organisational and safety culture remains a focus for the CRR as does the continued oversight of railway organisations and their implementation of their respective Safety Management Systems (SMS). It is noted that safety expertise has been strengthened at board level in Iarnród Éireann and new executive management is in place at Transdev. Continued investment in developing employees in terms of their safety capability, and promoting a just culture should be forefront of management's minds particularly given the changes being made to common safety methods under the European Union 4th Railway Package.

Railway safety occurrences are recorded every day on our railway networks and remind us that railway safety is never something to be taken for granted, it is a result of daily effort by numerous actors interacting in the railway system that is becoming more and more complex. That said we must all do more and strive for continuous improvement in all we do.

Tony Zyhne.

Anthony Byrne Principal Inspector – Supervision & Enforcement

Executive Summary

This is the eighth separately published annual safety performance report of the Commission for Railway Regulation (CRR). It has been prepared for the general public in line with Section 10 of the Railway Safety Act 2005 (the Act), which requires that the CRR 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 CRR is the independent railway safety regulator in the Republic of Ireland and is responsible for overseeing the safety of all railway organisations, including Iarnród Éireann, Transdev (Luas Operator), Balfour Beatty Rail Ireland (BBRI), Bord Na Móna where their railway interfaces with public roads, the Railway Preservation Society of Ireland and a number of smaller heritage railways and the authorisation of projects undertaken by the Transport Infrastructure Ireland (TII) formally the Railway Procurement Agency (RPA).

The safety performance of Iarnród Éireann, BBRI and Transdev is, in the main, positive and broadly in line with previous years, against a background of rising passenger numbers on all the major routes.

However, concerns remain for both the rail and tram networks, with the operational environment continuing to remain demanding. Imported risk from third party activity interfacing with the railway continues to be an issue, particularly against a background of both rising passenger numbers and operating in a continually busier environment.

There were no passenger fatalities or serious injuries in 2016. However, 5 people lost their lives due to unauthorised entry onto the railway. There were no reports of level crossing deaths this year.

Passenger injuries were broadly consistent with 2015 data; IÉ employee injuries have also fallen, even as the number of passengers carried has continued to increase. The number of train collisions with animals and obstacles increased in 2016, reversing the previous downward trend.

Signals Passed At Danger (SPADs) appears to have plateaued since 2012, after trending downward for the previous decade. The trend is being monitored as part of specific supervision activities by the CRR. Iarnród Éireann is also developing a unique transmission based train protection system that seeks to overlay, and eventually replace, the current train control system and enhance safety through increased supervision of train movement.

LUAS safety performance in 2016 was broadly consistent with previous years, and trending in a positive direction. There had been concern that Emergency Brake applications were rising in 2015, but this has been acted upon by the operator and a downward trend re-established. These are not actual accidents, but situations where the tram driver has braked sharply. In other

initiatives, Transdev has successfully worked with other stakeholders, such as the Gardaí and Dublin City Council to improve the operating safety metrics of the Luas.

Further insight is given to Ireland's rail safety performance within a European context. It is demonstrated in the report that Ireland continues its satisfactory trend of recent times relative to other European Railways. Additional analysis is presented showing the prevalence of train protection systems in Europe, where it was noted Ireland's network has had no increase in percentage of track covered by ATP. Notable international railway incidents are also discussed.

In 2016 the RAIU published three reports into accidents and incidents that were formally investigated. One of these reports was an investigation into SPAD occurrences between 2012 and 2015. Altogether, these three reports produced a total of 17 new safety recommendations, which are detailed in Chapter 5.

Table of Contents

1	Intr	oduction	8
	1.1	Introduction	9
	1.2	Overview of Report	9
	1.3	The Commission for Railway Regulation	9
	1.4	Statistical Qualification	9
2	Pub	lic Representations	11
	2.1	Introduction	12
	2.2	2016 Data and Commentary	12
3	Rail	way Safety Trends in Ireland	15
	3.1	Introduction	16
	3.2	Iarnród Éireann	16
	3.3	Balfour Beatty Rail Ireland	31
	3.4	Transdev (Luas) Statistics	31
	3.5	Bord Na Móna Industrial Railway Statistics	36
	3.6	Heritage Railways	36
4	Rail	way Safety Trends in Europe	38
	4.1	Introduction	39
	4.2	Percentage of tracks with Automatic Train Protection (ATP) in operation	39
	4.3	Signals passed at danger relative to train-km	40
	4.4	All accidents relative to train-km	41
	4.5	Level-crossing accidents relative to train km	42
	4.6	Derailments of trains relative to train km	43
	4.7	Total number of accomplished safety audits	43
	4.8	Network Comparisons	44
5	Maj	or Accidents Worldwide	46
	5.1	Introduction	49
	5.2	RAIU Active Investigations	49
	5.3	RAIU Investigation Reports	49
	5.4	RAIU Safety Recommendations	50
6	Refe	erences	58
	6.1	Documents Used	59

Table of Figures

Figure 1- Public Representations to the CRR by year
Figure 2 - CRR Public Representation by category14
Figure 3 - IÉ Passenger Journeys 2003-201616
Figure 4 - Train-km on the IÉ Network 2003-201617
Figure 5 - Personnel engaged in full time employment with IÉ
Figure 6 - IÉ Operational fatality and Injury Statistics by year
Figure 7 - Passenger Injury Statistics by year
Figure 8 - Employee Injury statistics by year (Railway Operations)21
Figure 9 - Employee Injury statistics by year (Railway Infrastructure)
Figure 10 - Employee Injury statistics by year (Railway ECM)22
Figure 11 - Total Collisions by year
Figure 12 - Train Collision Statistics detail by year Part 124
Figure 13 - Train Collision Statistics detail by year, part 224
Figure 14 - Number of level crossings by year25
Figure 15 – Level Crossing by type in Ireland
Figure 16 - IÉ SPADs by year27
Figure 17 - Train Derailments by Year
Figure 18 - Rolling Stock Incidents by year
Figure 19 - Broken Rails by year
Figure 20 - Cracked or Broken Fishplates on the IÉ Network, by year
Figure 21 - Railway Bridges struck by road vehicles
Figure 22 - Number of Road Traffic Accidents involving a tram, by year
Figure 23 - Pedestrian coming into contact with Tram
Figure 24 - RTC per million km run
Figure 25 Tram derailments
Figure 26 - Emergency Brake Applications
Figure 27 - Percentage of EU/EEA tracks with Automatic Train Protection (ATP) in operation, by country

Figure 28 - Signals passed at danger per million train-km	41
Figure 29 - All accidents relative to train km	42
Figure 30 - Level crossing accidents relative to train km	42
Figure 31 - Derailments of trains relative to train km	43
Figure 32 - Total number of accomplished audits	44
Figure 33 - Total number of train-km	44
Figure 34 - Number of passenger km	45
Figure 35 - Number of line kilometres	45
Figure 36 - RAIU investigations initiated in 2016	49
Figure 37 - RAIU Investigation Reports published in 2016	

1 Introduction



1.1 Introduction

This is the eighth Annual Safety Performance report of the Commission for Railway Regulation (CRR), prepared for the general public in line with Section 10 of the Railway Safety Act 2005 which requires the CRR to operate in an open, non-discriminatory and transparent manner. This report provides background statistics and comment to a number of important safety performance indicators. Performance indicators are guided by the Common Safety Indicators (CSI), as specified in Directive 2004/49/EC and amended by Directive 149/2009/EC and Directive 2014/88/EU. Further indicators are included in this report to reflect unique aspects and risks particular to Irish Railways.

1.2 Overview of Report

In Chapter 2, a brief overview of the public representations received by the CRR is presented. Safety trends in Ireland are presented and discussed in Chapter 3. All categories of train incidents are included. In Chapter 4, a high level comparison with other European railways shows where Iarnród Éireann (IÉ) is positioned in terms of railway safety. This includes a brief overview of significant accidents that have occurred in other countries in 2015. Chapter 5 concerns the Railway Accident Investigation Unit (RAIU) and recommendations made arising out of their investigations. The status of each recommendation is explained together with details of actions taken to date.

1.3 The Commission for Railway Regulation

The CRR (then the Railway Safety Commission) was established on 1st January 2006 under provision of the Railway Safety Act 2005, with responsibility for railway safety regulation. 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"

The CRR as the NSA has responsibility for conformity assessment and issuing of safety certificates and safety authorisations for safety management systems, new rolling stock and infrastructure, and monitoring the industry to ensure it manages its safety risk effectively. The CRR also co-ordinates and encourages railway safety initiatives between the industry and external stakeholders. Further details may be found on the CRR website <u>www.CRR.ie</u>.

1.4 Statistical Qualification

The CRR produces this report to enhance public access to information about safety performance of the various Irish railway organisations. The CRR's goal is to keep this information timely and accurate. If errors are brought to the CRR's attention, every effort will be made to correct them.

This information is:

- of a general nature only
- not professional or legal advice

It is important to note that the figures used in this report are intended to illustrate broad trends and are not meant to be read as exact calculations. Rounding has been used and this could affect the overall data.

It is the CRR's goal to minimise any inconvenience caused by technical errors. However, some data or information in this report may have been created or structured in files or formats that are not error-free. The CRR accepts no responsibility with regard to such problems incurred as a result of using data from this report.

2 Public Representations



2.1 Introduction

The CRR encourages the public, passengers, railway staff and others to bring any railway safety concerns to its attention. Facilities are available to communicate with the CRR by phone, post or via the CRR website (www.crr.ie) and a confidential recipient programme. The CRR also monitors media coverage of incidents related to railway safety. The input of all stakeholders in the railway, such as employees, passengers and the general public is valuable in the CRR's work to improve railway safety. Where these issues relate to service rather than safety, the CRR directs the representation to the appropriate entity. Where the matter involves railway safety the CRR endeavours, wherever possible, to deal with the matter directly. If necessary the CRR will seek information from the appropriate railway company for further clarification.

2.2 2016 Data and Commentary

In 2016, the CRR received 58 direct or indirect representations relating to a range of heavy and light rail infrastructural and operational matters, 2 fewer then that received in 2015 (60), but in line with the 5 year average of 59. Of these, 42 are related to Iarnród Éireann operations or infrastructure (51 in 2015), 9 pertained to the LUAS (Dublin Light Rail) system (8 in 2015) and 2 for NIR, and 5 others.

A number of the representations did give cause for concern and the CRR acted promptly to ensure that corrective action was taken by the relevant Railway Organisation. In some instances the Railway Organisation was required to take immediate action. It is CRR policy that all safety related concerns are investigated. Representations are continually tracked for re-occurrence and detection of trends. If either are observed, monitoring activities are increased to determine and address underlying causes.

The variation in public representations from 2015 to 2016 is downward, but as mentioned above, in line with the 5 year average of 59 per annum. The increase in 2013 was attributed to passenger safety concerns of overcrowding of services on the Iarnród Éireann network. Passengers continued to contact the CRR on this concern, and 4 related to overcrowding on IÉ and one on Luas in 2016. Figure 2 contains further data describing a more detailed breakdown.



Figure 1- Public Representations to the CRR by year

Representations from 2016 were further analysed and broken down in to the following categories:

- Safety at Stations: Queries relating to incidents or concerns at stations
- Safety of Infrastructure: Queries relating to Railway Infrastructure such as bridges, level crossings or fencing
- Safety of Rolling Stock: Queries relating to Vehicles such as grab rail security or door operation
- Safety of Train Operation: Queries relating to operations such as train loading, excess train speed or shared running of trams
- Safety of Railway Working: Queries relating to operational activities on the railway such as network regulation or management control.

The numbers of representations/complaints by category is shown in Figure 2. The distribution has changed somewhat compared to 2015. The number of issues relating to Railway Operations in part reflects the increase in number of concerns regarding overcrowding. Interestingly there has been a reduction in representations regarding station facilities, whilst at the same time passenger numbers have grown, which does explain the increase in representations related to overcrowding, it is known that the whole IÉ 22000 fleet is now deployed again, with previously decommissioned stock such as the 2700s being re-introduced.

It is not possible to ascribe changes in reporting to one particular reason, but the CRR will continue to monitor as to if the trend continues.



Figure 2 - CRR Public Representation by category

3 Railway Safety Trends in Ireland



3.1 Introduction

The safety performance of the Railway Organisations in the Republic of Ireland is considered for the four principal railway sub-sectors that the CRR regulates, namely heavy rail, light rail, public highway interfaces with industrial rail systems, and heritage railways. Each Railway Organisation is mandated by law to report statistical data on railway operations and incidents to the CRR. This data is then used for assessing Railway Organisation safety performance and management of risk.

3.2 Iarnród Éireann

3.2.1 Operational Statistics

At year end, the IÉ operational network was 1683 route-kilometres, the same as in 2015. There were no significant changes to the network or to the operational pattern of trains.



Figure 3 - IÉ Passenger Journeys 2003-2016

Passenger Journeys are up 7.9% on the 2015 figure to 42.8 million reflecting the recovery in the economy and exceeding the figures seen in 2005, although not yet at those seen in 2006-2008 of ~ 45,000,000. The trend, noted in 2015, has now been established which demonstrates an increase in passenger journeys for the last five years. There is scope for this pattern to continue, in excess of economic grown, and as Infrastructure projects such as track improvements of line speed, and operational improvements such as Phoenix Park Tunnel (started in November 2016) are reflected in full year data. The primary limit to this growth would appear to be capacity of both track and rolling stock.



Figure 4 - Train-km on the IÉ Network 2003-2016

The long term trend for reduced freight movements is quite evident in Figure 4. A peak of about 5,000,000 freight train-km was reached in 2005 but this declined rapidly afterwards following strategic operational decisions which reduced freight traffic. At about this time, passenger-km soared and peaked in 2008. Iarnród Éireann is currently endeavouring to expand freight services following the plateauing of freight from 2010, whilst the recorded train-km has remained static between 2014 and 2016 although test runs of longer freight trains have been done, and other options are being explored.

The Train-km metric does not measure the size of a train, just that a train has run, for example during the economic downturn, 4-car sets were run in place of running half empty 8-car sets. At the time of writing, the active fleet of ICRs, DMUs and EMUs is once again fully deployed, with options being looked at to increase capacity.



Figure 5 - Personnel engaged in full time employment with IÉ

Since 2008, Iarnród Éireann had decreased employee numbers significantly. This trend has been arrested in the last 3 years, with essentially consistent staff numbers since 2013. As the volume of both passenger and freight traffic starts to increase again, having a critical mass of competent staff is vitally important to maintaining operational and infrastructure safety.

3.2.2 Iarnród Éireann Fatality and Injury Statistics

Figure 6 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 2016.

Category	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Trend
		Ra	ilway o	peratio	ons: pas	senger	fatal in	juries				
Fatal injury to passenger due to a train	0	0	0	0	0	0	0	0	0	0	0	
Fatal injury to passenger due to a train									0		0	
accident at level crossing	0	0		0	0		0	0	0	0	0	
other than in train accident	0	0	0	0	0	0	0	0	0	0	0	
Fatal injury to passenger attempting to board	0	0	0	0	0	0	0	0	0	0	0	
		Rail	way inf	rastruc	ture: th	ird par	v fatal	iniurie	<u> </u>			
Fatal injury to third party at a level crossing		itan	i ay ini	lastiae			.y ratar	injune.				Δ
involving a train	0	1	1	0	2	0	0	0	0	0	0	
Fatal injury to third party at a level crossing not involving a train	0	0	0	0	0	0	0	0	0	0	0	
Railway operations: employee fatal injuries										0	0	
Fatal injury to employee at a level crossing due to train in motion	0	0	0	0	0	0	0	0	0	0	0	
Fatal injury to employee due to train in motion	0	0	0	0	0	0	0	0	0	0	0	
(other than at a level crossing) Fatal injury to employee not due to train in					-			-				
motion	0	0	0	0	0	0	0	0	0	0	0	
		Rail	way inf	rastruc	ture: e	mploye	e fatal	injuries	5			
Fatal injury to employee at a level crossing	0	0	0	0	0	0	0	0	0	0	0	
Fatal injury to employee due to train in motion		0			0	0	0		0		0	
(other than at a level crossing)	0	0							0	0	0	
motion	0	0	0	0	0	0	0	0	0	0	0	
		Railw	ay oper	ations:	fatal i	njuries	to othe	r perso	ns			
Fatal injury due to train in motion not at level	0	1	0	0	0	0	0	0	0	0	0	\land
crossing Fatal injury to customer or visitor, no train												
involved	0	1	0	0	0	0	0	0	0	0	0	
Fatal injury involving train in motion on railway or level crossing where trespass or	7	5	8	3	8	7	5	4	6	2	5	
suspicious death was indicated		-		-			-					
	0	Railwa	y opera	ations:	non fat	al injuri	ies to p	asseng	ers			
Injury to passenger travelling on train due to a railway accident not at level crossing	0	0	0	2	0	0	0	0	0	0	0	\wedge
Injury to passenger travelling on train due to	0	0	0	0	0	0	0	0	0	0	0	
railway accident at level crossing											Ŭ	/
alight from train	55	50	43	17	64	46	41	39	45	48	79	
Injury to passenger travelling on train, other than due to a railway accident	41	35	22	40	28	10	27	43	18	15	31	$\sim \sim \sim$
		Railwa	y infra	structu	re: third	d party	non fat	al injur	ies			~
Third party at level crossing injury involving a	0	1		0	0	1	2		0	0	0	
train	0	1	0	0	0	1	2	0	0	0	0	
Level crossing user injury not involving a train	0	1	1	1	0	2	5	1	0	0	0	
	Ra	ilway i	nfrastru	cture:	non fat	al injur	ies to o	ther pe	ersons			
Injury to customer or visitor to premises	72	70	54	56	85	113	116	193	205	146	192	
injuries to other persons including unauthorised persons	0	1	0	0	0	0	5	3	0	1	2	
		Railv	vay ope	erations	: non f	atal em	ployee	injurie	s			
Employee lost time injury involving train	15	7	8	13	11	7	13	5	21	3	1	$\searrow \land \land$
movement or train accident Employee lost time injury while working on												
railway not due to train in motion	38	36	37	31	27	22	32	39	43	32	30	
		Railwa	ay infra	structu	re: non	fatal e	mploye	e injur	ies			
Employee lost time injury involving train	0	1	1	0	1	2	1	0	0	0	0	
Employee lost time injury while working on	21	42	42	24	20	22	27	41	25	6	22	
railway not due to train in motion	31	42	42	34	30	23	32	41	25	D	23	``
level crossing not due to train in motion	2	4	0	0	0	0	1	1	2	0	3	
Entity in ch	arge of	mainte	nance	and ma	intenar	ice wo	rkshons	: non f	atal em	plovee	iniuries	
Employee lost time injung involving train											,unici	Δ
movement or train accident	0	0	0	1	0	0	0	0	0	0	0	
Employee lost time injury while working on	30	36	27	21	10	18	10	14	18	13	11	
ranway not due to train in motion	L		L	L		L						

Figure 6 - IÉ Operational fatality and Injury Statistics by year

3.2.2.1 Fatal Injuries

There were no passenger fatalities or serious injuries in 2016. However, there were 5 fatal injuries on the railway, which is in line with the trend over the past 11 years, albeit a regrettable increase from the two in 2015. All of these fatalities were categorised as trespasser fatalities. The CRR refers to a coroner's verdict, when available, to assist in classifying the circumstances surrounding a fatality.

3.2.2.2 Passenger Injuries (Customer & Visitor injuries)

The data indicates that the largest proportion of incidents occur to persons during time spent at stations as opposed to time spent on trains. This is common across many railways due to the sedentary nature of passengers when on board a train. It should be noted that with respect to EU transport statistical definitions a person boarding/alighting from a stationary train is classidefed as 'other person at a platform'.





Similar to other years, injuries to persons (customers or visitors) on railway premises remain at the largest single group with slips, trips and falls being the dominant cause of these injuries. There has been revision on the way in IÉ record and report passenger injury statistics over the past 18 months. This in part explains the sharp fluctuations in the "Injury to customers visiting premises", and apparent increase in other categories. It should be noted that there is also a significant increase in passenger numbers, so a proportional increase in absolute incidents might be expected in line with that growth.

These incidents tend to be of a minor nature and are usually treated by first aid at the station. IÉ continue to report usage of mobile phones as factor in many incidents, where customer/visitor's attention is divided and therefore more prone to injury at stations, due to a slip, trip or fall.

3.2.2.3 Employee Injuries

As in last year's report, employee injuries are categorised in the first instance by the sector of the railway system in which they work, i.e., Railway Operations, Infrastructure maintenance/projects and Entity in Charge of Maintenance (ECM)*.



Figure 8 - Employee Injury statistics by year (Railway Operations)

The significant rise in Lost Time Incidents involving train movements in 2014 has been reversed and 2016 repeats that of 2015. In 2015 IÉ rolled out a number of safety initiatives such as "Accident Free Depends on Me" and "Close Call" reporting and are likely to be contributory to the sustained reduction in employee injuries in 2015/16.

* Note ECMs are organisations that are certified to undertaken maintenance of rolling stock, typically freight vehicles but also passenger trains in the case of Iarnród Éireann – Railway Undertaking



Figure 9 - Employee Injury statistics by year (Railway Infrastructure)



Figure 10 - Employee Injury statistics by year (Railway ECM)

2016 saw a marked increase in injuries to employees in the railway infrastructure business, returning to the level of 2014. The CRR are monitoring this working with IÉ-IM to understand why the reduction occurred in 2015, and what caused its reverse in 2016.

In response to an increasing trend for the ECM in 2014, an Accident Reduction Strategy was established that has sought to reduce accidents by enhanced analysis of accident causes and review of safety management procedures.

3.2.3 Iarnród Éireann Operational Incident Statistics

3.2.3.1 Train Collisions

Train collisions can pose a significant risk to passengers, train crew and third parties. They have the potential to cause significant human and environmental harm. Figure 11 illustrates the trend for collisions since 2003. Figure 11 is supported by Figure 12 & 13 to aid understanding of the data. Two categories, 'Total Collisions with Obstacles on the line' and 'Train Collisions with animals (large)', have been separated to enhance visibility of the data as in isolation is of limited benefit. It does however illustrate a significant increase in 2016.



Figure 11 - Total Collisions by year

Category	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Trend
Train collision with passenger or goods train on running line	0	0	0	1	0	0	0	0	0	0	0	0	0	0	
Train/railway vehicle collision in station or possession movement	2	0	1	1	0	1	1	0	0	1	1	1	1	1	
Train collision with a motor vehicle at a level crossing	1	2	2	1	4	4	0	2	1	2	1	2	0	0	
Train collision with pedestrian at a level crossing	0	0	0	0	1	0	0	1	0	0	0	0	0	0	
Train collision with attended gates at a level crossing	2	4	2	2	2	1	0	1	0	0	0	0	1	0	.l
Train collision with road vehicle obstructing the line (not at a level crossing)	2	0	0	0	0	0	0	0	0	1	1	0	1	1	""
Train collision with other obstacle on the line	4	10	8	5	9	17	10	1	7	6	7	29	1	31	
Train collision with large animal(s) on the line	43	40	42	43	42	33	20	24	35	26	29	9	29	35	111111.1 11

Figure 12 - Train Collision Statistics detail by year Part 1



Figure 13 - Train Collision Statistics detail by year, part 2

Total train collisions (with obstacles/large animals) have risen to 68 in 2016 from 33 in 2015. There has been some volatility in the data between 2013 and 2016, but the trends show it continues to be a cause for concern. As discussed in previous reports, animals, (deer, cattle and sheep) are a major contributor to collision statistics in Ireland. Iarnród Éireann continues

'Other Obstacle' collisions have increased in 2016 after a drop in 2015. Collisions with branches and other debris are largely the cause of increase, likely to be as a result of storms experienced throughout the country in 2016.

reduction in the number of level crossings should also be assisting in this trend.

3.2.3.2 Level Crossings

Level crossings are a significant risk to the railway and to any third parties who use them. The long established trend, as shown in Figure 14 and Figure 15 is a decrease in the number of level crossings; there were 1701 level crossings in 2004 vs 948 recorded for 2016, with 23 being eliminated in 2016.



Figure 14 illustrates the varying number of level crossings on active lines, i.e., not on closed or out of use lines.

Figure 14 - Number of level crossings by year

The reader may note an upward trend from 2011 to 2012. The number of registered level crossings increased due to the separate classification of pedestrian-only crossing points at certain manned level crossings and the regularisation of a small number of unofficial crossing points on well-established rights of way. The graph also demonstrates the long term trend of level crossing elimination. Sustained efforts by Iarnród Éireann have contributed greatly to reducing the risk presented by level crossings.

The breakdown of level crossings by type and year in Ireland is shown in Figure 15. Passive level crossings on public roads that require the road user to manually open and close gates remain the highest risk type of level crossing, closely followed by passive 'Field type' level crossings. Recent years have seen a decline in investment for the removal or upgrade of level

crossings. Iarnród Éireann are currently reviewing novel technological designs to enhance safety and operation at user-worked level crossings whilst operating within constrained budgets.



Figure 15 – Level Crossing by type in Ireland

3.2.3.3 Signals Passed at Danger (SPAD)

A SPAD is defined as having occurred when a train passes a stop (red) signal without authority. SPADs are a particular precursor event that the CRR monitors regularly during its supervisory meetings with IÉ. The trend in recent years has been a steady decline, but has started to rise again since the low of 2011.



Figure 16 - IÉ SPADs by year

IÉ use a ranking tool developed in Great Britain by an industry body 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 categorised by type and are grouped into one of 3 severity bands; Low Risk; Medium Risk; and High Risk. The trend is being monitored as part of specific supervision activities by the CRR, However, since 2011 the number of SPADs have essentially plateaued.

Regardless of severity, all SPADs are investigated by IÉ to determine if there are lessons to be learnt, possible countermeasures against SPADs may include but are not limited to:

- Examination of technical rolling stock or infrastructure elements
- Provision of signage
- Placing drivers under additional monitoring
- Alteration to briefing documents
- Review of applicable rules

The course of action will depend on the frequency of occurrence and any common factors with other SPADs deemed relevant.

3.2.3.4 Train Derailment

Train derailments remain at low levels. Routine track inspection and maintenance are important activities that reduce the likelihood of derailment occurrences. Similarly, vigilance by railway employees who work in sidings together with safe systems of work that are understood by railway staff has the potential to reduce the number of occurrences of this type.



Figure 17 - Train Derailments by Year

The rising trend of derailments in IÉ Sidings from 2013-15 has reversed. These derailments are typically minor in nature and low risk, nonetheless they will continually monitored by the CRR. IÉ had committed to auditing safety systems for train operations on sidings, and it is expected this will continue to improve indicators.

3.2.4 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, 2600 classes) •
- Electrical Multiple Unit (8100, 8200, 8500 classes)
- Locomotives (201, 071 classes)
- Passenger Carriages (Mark IV and DeDietrich) •
- Freight wagons (of various types) •

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

• Fire or smoke incidents

- Failure of Rolling Stock Axle Bearing
- A train dividing (parting) while in service Door issues



Figure 18 - Rolling Stock Incidents by year

Failures with rolling stock have the potential to be catastrophic. The number of reported occurrences remained very low in 2016 with the exception of fire/smoke occurrences. The majority of engine fires in 2016 occurred to either the 22000 or 29000 fleet. Every occurrence was investigated by IÉ, with no obvious trend identified. In all cases actions were taken to have to reduce the chance of reoccurrence including fleet-wide checks when considered necessary.

In the Commission's 2015 Annual Report reference was made to the "monitoring of abnormal wear that has become evident in the IÉ Intercity Rail Car axle journal bearings. Monitoring of the situation by the Commission, through regular meetings and inspections, continued in 2016 due to the fact that the axle journal bearing life experience on these vehicles was considerably lower than the design level. However, none of the distressed bearings have triggered a Hot Axle Box Detector alarm or an axle box mounted temperature strip indication." As an additional but associated project Iarnród Éireann introduced a number of additional control measures that included the installation of three Bearing Acoustic Monitors across their network to assist in the early identification of defects / flaws with wheelsets. These are proving to be extremely useful in the early detection of defects that can be quickly addressed by the Chief Mechanical Engineers department of Iarnród Éireann.

3.2.5 Iarnród Éireann Infrastructure Incidents

IÉ operate and maintain a large number 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. Assets can fail due to aging and fatigue and the railway network in Ireland is abundant in legacy structures such as bridges and culverts. Rigorous inspection programme's and preventative maintenance minimise the risk of catastrophic failures. However, from time

to time incidents do occur and data relating to some of these is now presented in sections 3.2.5.1 and 3.2.5.2.

3.2.5.1 Broken Rails and Fishplates

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 tested annually. There were three broken rails on a passenger carrying line in 2016 in line with a trend established since 2001, see Figure 19 - Broken Rails by year. Whilst these did not result in a train accident, it is an area where IÉ remains vigilant. The CRR closely monitors Iarnród Éireann's management of its assets through regular supervision meetings.



Figure 19 - Broken Rails by year



A fishplate is a special bolted connection that joins two rails together. The trend for 'Cracked' or 'Broken Fishplates' continues on the overall downward direction seen over the last ten years. Following a small rise in 2012, a significant decrease was noted for 2013, with this trend continuing in 2014, 2015 and 2016. This decrease is attributable to the installation of continuous welded rail (CWR) under the Railway Safety Investment programme (1998-2013).

3.2.5.2 Bridge Strikes

A railway bridge may be a road over the railway or it may 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 over a road. Both types of incident can, in certain circumstances, result in very severe consequences and road users should be mindful of their driving in the vicinity of the railway. If driving an oversized vehicle, road vehicle drivers should know their vehicle height.



Figure 21 - Railway Bridges struck by road vehicles

The total number of bridge strikes, i.e., under-bridge and over-bridge, in 2016 rose compared to 2015 (90 vs 85 in 2015). This does need to be set against a backdrop of rising road vehicle traffic, which is approaching its 2008 peak, whilst strikes are considerably lower.

The Road Rail Safety Working Group (RRSWG) is a cross party organisation that tackles this issue, amongst others. They met 3 times in 2016. The group is an advisory one consisting of high ranking officials from the following organisations:

- City and County Councils
- Iarnród Éireann
- Transdev
- Transport Infrastructure Ireland
- An Garda Síochána
- Road Safety Authority
- Irish Road Haulage Association

County and City Managers
 Association
 Department of Transport, Tourism & Sport

The RRSWG specifically focuses on road/rail interfaces i.e., locations where the railway and the road intersect, such as at level crossings and bridges over and under railways or tramways. The group aims to facilitate exchange of information, provide advice and support to stakeholders, and discuss mitigation measures which may be enacted.

3.3 Balfour Beatty Rail Ireland

Balfour Beatty Rail Ireland Limited (BBRI) are classified as a Railway Undertaking (RU) under the Railway Safety Act 2005, as amended and therefore are required to have an approved Safety Management System (SMS). Under Commission Regulation (EU) No.1158/2010 on a common safety method for assessing conformity with the requirements for obtaining a safety certificate, Parts A and B Safety Certificates covering the operation of on track machines (OTMs) over the Iarnród Éireann network were issued to Balfour Beatty Rail Ireland Limited (BBRI) on 24th February 2014.

This requires they are compliant with the same relevant law as other RUs as they conduct movements on the IE network. While they do not carry passengers, their activities are safety critical and have potential for significant harm if not properly controlled.

BBRI is a relatively small organisation, and have notified a staff level of 57 employees (having expanded from an initial 45) to the CRR. BRRI does not operate any passenger services, and provide many of their services outside peak and daytime periods. The total train kilometres for 2016 has nearly doubled to 108,526 km from 64,737 km in 2015.

There was a single notifiable occurrence in 2016, in which an OTM drove through a set of points that that was not set for the direction in which the OTM was travelling. The immediate cause was due to operator error, however, the incident was investigated and actions have been taken to minimise the chance of reoccurrence.

3.4 Transdev (Luas) Statistics

Transdev has been operating the Luas since it commenced operation in June 2004. Passenger journeys in 2016 were 34.1 million, compared to 34.6 million in 2015. There were two main contributory factors to this decrease, the closure of the Red Line from Jervis Street to Connolly and The Point (6 of the busiest 32 stops) for six weeks during Luas Cross City (LCC) construction work, and industrial action on a number of days.

3.4.1 Road Traffic Collisions

The Luas by design co-exists with the public and road traffic along significant sections of its alignment, most notably in the city centre. The Luas operates primarily by 'line of sight' as typical of the majority of light rail systems around the world. However, given that the Luas shares sections of the carriageway with road vehicles, road traffic collisions (RTCs) can and do occur. The number of road traffic accidents has increased by one from 22 in 2015 to 23 in 2016, see Figure 22. This is against a background of significantly higher traffic volumes of all types, as the economy has continued to grow. It should be noted, see Figure 24, that Road Traffic Collisions per million kilometres run were, at the end of 2016, at an all-time low.

Transdev, the Luas Operator has put in significant effort into analysing the incident statistics in recent years and has identified a number of 'Black Spots' for RTCs, and where possible put measures in place to minimise future occurrences. In 2016, all the RTCs but one occurred on the Red Line, reflecting the significant shared running that occurs on that line; the Green line is almost entirely segregated from other road traffic.

For example the previous accident black spot of Queen Street and Benburb Street saw only one RTC since modifications were made to that junction. In both 2013 and 2014 there had been 6 per annum, at this location.

Actions that Transdev and its partners/stakeholders have taken include:

- Major communication campaigns combined with all stakeholders including NRA, Gardaí, and RSA to target red light infringements at specifically the Jervis Street and Church Street junctions.
- Completion of the Red Light camera project and enforcement starting in late 2015 with associated media campaign.
- Road Safety Audits of key junctions by an independent assess to review what if any improvements are possible.
- Road junction upgrades and Queen Street
- Development of a portable camera to assess the level of red light infringements at different junctions.



Figure 22 - Number of Road Traffic Accidents involving a tram, by year.





Figure 23 - Pedestrian coming into contact with Tram



Figure 24 - RTC per million km run

A significant majority of incidents where contact is made between trams and pedestrians occur in and around Dublin city centre. The Luas Red Line in particular operates through 41 signalled junctions which are at grade. Such junctions carry a higher risk of the tram coming into contact with pedestrians. A total of 5 such incidents occurred in 2016, in line with the trend of 7-8 since 2012, of these two were cyclists and three were pedestrians. No serious injuries were reported. However, whilst the number of incidents is stable, it should be noted the number of tram km travelled is increasing, Figure 24 shows the effect of this.

An initiative which was trialled with new road markings around pedestrian crossings at platforms, has been rolled out to the whole network in 2016, funded by TII.

3.4.3 Tram Derailments

There were two derailments in 2016 with the last previous derailment occurring back in 2010. The first of the 2016 derailments was due to a driver stopping on a spring operated set of points, changing from 1 driving cab to the other and departing in the opposite direction. This took place in a shunting area with no passengers on board so was of minor significance.

The second derailment in 2016 was a consequence of a road traffic collision (RTC). In both cases no faults were found with either the infrastructure or rolling stock.



Figure 25 Tram derailments

3.4.4 Tram Emergency Brake Applications

A useful precursor 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. There are occasions when a driver may need to apply the EB to prevent a harmful incident.



Figure 26 - Emergency Brake Applications

There were 527 EB applications made in 2016 representing about an 11% decrease on 2015 figures. Operator analysis of this long term trend since 2009 indicates EB applications are linked to new or changed items on the system such as new drivers, new infrastructure, or modifications to tram signalling systems. Trandev have been running training and coaching of drivers in defensive driving to reduce the need for EBs which whilst avoiding a contact with pedestrian or other road vehicle, may cause an incident for a passenger on board due to sudden braking and associated jerk forces. The operator is striving for the goal of the optimum to allow the safe and effective operation of the system.

3.5 Bord Na Móna Industrial Railway Statistics

The remit of the CRR 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 are 98 level crossings and 50 underpasses, of which 47 are under roads and 3 are under Iarnród Éireann rail lines.

Bord Na Móna reported one accident in 2016 at Derraghan (Ash Disposal Facility) level crossing. It was reported that a member of the public crashed into the rail crossing gates which had just been opened by a member of BNM staff. The staff member saw the van coming and got out of the way. The advance warning lights were reported to be functioning and thus it can only be concluded that the van driver was distracted in some way. No one was injured but the car and gate sustained damage.

3.6 Heritage Railways

A heritage railway is defined in Irish Legislation as 'a person who only operates train services or railway infrastructure of historical or touristic interest.' The CRR monitor the operations of 8 self-contained heritage railways. They are:

- Cavan and Leitrim Railway¹
- Difflin Lake Railway, Oakfield Park, Raphoe
- Finntown & Glenties Railway
- Listowel Lartigue Monorail

- Tralee & Dingle Railway¹
- West Clare Railway¹
- Waterford & Suir Valley Railway (W&SVR)
- Irish Steam Preservation Society Stradbally

¹ These railways have not yet received a Safety Management Certificate from the RSC and were reported as being non-operational in 2016

The CRR mandated all heritage railways to document a Safety Management System (SMS) and have it approved by the CRR (then RSC) as of the 1st of January 2014, in line with European standards. CRR guideline 'RSC-G-022' (Issue 2), published 21st of January 2013, outlines the elements a heritage railway must include in its Safety Management System.

One accident occurred in 2016 on the Difflin Lake Railway which resulted in a child sustaining minor injuries. This accident was the subject of an external investigation by the Railway Accident investigation Unit (RAIU). Given in excess of 60,000 passengers were carried by the heritage sector in 2016, 1 reportable accident would indicate an overall positive safety performance. The CRR undertook inspections and/or audits on all the operational heritage railways in 2016 and any findings identified are being addressed by the railway organisations. The CRR continues to work with a number of heritage railway operators to improve their safety standards and processes.

The Railway Preservation Society of Ireland (RPSI) is also a railway organisation who operate steam and diesel hauled heritage trains. However, they operate services on the Iarnród Éireann rail network which presents different and additional risks. Furthermore as a Railway Undertaking (RU) under the European Railway Safety Directive they are subject to a different supervision regime that is commensurate with the risks they import onto the Iarnród Éireann network. As an RU the RPSI has received safety certification based on the acceptability of its Safety Management System, compliance with which is also supervised by the CRR.

The RPSI ran approximately 6000 miles (8656 km) in 2016, which would be considered to be high, with no reportable accidents or injuries. There were 4 reported incidents which the CCR are monitoring through quarterly Safety Management Review Meetings, and it is considered that co-ordination between the RPSI and IÉ-IM has improved since the Midleton incident in 2015.

2016

4 Railway Safety Trends in Europe



4.1 Introduction

In European terms, the CRR is defined as the National Safety Authority (NSA) for the European railway network in Ireland. Each European member state has an NSA which, in accordance with the Railway Safety Directive (2004/49/EC), must submit its annual report on railway safety to the European Union Agency for Railways (EUAR). The EUAR in turn analyses railway safety on a European scale and publishes its report. EUAR reports do not take into account light rail (Luas) or metro systems, or self-contained heritage railway systems.

The EUAR produces a biennial report, the most recent being published in 2016, which includes data up to and including 2014. An EUAR report is not available for 2015 for comparison purposes. Data was extracted from the publicly available E-Rail Database that EUAR maintain. This is a repository for European railway safety data, as input by National Safety Authorities. Some noteworthy statistics are presented from this database. Definitions for data categories used, where not stated, can be found in the document 'Implementation Guidance for use of Common Safety Indicators', which is produced by EUAR and is available at http://www.era.europa.eu/.

4.2 Percentage of tracks with Automatic Train Protection (ATP) in operation

One critical measure of railway infrastructure is the percentage of railway fitted with Automatic Train Protection (ATP). The European Union Agency for Railways, in common with most professional railway organisations, consider ATP to be the most effective railway safety measure that railway infrastructure managers can implement to reduce the risk of collisions and derailment on mainline railways. ATP enforces obedience to signals and speed restrictions by speed supervision, including automatic stopping at signals. 25 Member States reported the percentage of lines equipped with such a system. This data is shown in Figure 27.

The notable element of the Irish data is that ATP coverage has not increased. Most EU states tend to expand ATP over the long term on their rail systems. This is part of a worldwide trend where many developed nations have extensive use of ATP.

Of the 1683 route kilometre of Ireland's conventional rail network, 53 km are equipped with DART-ATP. DART-ATP is only functional on DART EMU rolling stock that runs on the DART system. Because the DART-ATP low-speed override must be used for regular operations, it has been reclassified as a train protection system (TPS) in accordance with Directive 2014/88/EU. All other rolling stock does not have DART-ATP technology fitted, but can still run on this section. The Irish network also makes widespread use of a Continuous Automatic Warning System which also meets the EU definition of Train Protection System: it

warns the driver of the signal aspect ahead. It also requires the driver to acknowledge a signal downgrade, so as to avoid a penalty brake application.



Figure 27 - Percentage of EU/EEA tracks with Automatic Train Protection (ATP) in operation, by country

4.3 Signals passed at danger relative to train-km

Earlier in this report it was noted that 2015 SPAD performance in Ireland (IE) is no longer improving. Data presented in this chapter shows relative performance using million train kilometres travelled on the network. Ireland is not an outlier in terms of SPAD performance, but clearly could do better, as mentioned in the review conducted by the RAIU into IÉ SPAD performance, published on 11th April 2016.



Figure 28 - Signals passed at danger per million train-km

4.4 All accidents relative to train-km

In European Terms the Irish Network is quite small, and has had very few passenger fatalities in the last 35 years. However, given the relatively small amount of passenger kilometres measured, a small number of fatalities could change relative performance, which makes it incumbent on all stakeholders to remain vigilant and continuously improve safety systems. All accidents in this instance are those which are reportable within the Common Safety Indicator framework as described in the European Union Railway Safety Directive 2004/49 (as amended).



Figure 29 - All accidents relative to train km

4.5 Level-crossing accidents relative to train km

Level Crossings are a significant risk to railway safety and the density of level crossing on the Irish network is above the EU average. However, it is clear from the data presented in Figure 30 that Ireland, in comparison to other European countries, has a positive safety record in terms of level crossing accidents relative to train kilometres.



Figure 30 - Level crossing accidents relative to train km

4.6 Derailments of trains relative to train km

The indicators are largely positive for Ireland with regards to derailments. There are favourable comparisons evident with all other major railways in the EU. Whilst the Irish Network is relatively low speed and has low utilisation compared to some other member states, derailment risk still requires careful management in a challenging environment where resources have been reduced in the period under review.



Figure 31 - Derailments of trains relative to train km

4.7 Total number of accomplished safety audits

The European Commission has developed specific regulations to ensure that all railway organisations monitor their safety performance. One key measure of this is safety audits accomplished. Railway Organisations are required to audit their compliance with European and National Law, and act on the results accordingly. The CRR closely monitors railway organisations to ensure they comply, and in addition the CRR also regularly audit railway organisations. It can be seen that the absolute number of audits performed in Ireland is relatively few, which is to be expected given it has a small railway network.

As can be seen in Figure 33 the numbers of audit and inspections vary widely within Member States. This is partly due to ambiguous definitions of what constitutes an audit and an inspection. Even when accounting for possible misclassification of inspections as audits and vice-versa, the variation in the supervision effort across the EU appears to be significant.



Figure 32 - Total number of accomplished audits

4.8 Network Comparisons

Comparisons are presented below to show the scale of traffic on the Irish Network in comparison to other EU Member States.



Figure 33 - Total number of train-km

It can be seen from Figure 33 that there is a relatively small amount of train-km measured in Ireland when compared to the European context. This is as one might expect given our size and population density. Germany is the country with the highest number of train-kilometres, accounting for one quarter of all train-kilometres in the EU. It is followed by the UK and



France, each reporting more than 500 million train-km in 2014. These three countries account for 53 % of train traffic in the EU.

Figure 34 - Number of passenger km

Figure 33 follows a broadly similar trend to Figure 34. The Y-Axis is measured in millions. Many of the countries where there is high passenger numbers generally utilise extensive modal sharing whereby the train might be part of a journey along with bike, bus, tram and car.



Figure 35 - Number of line kilometres

Figure 35 shows the number of line kilometres, which is a measure of the length of route in a country's network.

4.9 Major Accidents Worldwide

A number of major incidents on railways in other countries during 2016 provided a stark reminder that despite many indicators showing improvement in overall safety performance, potential still exists for catastrophic accidents. The CRR is an active participant in a small number of fora with other National Safety Authorities in Europe and similar agencies worldwide regarding such incidents and endeavour to share learning points derived from investigations. What follows is a brief overview of recent accidents in other jurisdictions which the CRR considered noteworthy for the Irish rail industry.

The United Kingdom

Croydon Tramway, London, 9th November 2016. In the dark and in heavy rain a tram derailed and turned over resulting in 7 fatalities and 58 injuries. At the time of writing the investigation is still ongoing, however it has been identified that the tram was travelling significantly faster than would have been expected for that location, no mechanical or electrical faults have been identified.

With reference to the similarities with the Dublin, Luas system, it should be noted that media reports have suggested that the type of window glass used on the Croydon Tram contributed to the high number of fatalities, and severe injuries. The windows of the Croydon tram are reported to be tempered glass, which shatters when struck, as they are intended as an alternate route of escape. The Luas trams windows, but not doors, are laminated glass, which would contain passengers within the vehicle in the case of this type of incident, with egress only possible via the doors. Note that the CRR and Luas operation companies continue to review information from the Croydon investigation for lessons learned.

Germany

Bad Aibling, Bavaria, 9th February 2016. On a single track section of the Mangfall Valley Railway, a signalman, distracted by his mobile phone, directed two trains into the same section of track travelling in opposite directions. The error was compounded by the signalman dialling an incorrect emergency number once the error had been realised.

Both trains were travelling at circa 100 km/h at the time of the incident. Of approximately 150 people on board the two trains, 12 people died and 85 others were injured, including 24 seriously. The signalman received a prison sentence of three and a half years.

<u>India</u>

• Pukhrayan, Uttar Pradesh, northern India, 20th November 2016, Passenger train derailed due to a rail fracture (broken rail), resulting in at least 151 dead, and 150 injured.

• Kanpur, Uttar Pradesh, northern India, 28 December 2016, Passenger train derailed following rail fracture, resulting in more than 60 injuries.

Both incidents were thought to be due to rail fracture, a subsequent apparently deliberate fracture was found in January 2017 before a third incident occurred, and three people arrested. Prior to this third incident the railway maintenance practices had come under intense scrutiny.

Iran

Semnan-Damghan train collision, 25th November 2016. Following this accident there were 49 fatalities and 103 injuries. The accident occurred when a train which had stopped due to mechanical issues, was struck by a following train. The incident was primarily caused by signalman error, as the following train had been halted by a signal, but after the signalman shift had changed, a proceed (green aspect) signal was given in error. Rescue efforts were hampered by the location, as it was very remote in wintery conditions and an apparent lack of rescue resources; a reported single helicopter was all that was available.

<u>Italy</u>

Andria-Corato train collision, 12th July 2016. There were 23 fatalities and 54 injuries in a collision on the last remaining section of single line operated under a telephone block signalling system, rather than a more up-to-date signalling system which had been installed on the rest of the line. Both trains should have passed each other at Andria station. It was concluded that a late running preceding train had been mistaken for one of the trains involved in the collision, at which the signalman mistakenly gave a proceed signal.

5. Accident Investigations



4.10 Introduction

The Railway Accident Investigation Unit (RAIU) is a functionally independent organisation within the Department of Transport, Tourism & Sport (DTTAS). 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 European Railway Safety Directive 2004/49/EC and the Railway Safety Act 2005 as amended by S.I. No.258 of 2014.

4.11 RAIU Active Investigations

The RAIU initiated one formal investigation into railway accidents and incidents in 2016 (Table 5-1). They also commenced a 'Trend investigation into Signals passed at danger' (SPAD) occurrences. The RAIU published their investigation/trend investigation reports in 2016 and all safety recommendations made have been assigned to the applicable railway organisations and the CRR are tracking their implementation.

Date of Incident	Details	Duty Holder
17 th December 2016	Difflin Light Rail Passenger Fall, Co. Donegal	DLR

Figure 36 - RAIU investigations initiated in 2016

4.12 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 2016, the RAIU published 3 investigation reports which are listed in table 5-2. As a result of their investigations the RAIU made a total of 17 safety recommendations which are discussed in section 5.4.

Date Report Published	Title of Report	No. of recommendations made	Duty Holder
11 th April 2016	Trend Investigation into SPAD Occurrences on the Iarnród Éireann Network	14	IÉ-IM
6 th September 2016	Dangerous Occurrence between Ballybrophy and Portlaoise	2	IÉ-IM
20 th October 2016	Operational Incidents at Ardrahan and Spa Road, Castleconnell	1	IÉ-RU

Figure 37 - RAIU Investigation Reports published in 2016

4.13 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, 17 were made in 2016. In accordance with the Railway Safety Directive the RAIU should address recommendations to the safety authority (the CRR) 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 CRR categorise the status of recommendations as being either 'Open', 'Complete' or 'Closed'. These are defined as follows;

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

A summary is presented below of the actions taken (at the time of writing) in relation to the three RAIU Investigation Reports published in 2016 where safety recommendations were made, and the status of each recommendation.

It should be noted that just because a safety recommendation is identified as being 'open' does not mean that no action has been taken, rather the railway organisation responsible has not yet reported that they have concluded the actions they propose to take to action the individual safety recommendation.

Similarly, 'complete' status safety recommendations are likely to have been reviewed by the CRR and further evidence in support of the railway organisations claim that the recommendation had been addressed is either awaited or has been supplied and is undergoing review by the CRR.

R2016 – 001- Summary of Investigation into SPADs on the IÉ network from January 2012 to July 2015; (*Report Published 11th April 2016*)

Summary:								
In December 2013, two serious 'Signal Passed at Danger' (SPAD) events were reported to the RAIU								
by Iarnród Éireann (IÉ). After an initial review of these SPADs, and an earlier SPAD in April 2013								
the RAIU made the decision	on to carry out a full review of Catego	orv A SPADs on the IÉ network from						
2012 to 2014. This was later extended to include SPADs from January to June 2015.								
Number of recommendati	ons made 14							
Recommendation 1	IÉ-IM must introduce an adequate t	rain protection systems on all of the						
(1-2016)	IÉ network for the protection of trai	ins: this system should be robust and						
	to an acceptable standard within Eu	rope: and have the appropriate ATP						
	and speed supervision functionality							
Action/s taken /	On the 25th May 2016 IÉ-IM advis	ed by way of email with covering						
in progress	letter that the recommendation is ac	cepted. However works to affect the						
m pro bio	safety recommendation are subject	to funding						
Status	Complete							
Dutub	Complete							
Recommendation 2	IÉ-IM should review the functional	ity of the ATP's running release to						
(2-2016)	ensure that the train protection func	tion in relation to passing a signal at						
(,	danger is appropriately maintained	where drivers are approaching						
	signals displaying red aspects. If thi	is is not feasible with the current						
	equipment it should be included any	v new train protection system						
	introduced on the network.							
Action/s taken /	On the 25th May 2016 IF-IM advised by way of email with covering							
in progress	letter that the recommendation is ac	cented However works to affect the						
III progress	safety recommendation are subject	to funding						
Statue	Onon	to funding						
Status	Open							
·								
Recommendation 3	IÉ-IM should review the functional	ity of signals in the Connolly area so						
(3-2016)	that the instances of abnormal upgra	ades or downgrades are minimised.						
Action/s taken / in	Submission received from Jarnród I	Fireann on 26th May 2016						
nrooress	confirming that a review had been i	indertaken and no faults were found						
progress	An undated submission was received	ad by the CRR on the 13th January						
	2017	a by the civic on the 15th sundary						
Status	Closed							
Status	Closed							
Recommendation 4	IÉ-RU should commission an inder	endent review in terms of human						
(4-2016)	factors to determine why there is a	prevalence for the occurrence of						
(+-2010)	SPADs at certain times of the day:	at certain times of drivers shifts:						
	and for drivers with three-five years	a driving experience						
Action/s taken / in	On the 30th May 2016 IF-RU advis	and by way of email with						
prograss	off the Sour May 2010 IL-ICC action	inion that this recommendation is						
progress	allachements that they are of the op	aity Collage Dublin to undertake a						
	complete. ID-KU have engaged 11	Decourrences that address the						
	Study of Driver Denaviour and SrA.	D occurrances, that address the						
0	RAIUs safety recommendation.							
Status	Complete							

Recommendation 5	IÉ RU should review the culture within the company so that actions
(5-2016)	taken after SPAD's supports learning within the driver grades should
	errors occur, and that the DD&SS is used for redeveloping competence
	in driving skills and supporting the drivers in returning to driving
	duties, after a SPAD event.
Action/s taken /	On the 30th May 2016 IÉ-RU advised by way of email with covering
in progress	letter that the recommendation is accepted and a plan of work has been
1 0	determined.
Status	Open
Recommendation 6	IÉ-RU should introduce a near miss reporting system, whereby, drivers
(6-2016)	may report near misses without the fear of sanctions being imposed.
Action/s taken /	On the 30th May 2016 IÉ-RU advised by way of email with covering
in progress	letter that the recommendation is accepted and a plan of work has been
	determined.
Status	Complete
Recommendation 7	IE-IM should identify high risk safety critical signals and, where the
(7-2016)	technology exists, introduce a mechanism to monitor the approach
	speed to these signals; to ensure that near misses are identified and
	managed.
Action/s taken / in	On the 25th May 2016 IÉ-IM advised by way of email with covering
progress	letter that the recommendation is accepted. However works to affect the
. .	safety recommendation are subject to funding
Status	Open
Recommendation 8	IÉ-IM should review the Traffic Regulator's Manual with a view to
(8-2016)	introducing guidance for Traffic Regulator's in terms of the
````	management of train delays and the switching of crossing points.
Action/s taken / in	In May 2016 IÉ-IM advised that they will review and reissue the
progress	Traffic Regulators manual. A submission from Jarnród Éireann is
progress	awaited
Status	Open
Statas	open
Recommendation 9	IÉ-IM should review their training and competency management for
(9-2016)	Traffic Regulators so that they have the appropriate skill set in terms of
() _010)	identifying potential risks associated with the regulating of trains
Action/s taken / in	In May 2016 IÉ-IM advised that they will review and reissue the
progress	training and competency management standard for Traffic Regulators
Status	Onen
Status	open
Recommendation 10	IÉ-RU and IÉ-IM should carry out a review of the interfaces between
(10-2016)	different operational staff (i.e. drivers LCCOs signalmen and EOs) so
(10 2010)	that all operational staff can adequately
	manage train operations during degraded situations. Part of this review
	should focus on the safety critical communications between operational
	should rocus on the safety endear communications between operational
	Statt. (13th April 2016 CRP consider IÉ IM are best placed to lead this
	activity and are thereby assigned ownership of this safety
	activity and are ineredy assigned ownership of this safety
	recommendation.)

Action/s taken /	In May 2016 IÉ-IM advised that they will carry out a review. A				
in progress	submission from Iarnród Éireann is awaited.				
Status	Open				
Recommendation 11	IÉ-IM should identify all locations where safety critical				
(11-2016)	communications are not recorded and develop a programme of works				
(11 2010)	for the introduction of recording safety critical communications at these				
	locations.				
Action/s taken /	On the 25th May 2016 IÉ-IM advised by way of email with covering				
in progress	letter that the recommendation is accepted. However works to affect the				
	safety recommendation are subject to funding				
Status	Open				
	•				
Recommendation 12	IÉ-IM should review the procedures applicable to signalman, Level				
(12-2016)	Crossing Keeper, LCCO and level crossing emergency operators with				
~ /	particular emphasis on the actions to be taken by each when a fault is				
	detected at a level crossing. This review should consider circumstances				
	where a train may already have entered the affected section of line, and				
	circumstances where the signal may be missing or extinguished.				
Action/s taken / in	May 2016 - IÉ-IM advise that the IM Safety Department Procedures				
progress	Section will allocate a resource to review the applicable instructions for				
1 0	the Signalman (CTC, PCECP and Cabin, Level Crossing Keeper, Level				
	Crossing Control Centre Operator, LC Emergency Operator and LC				
	Attendant.) When this review is complete it will be possible to draft				
	proposed amendments to the existing suite of instructions, along with				
	some entirely new instructions.				
Status	Open				
Recommendation 13	IÉ-IM, should review their procedures for the placement of speed				
(13-2016)	boards and brief relevant staff to be vigilant in the placement of lineside				
	signage with respect to the potential for obscuring of signals or				
	otherwise unintentionally providing distractions to drivers, especially in				
	the case where there are fixed colour light signals or they have potential				
	to cause SOY SPADs.				
Action/s taken / in	In May 2016 IE-IM advised that they will carry out a review of the				
progress	procedure. A submission from Iarnród Eireann is awaited.				
Status	Open				
Kecommendation 14	IE-INI & IE-RU should review the current system of reporting SPAD				
(14-2016)	events so that reports are consistent and published within a set period of				
	unne. (12th Amril 2016 CDD consider IÉ DM are best placed to les d this				
	(1501 April 2010 - CKK consider IE-INI are best placed to lead this				
	activity and are thereby assigned ownership of this safety recommendation )				
Action/s taken / in	May 2016				
progress	IMay 2010 IM_SMS_007 required that reports are completed within 22 weeks of				
progress	the investigation remit being issued. There is a monitoring process in				
	ne investigation remit being issued. There is a monitoring process in place to ensure all investigations are completed timely. There are				
	currently no SPAD investigations overdue				
Status	Closed				
Status	CIUSCU				

**R2016-002** -Dangerous occurrence between Ballybrophy and Portlaoise 12th September 2015 (*Report Published 06-09-16*)

Summary: On Saturday morning, 12th September 2015, a joint Balfour Beatty Rail Ireland (BBRI) and Iarnród Éireann (IÉ) team were working in a T3 Possession1 on the Dublin to Cork Up and Down Lines near to the 54 mile post (MP). The Weekly Circular stated that the T3 Possession was to be shortened (by time) to 05:20 hrs, to allow for Single Line Working SLW on the Down Line from 05:20 hrs. However, according to the method statement for the works, the T3 Possession was to change to SLW on the Down Line at 06:00 hrs.

There was one worksite in the T3 Possession where ballast cleaning was being undertaken; BBRI, with IÉ staff were working with a ballast cleaner as part of the planned upgrade of the Dublin to Cork Line. At 05:40 hrs, the BBRI ballast cleaning crew members, who were accompanied by two IE staff, were attempting repairs to the ballast cleaner; when an empty passenger train (Train J207) travelling from Laois Train Care Depot (County Laois) to Mallow (County Cork) passed through the ballast cleaning location. The BBRI and IÉ staff were unaware of the train's approach, however, they were in a place of safety as the train past and as a result there were no fatalities or injuries as a result of this incident; however there was potential for them to be in a position of danger.

Number of recommendations made		2			
Recommendation 1	IÉ-IM should review the Site Safety Briefing procedure to ensure all				
(15-2016)	personnel have made themselves aware of the information contained in				
(15 2010)	the relevant Weekly Circular				
Action/s taken /	In October 2016 IE-IM advised that the next revision of the CCE Site				
in progress	Safety Briefing Book will include a section requiring the inputting of				
	the relevant Circular Number and a prompt requesting clarification of				
	awareness of the relevant circular information.				
Status	Open				
Recommendation 2	IÉ-IM should review the method of allocation and accountability for				
	general operatives deta	ailed for work sites, to ensure that there are			
(16-2016)	sufficient personnel on site to perform the required duties.				
Action/s taken /	In October 2016 IÉ-IM	I advised that the CCE will issue an instruction to			
in progress	Infrastructure Managers to review the current processes currently in				
	place which ensure suf	ficient personnel on site in relation to the			
	allocation and account	ability for general operatives. Methods will be			
	discussed and agreed a	the CESSC			
~	discussed and agreed a				
Status	open				

**R2016-003** -Operational incidents at Ardrahan on the 23rd October 2015 & Spa on the 28th November 2015

(Report Published 20-10-16)

Summary: This publication investigates two incidents involving the same Class 2600 rolling stock that occurred within five weeks of each other:

- On Friday 23rd of October 2015 at 19:50 hrs, the 18:00 hrs passenger service, from Limerick to Galway, was involved in a platform overrun and Signal Passed at Danger (SPAD) without authority at Ardrahan Station (Galway) and travelled through Level Crossing XE156 Ardrahan, with barriers raised and open to road traffic. There was no material damage to infrastructure as a result of the incident at Ardrahan. The units involved showed wheel flats on all wheels that required wheel turning.
- On Saturday 28th November at 21:16 hrs, the 19:00 hrs passenger service from Ballybrophy to Limerick, passed signal XN159DS at danger without authority and collided with the level crossing gates at Level Crossing XN159 Spa (Castleconnell, Limerick) as they were being opened. The gates at XN159 were beyond repair and required replacement as a result of the collision.

Number of recommendations made		1			
Recommendation 1 (17-2016)	IÉ-RU should review all traction fleets that do not have sanding capabilities, and fit suitable systems to minimise the risk of low adhesion incidents.				
Action/s taken / in progress	Submissions received December 2016 and April 2017 (Declarations Only). Meeting held with CMETM, RU SM (Acting) 9th May 2017. CMETM advised that the 2600 Fleet have now been fitted with sanding capability. 201 Loco Sanding Fitment project (albeit for traction purposes as opposed to braking) will be completed in 2 Stages. 1 - move under-floor equipment, then 2 - install sanding equipment. PCD for Enterprise 201's (8 No.) is start of LRA season, remainder of fleet (14 No.) is year end. All EMUs and DMUs have WSP and sanding facility				
Status	Open				
Having review the RAIU recommendation had wide organisations review their	's report into these occur er implication and theref r traction fleets in light c	rrences the CRR considered that the safety fore requested that a number of other railway of the RAIU's findings and safety			
recommendation. The actions being taken by these other organisations is also being monitored by					

#### 4.13.1 RAIU Recommendations Summary

the CRR.

The table below confirms the current status of all RAIU recommendations. (31 December 2016)

Veer	No. of	No. Of Recommendations						
Year	Reports	Open	Complete	Closed	Total			
2006*	1	0	0	14	14			
2007	0	0	0	0	0			
2008	1	0	0	7	7			
2009	5	0	0	13	13			
2010	6	1	2	23	26			
2011	6	2	9	6	17			
2012	3	1	2	10	13			
2013	3	2	5	3	10			
2014	6	6	2	19	27			
2015	2	3	0	1	4			
2016	3	17	2	1	20			
Totals	36	32	22	97	151			
	151							

Table 1: RAIU Recommendations Summary

*CRR Recommendations made prior to establishment of RAIU

In isolation the numbers of open safety recommendations may appear high, however, as stated above railway organisations are taking actions to address the RAIU's recommendations and minimise the chance of reoccurrence. It should also be noted that many safety recommendations made by the RAIU are not 'quick fixes', Many require strategic planning, engineering design, public consultation, planning permission and/ or government funding and all of which can take many years to actually 'close' a safety recommendation.

# References



# 6.1 Documents Used

CRR (2016), "Annual Report", Railway Safety Commission, Dublin.

ERA (2014), "Railway Safety Performance in the European Union"

ERA (2015), Common Safety Indicator Data, https://erail.era.europa.eu/ retrieved 18.12.2017

Iarnrod Éireann (2016), Annual report 2016