AN COIMISIÚN UM RIALÁIL IARNRÓID
COMMISSION FOR RAILWAY REGULATION

RAILWAY SAFETY PERFORMANCE IN IRELAND 2021

CRR
AN COIMISIÚN UM RIALÁIL IARNRÓID
COMMISSION FOR RAILWAY REGULATION

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Foreword

The Commission for Railway Regulation (CRR) is pleased to publish its Annual Safety Performance Report for 2021. This report supplements the CRR's Annual Report to the Minister and provides further detail on the safety performance of the railway organisations operating in Ireland.

CRR Inspectors continuously supervise the safety performance of the principal railway organisations operating in the state. This is done through frequent engagement with railway organisations be that undertaking audits, conducting inspections or meeting with company executives and managers, to check they are applying and improving their safety management systems.

The COVID-19 pandemic continued to impact on our supervision activities in 2021, given many of the restrictions put in place in 2020 remained in 2021. Nonetheless CRR Inspectors remained flexible and professional in their approach to overseeing the railway organisations that are supervised.

Passenger numbers onboard mainline, suburban and tram services remained low in 2021, which reflects the first full year of travel restrictions and many workers being asked to work from home where possible in line with Government public health advice. Safety performance on the Dublin Light Railway Network (Luas) network was mixed, with continued reduction in the number of road traffic collisions and zero tram derailments, but with slight increases in tram contact with pedestrian and signals passed at stop categories.

In the Irish heavy railway sector, safety performance continued to be broadly positive in 2021, both when compared against previous years and European statistics, cognisant of the reduced passenger numbers. In an operational context there was a continued reduction in the number of Signal Passed at Danger (SPAD) occurrences, however there was an increasing number of train derailments (albeit all were in Iarnród Éireann sidings). There was also an increase in the number of occurrences where trains collided with large animals, with over 90% being with deer.

While the number of serious accidents and accidents was low in 2021 there were several very serious dangerous occurrences where violations of rules by railway staff could have resulted in multiple fatality events. These were; an instance in which a contractor working under the direction of an Iarnród Éireann Supervisor fell from a Road Rail Vehicle Bucket, 19th May 2021; a member of Iarnród Éireann Track Engineering staff narrowly avoided being hit by a moving train as they were recording rail temperatures, 21st July 2021; a train collided with track maintenance equipment and narrowly avoided hitting several engineering staff, 27th August 2021; and the overturning of a Road Rail Vehicle, 28th November 2021.

In 2022, the CRR will be paying particular attention to how company executives and managers respond to these occurrences along with how they try to improve and promote a positive safety culture.

Nonetheless, there were no passenger or worker fatalities on our railways in 2021 which is arguably the most important statistic. The CRR acknowledges the assistance of all who have provided the data that has enabled the publication of this report.

Anthony Byrne
Principal Inspector – Supervision & Enforcement

Executive summary

This annual safety performance report of the CRR is prepared for stakeholders and the general public as per the functions described in Section 10 of the Railway Safety Act 2005. The data used to compile this report is provided periodically throughout the year by the various regulated railway organisations. This data is requested to be provided as per a data specification provided by the CRR. This report aggregates this data and compares year on year performance along with commentary on safety performance indicators.

The CRR is the railway safety regulator in Ireland and is responsible for overseeing the safety of all railway organisations, which in 2021 included Iarnród Éireann Infrastructure Manager, Iarnród Éireann Railway Undertaking, Transdev Dublin Light Rail (Luas Operator), Rhomberg Sersa Ireland (RSIE), Translink (NIR), Transport Infrastructure Ireland (TII), Bord Na Móna (BNM) (where their railway interfaces with public roads), the Railway Preservation Society of Ireland (RPSI) and a number of smaller heritage railways.

The safety performance of the Irish railway sector is broadly positive, both when compared against previous years and European statistics. The effects of the COVID-19 pandemic however continue to make data analysis challenging as passenger numbers remained unprecedently low in addition to Government restrictions reducing the number of pedestrian/cyclist/vehicles interfacing with the railway.

There were no passenger fatalities in 2021. However, tragically there were five fatal occurrences on the conventional railway network where trespass or suspicious death was indicated. All of these occurred on the Iarnród Éireann network and no fatalities were reported on the Luas network.

Iarnród Éireann continued to see a relatively high number of train collisions, 74 in 2021 to 72 in 2020, which the data suggests is largely caused by collisions with debris and animals on the line. SPADs decreased slightly from 10 in 2020 to 8 in 2021. All of these involved Iarnród Éireann Railway Undertaking trains, and they have several initiatives underway in this area to continue the long-term downward trend observed over the last decade.

Transdev's safety performance indicators saw a marked decrease in tram contact with vehicles, down to 9 from 18 in 2020, however the brushed contact with vehicles has increased similarly from 6 in 2020 to 11 in 2021. In the majority of cases a car breaching a red light or encroaching on the tram's swept patch was deemed to be causal. Tram Signals Passed at Stop (SPAS) have increased slightly from 15 in 2020 to 17 in 2021 while tram contact with a pedestrian/cyclist also increased slightly from 5 in 2020 to 7 in 2021. In 5 of these cases the persons involved left the scene, however in 2 of the cases (where actions were indicative of acts of potential self-harm) the persons involved required emergency medical assistance.

Looking at performance in the context of Europe, Ireland continues to perform well in terms of the number of accidents. Ireland performs less well when it comes to the ratio of precursor events to accidents. Such events are, SPADs, wrong-side signalling failures, track buckles and broken rails. Previous reports note that the European Union Railway Agency (ERA) has communicated concerns to the sector regarding the quality of data collected at European Level.

In 2021, the Railway Accident Investigation Unit (RAIU)) concluded 7 investigations. These resulted in 34 new safety recommendations, 20 directed to Iarnród Éireann – Infrastructure Manager, 8 directed to Transdev the Dublin Light Railway operator and 6 directed to BNM. The RAIU also commenced 5 investigations in 2021.

1. INTRODUCTION

1.1 Introduction

This is the thirteenth Annual Safety Performance report produced by the Commission for Railway Regulation (CRR) prepared for the use of stakeholders and the general public. This report presents a number of high-level statistics and safety performance indicators, with associated commentary on their significance by the CRR. These safety performance indicators are based on the Common Safety Indicators (CSI) defined in Directive 2014/88/EU amending Directive 2004/49/EC for conventional heavy rail systems. For light rail systems (such as the Luas) and Heritage Railways (those solely for historical or tourist use) additional indicators are used to analyse the risks deemed by them to be particular to those sectors in Ireland. (See sections 2.4-2.6 for further detail).

1.2 Overview of report

Safety trends in Ireland for all railway systems are presented and discussed in Chapter 2.

In Chapter 3, an overview of relevant representations received by the CRR in 2021 is presented.

In Chapter 4, the safety performance of the Irish heavy rail system is reviewed in the context of the European Union with other member states. This chapter also includes a brief overview of significant accidents that occurred worldwide in 2021.

Chapter 5 concerns the RAIU and recommendations made arising out of their investigations. The status of each recommendation is presented along with details of the actions taken to date.

1.3 The Commission for Railway Regulation

The CRR was established on the 1st of January 2006 under the Railway Safety Act 2005 as amended. It is the independent railway safety and market regulator for heavy rail and the independent safety regulator for light and tourist railways in Ireland, a role largely defined in the European Union Regulatory framework for the Single European Railway Area. Under the Railway Safety Directive (EU Directive 2016/798/EC), as transposed in S.I. No.476 of 2020, the CRR is the National Safety Authority for heavy rail in Ireland. The CRR is also the railway safety regulator for the light rail systems, heritage systems and the public highway interfaces with industrial rail systems. These systems are regulated under the provisions of the aforementioned Railway Safety Act and are not within scope of the European Union Regulatory framework.

As stated in the 2021 Statement of Strategy, the CRR is committed to advancing railway safety, through effective regulation, and by fostering and encouraging the continuous improvement in safety management by railway organisations. It advocates the participation of all stakeholders in the further development of Ireland's rail sector so that it is a safe and efficient mode of transport that benefits our society.

Further details on the role and function of the Commission may be found on the CRR website www.crr.ie.

1.4 Statistical qualification

The CRR produces this report to provide stakeholders and the public with information about safety performance of the various Irish railway organisations. The CRR intends for this information to be timely and accurate. Any errors should be brought to the CRR's attention so that corrections can be made where necessary.

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. The data used to compile this report is provided to the CRR periodically throughout the year by the various railway organisations. This report presents aggregated data and compares year on year performance together with commentary on several safety performance indicators.

While the CRR has made every effort to ensure the accuracy of the data, it takes no responsibility for third party data presented in this report.

1.4.1 2021 Safety Performance and COVID-19

As was the case with 2020, the unprecedented decline in passenger numbers continued throughout all 2021. The continuation of restrictions on the movement of people (including stay-at-home advice, work from home recommendations, closure of non-essential businesses, etc.) during extended periods of 2021 resulted in similarly low passenger numbers. A further trend noticed in 2021 is the decline in passenger train kms along with the decline in passenger numbers. This is most likely as a result of society becoming adapted to the significant changes imposed by COVID-19 allowing timetabling of trains to be reduced.

There are several indicators that continue to be significantly lower than one might have expected, and it will take further years of analysis to identify which are merely outliers due to COVID-19 and which might continue further into the future due to continuing changes in previous societal norms. At a macro level the effects appear to present an overall reduction in risk, however there may also be increases in risk at a micro level. For example, while headline statistics such as accidents, injuries and collisions are unprecedently low, some individual statistics, such as the number of bridge strikes and similar traffic/pedestrian figures remain at pre-pandemic levels which is of note given the significant reduction in journeys due to COVID-19 in 2021. As such railway safety is still as immediate an issue as ever.

2. RAILWAY SAFETY TRENDS IN IRELAND

2.1 Introduction

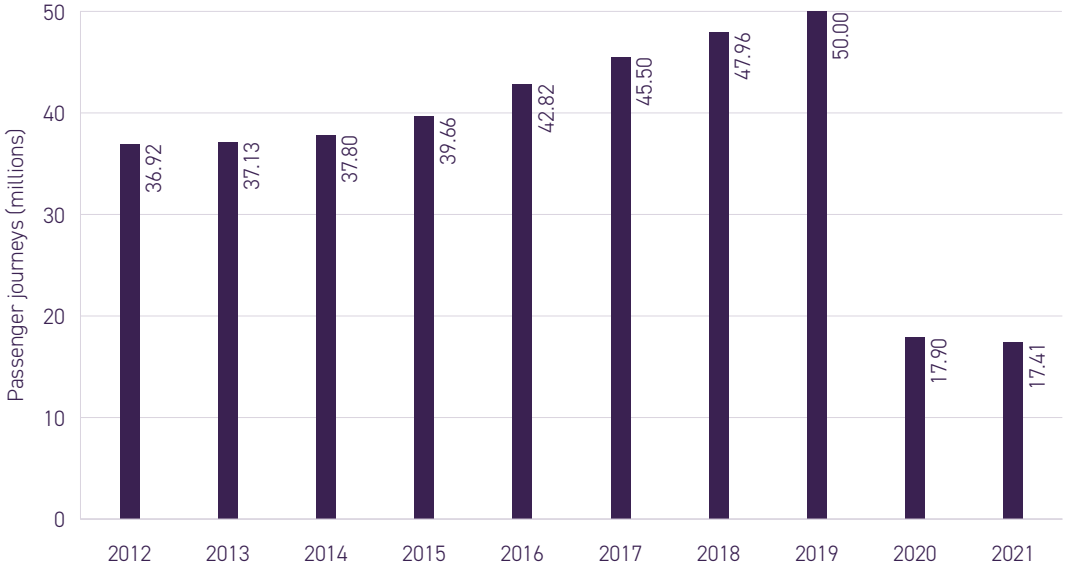
The safety performance of the Railway Organisations in the Republic of Ireland is considered for the four principal railway sub-sectors that the CRR regulates: heavy rail, light rail, public highway interfaces with industrial railway systems, and heritage railways.

2.2 Iarnród Éireann Railway (Ireland's conventional system)

2.2.1 Operational statistics

At the end of 2021, the Iarnród Éireann -Infrastructure Manager (IÉ-IM) reported to the CRR that its operational network remained 1,680 route-kilometres, or 2,400 km of operational track based upon the Iarnród Éireann Network Statement for 2021. Operational patterns remained substantially changed throughout 2021 as railway services continued to be heavily affected by the COVID-19 pandemic.

Figure 1
IÉ Passenger journeys, 2012 – 2021



Passenger journeys decreased slightly which was not unexpected given that 2021 was the first full year of operation under COVID-19 restrictions. Throughout 2021 there was consistent advice from the Government to work from home wherever possible and other restrictions in one form or another that effected passenger demand. Regardless of the reasons for the drop in demand, this figure is useful as it can be a universal modifier to other, macro level, statistics. The 17.41 million passenger journeys is 35% the amount seen pre-pandemic, using this figure it allows us to meaningfully evaluate other statistics that have been abnormally skewed downward due to passenger demand.

Figure 2
Passenger train-km on the IÉ-IM network

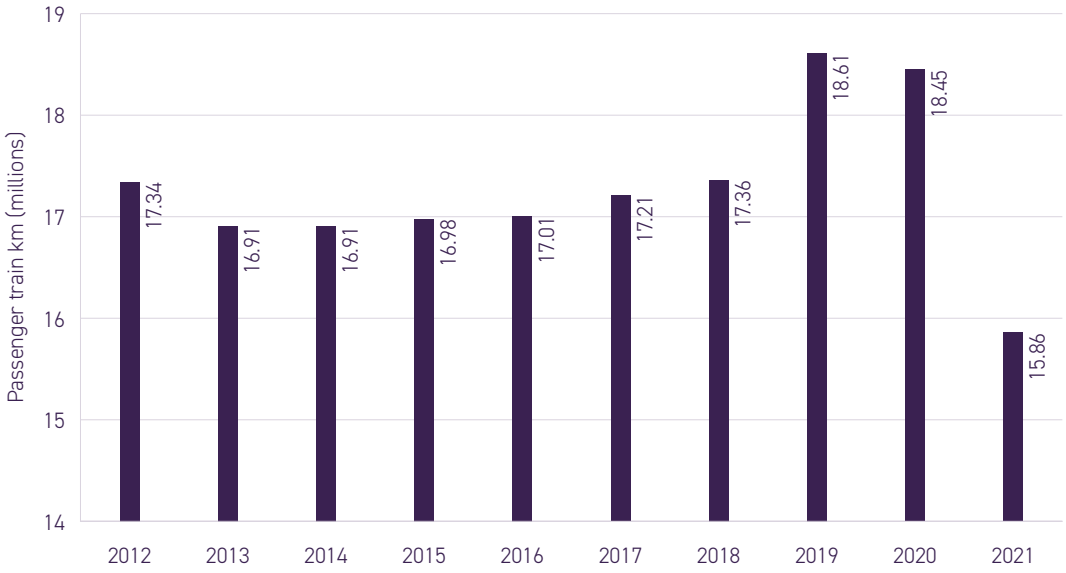


Figure 3
Freight train-km on the IÉ-IM network

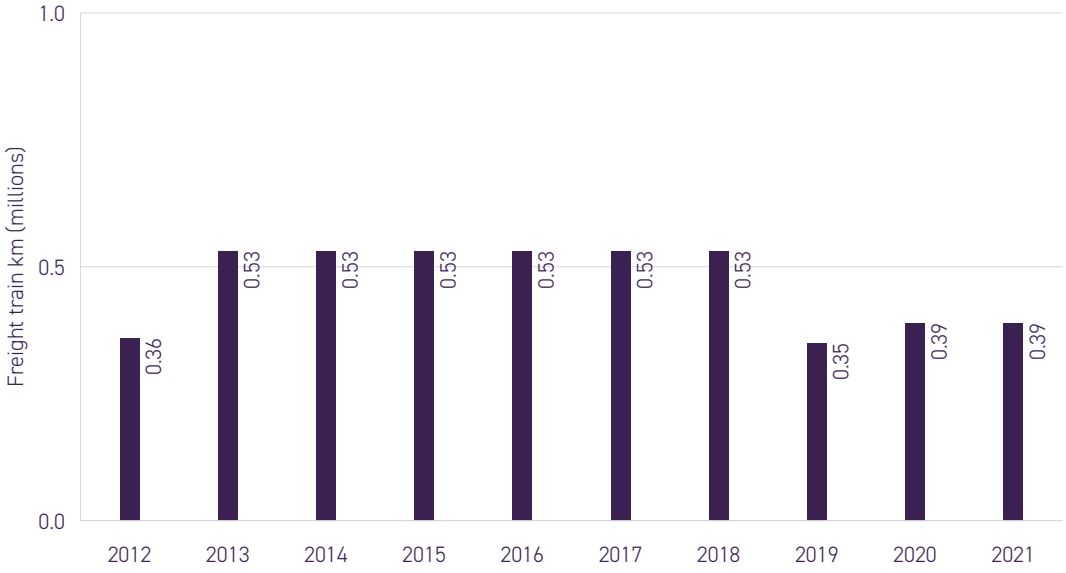
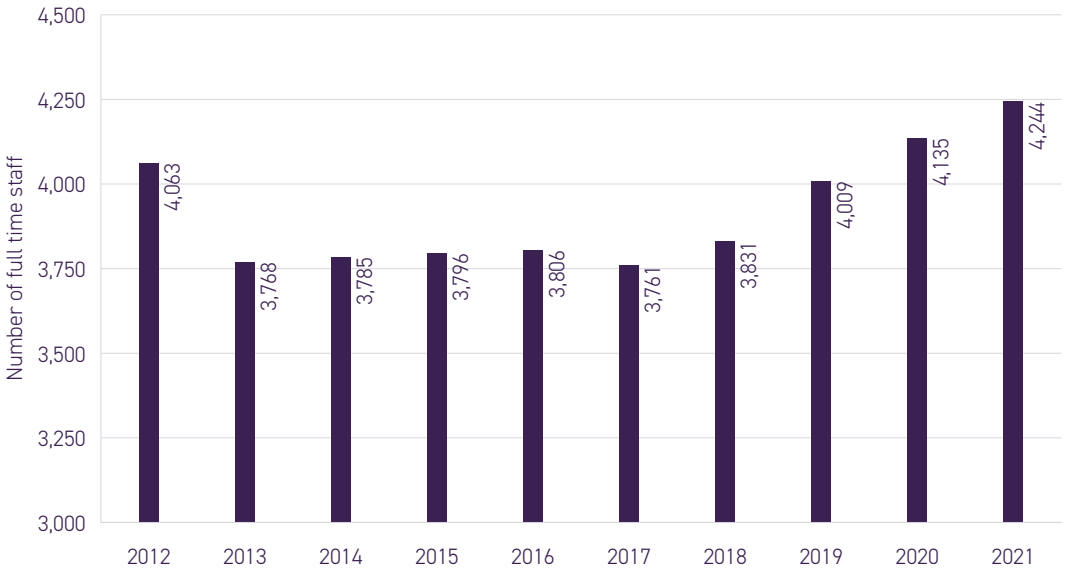


Figure 2 shows that IÉ passenger train kilometres decreased by 14%. This drop is considerably higher than the drop experienced in 2020 (note that 2020 did have some 2.5 months of operation pre-pandemic) but still proportionally very small relative to the drop in overall passengers. The graph confirms 2 things; that there were a significant number of trains carrying a low number of passengers and that the timetabling of services in 2021 has been better modified to suit this reduced demand, concentrating on key peak service times. It was confirmed in the 2019 Safety Performance Review that the IÉ fleet was at maximum capacity, so it comes as no surprise that train kms have been reduced as the effects of COVID-19 on passenger demand became better understood.

Freight kms have remained stable with a slight increase over pre-COVID kms remaining. This is also not surprising as freight kms is somewhat decoupled from the effects of public health measures.

Figure 4
Personnel engaged in full time employment with IÉ (2012 – 2021)



Iarnród Éireann is composed of two railway organisations, Iarnród Éireann Infrastructure Manager (IÉ-IM) and Iarnród Éireann Railway Undertaking (IÉ-RU). The upward trend in staff numbers continues to increase in a consistent fashion, heading towards levels not seen since the 2010's.

2.2.2 Iarnród Éireann fatality and injury statistics

Table 1 illustrates the fatalities and lost-time injuries reported for employees and fatalities and injuries to third parties on the Iarnród Éireann railway network for the last ten years. Whilst fatality numbers are too small to identify any meaningful trends, the number of injuries to passengers is noticeably reduced on pre-pandemic levels. With passenger journeys being at 35% pre-pandemic levels, it is then not unexpected to find that injuries at railway premises and injuries to customers attempting to board/alight from a train are around 30-40% their respective pre-pandemic levels. The reporting of injuries is non-weighted, therefore little evaluation can be made at a regulatory level other than to consider that statistics with a relationship to passenger numbers have remained stable.

Table 1
IÉ operational fatality and injury statistics by year (2011 – 2021)

Category	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21	Trend
Railway operations: passenger fatal injuries												
Fatal injury to passenger due to a train accident, not at level crossing	0	0	0	0	0	0	0	0	0	0	0	
Fatal injury to passenger due to a train accident at level crossing	0	0	0	0	0	0	0	0	0	0	0	
Fatal injury to passenger travelling on a train, other than in train accident	0	0	0	0	0	0	0	0	0	0	0	
Fatal injury to passenger attempting to board or alight from train	0	0	0	0	0	0	0	0	0	0	0	
Railway infrastructure: third party fatal injuries												
Fatal injury to third party at a level crossing involving a train	0	0	0	0	0	0	0	0	0	1	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	
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 (other than at a level crossing)	0	0	0	0	0	0	0	0	0	0	0	
Fatal injury to employee not due to train in motion	0	0	0	0	0	0	0	0	0	0	0	
Railway infrastructure: employee fatal injuries												
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 (other than at a level crossing)	0	0	0	0	0	0	0	0	0	0	0	
Fatal injury to employee not due to train in motion	0	0	0	0	0	0	0	0	0	0	0	

Table 1
IÉ operational fatality and injury statistics by year (2011 – 2021)

Category	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21	Trend
Railway operations: fatal injuries to other persons												
Fatal injury due to train in motion not at level crossing	0	0	0	0	0	0	0	0	0	0	0	
Fatal injury to customer or visitor, no train involved	0	0	0	0	0	0	0	0	0	0	0	
Fatal injury involving train in motion on railway or level crossing where trespass or suspicious death was indicated	7	5	4	6	2	5	12	9	4	7	5	
Railway operations: non fatal injuries to passengers												
Injury to passenger travelling on train due to a railway accident not at level crossing	0	0	0	0	0	0	0	0	0	0	0	
Injury to passenger travelling on train due to railway accident at level crossing	0	0	0	0	0	0	0	0	0	0	0	
Injury to passenger attempting to board or alight from train	46	41	39	45	48	79	57	74	76	42	32	
Injury to passenger travelling on train, other than due to a railway accident	10	27	43	18	15	31	33	46	38	9	0	
Railway infrastructure: third party non fatal injuries												
Third party at level crossing injury involving a train	1	2	0	0	0	0	0	1	1	0	0	
Level crossing user injury not involving a train	2	5	1	0	0	0	0	1	1	2	1	
Railway infrastructure: non fatal injuries to other persons												
Injury to customer or visitor to premises	113	116	193	205	146	192	321	199	288	122	96	
Injuries to other persons including unauthorised persons	0	5	3	0	1	2	6	0	2	0	0	

Table 1
IÉ operational fatality and injury statistics by year (2011 – 2021)

Category	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21	Trend
Railway operations: non fatal employee injuries												
Employee lost time accident involving train movement or train accident	7	13	5	21	3	1	15	13	7	8	0	
Employee lost time accident while working on railway not due to train in motion	22	32	39	43	32	30	30	13	35	16	8	
Railway infrastructure: non fatal employee injuries												
Employee lost time accident involving train movement or train accident	2	1	0	0	0	0	0	0	0	0	0	
Employee lost time accident while working on railway not due to train in motion	23	32	41	25	6	23	22	26	24	20	33	
Employee lost time accident while working at level crossing not due to train in motion	0	1	1	2	0	3	1	1	0	3	0	
Entity in charge of maintenance and maintenance workshops: non fatal employee injuries												
Employee lost time accident involving train movement or train accident	0	0	0	0	0	0	0	0	0	0	0	
Employee lost time accident while working on railway not due to train in motion	18	10	14	18	13	11	10	12	15	4	11	

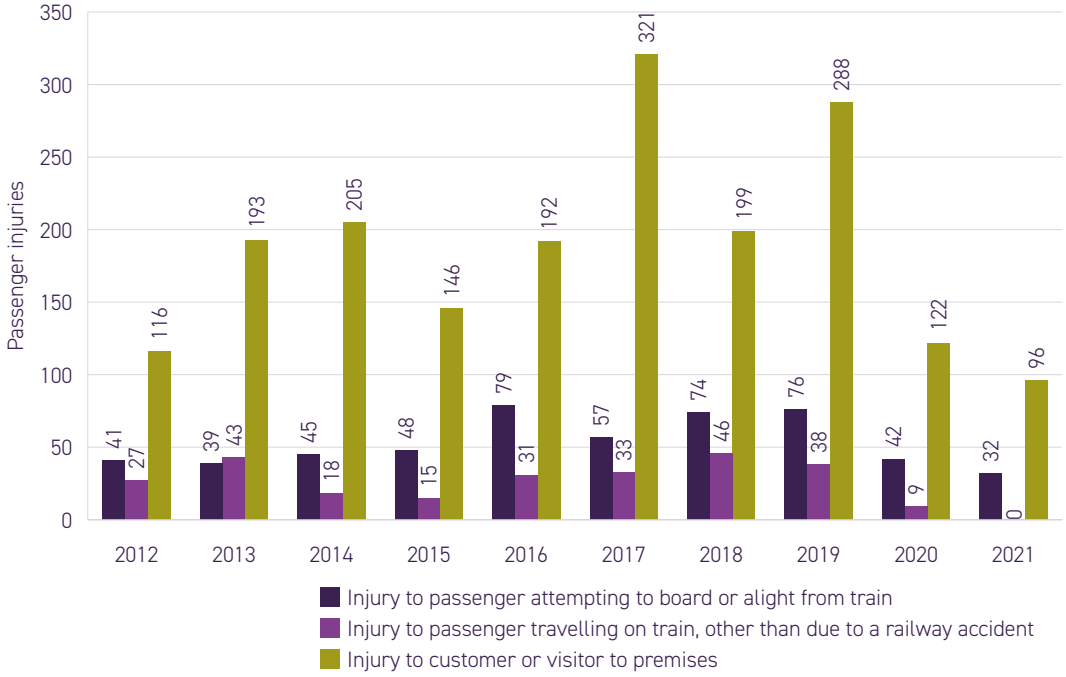
2.2.2.1 Fatal injuries

There were no passenger fatalities or serious injuries reported to the CRR in 2021. Tragically, there were 5 fatalities involving railway infrastructure and operation where trespass or suspicious death was indicated. The numbers are low, remaining in the single digits (except for 2017) for some 10 years. Whilst IÉ makes considerable effort to reduce this number, there are broader societal factors to consider, and the Railway Organisations are just one part of a larger system required to reduce this number further still.

2.2.2.2 Passenger injuries (customer and visitor injuries)

In line with European trends, the largest proportion of incidents occur to persons during time spent at stations as opposed to time spent on trains and in 2021 this was no different. No injuries, for any reason, were reported by passengers travelling on a train in 2021, continuing the trend in railway accident categories. However, as explained earlier, the reduced passenger journeys are very likely a factor in the reduction of injuries to passengers travelling on a train, other than due to a railway accident, evidenced since 2019.

Figure 5 Passenger injury statistics by year



Note: injury to passengers travelling on a train due to a railway accident at/not at level crossing is not represented due to being consistently 0 in the last 10 years.

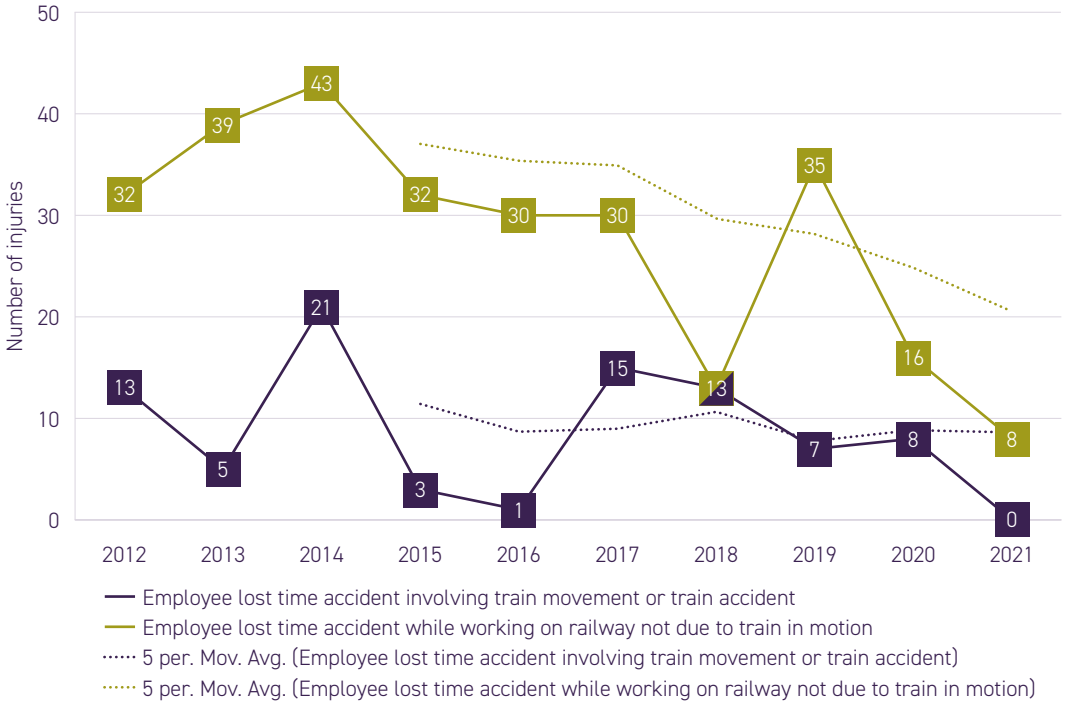
Injuries to persons (customers or visitors) on railway premises remain the largest single group with slips, trips and falls of various sorts being the dominant cause of these injuries. The reduction in numbers for 2021 is more in line with the real reduction in passenger journeys than it was for 2020, which indicates that the risk to the individual is no higher than it was in 2019. The interface between the station platform and the train is the most dangerous area for passengers on the Iarnród Éireann railway network and unfortunately the reduction in harm here has not been proportional to the reduction in passenger numbers, indicating a slight drop in safety performance.

2.2.2.3 Employee injuries

Employee injuries are categorised in the first instance by the sector of the railway system in which they work:

- Railway Operations
- Infrastructure Management
- Entity in Charge of Maintenance for Railway Vehicles (ECM)[1].

Figure 6 Employee injury statistics by year (railway operations)



Railway Operations incidents continued to reduce to record lows. As shown earlier in Figure 2, passenger train km reduced by 14%, however the reduction was far less pronounced when compared to passenger journeys, so this indicates positive performance.

Accidents to staff working in an infrastructure maintenance capacity (Figure 7) has increased considerably which is a concern. Given that the numbers have remained somewhat flat for the preceding 5 years it is a significant outlier which warrants further investigation.

The IÉ-RU Entity in Charge of Maintenance has also had a significant increase in accidents, although this is on the back of a record low number in 2020. The current level is still on the lower end of what has been reported pre 2020 but is unwelcome, nonetheless. As with other injury statistics, these are quite low relative to the size of the operation involved, so at a regulatory level there is no immediate concern. Although should the trends continue in an upwards direction year-on-year then regulatory action may be necessary.

1. ECMs are railway organisations that are certified to undertake maintenance of rolling stock.

Figure 7
Employee injury statistics by year (railway infrastructure)

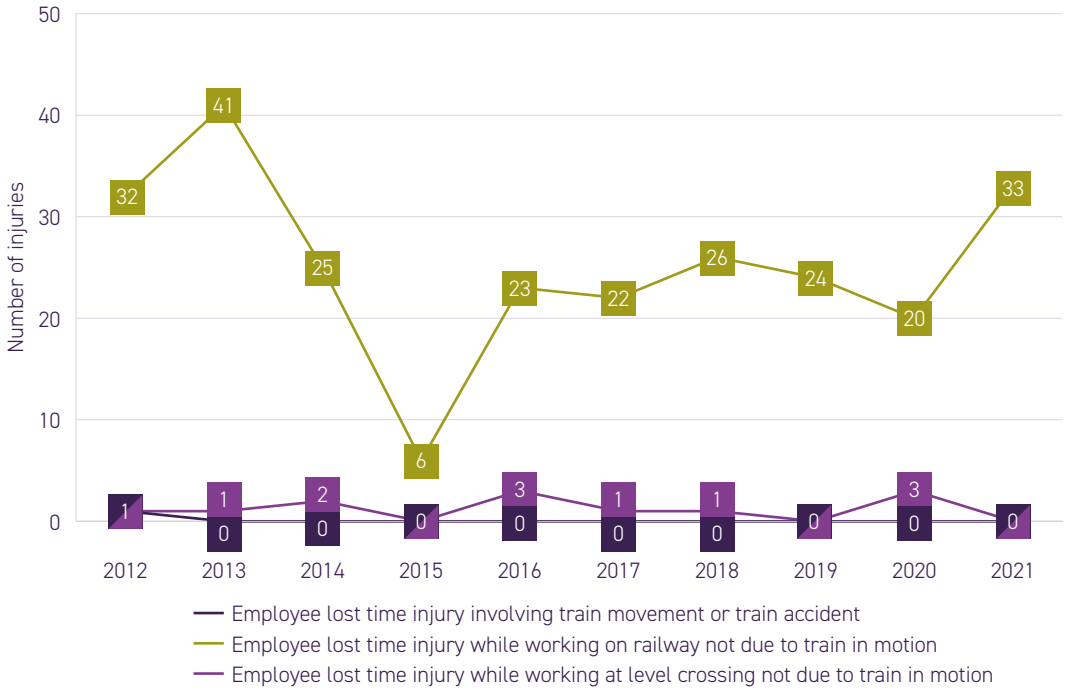
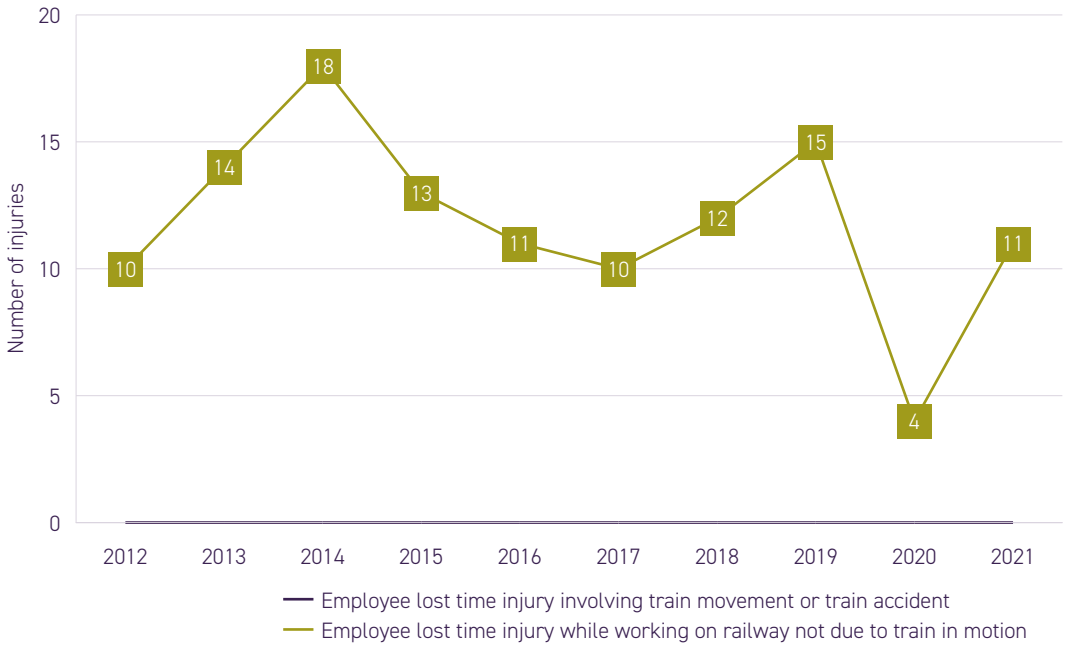


Figure 8
Employee injury statistics by year (IÉ-RU ECM)

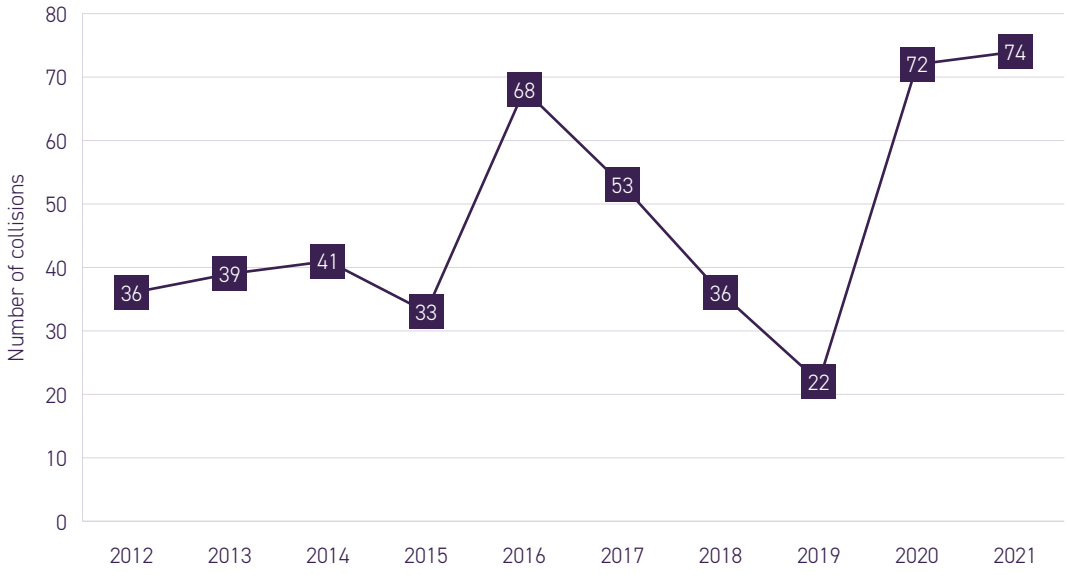


2.2.3 Iarnród Éireann operational incident statistics

2.2.3.1 Train collisions

Train collisions can pose a significant risk to passengers, train crew, third parties, and the environment. There are several categories of train collision, e.g., collision with road vehicles, with animals, with obstacles etc. Figure 9 illustrates the overall trend for collisions over the last 10 years. Figure 9 is supported by Table 2 and Figure 10 to aid understanding of the data. In figure 10, two categories, 'Total Collisions with Obstacles on the line' and 'Train Collisions with large animals', have been separated to provide a better understanding of the risk. The overall data shows another increase this year on what was an already significant increase in 2020.

Figure 9
Total collisions by year



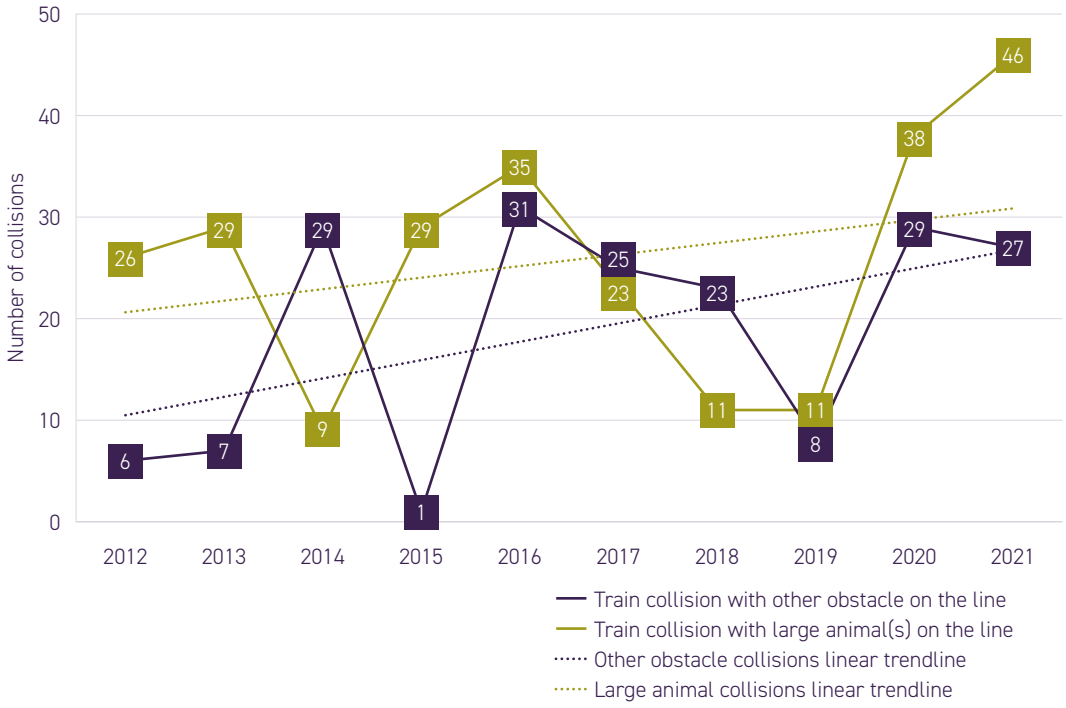
The data provided shows 2021 was another year with a high number of collisions. Large animals and obstacles on the line are the categories driving this observable increase in 2020 and 2021.

However, of the 46 collisions with large animals, 19 were reported to have occurred on the Mallow – Tralee line, which is in line with observations made in previous reports. For collisions with obstacles on the line the data shows a very even spread between unknown debris, identified miscellaneous objects (traffic cones, wheelie bins, temporary fencing), trees & branches and vandalism. The objects are not concentrated in any particular location either making identifying potential bad actors difficult. The high number of objects identified as 'debris' also make any meaningful analysis to the cause of increase in incidents difficult. Whilst the number of collisions related to trees or branches is significantly lower than 2020, this reduction is somewhat offset due to the large increase in objects identified as generic 'debris or accidental obstruction'.

Table 2
Train collision statistics detail by year, part 1

Category	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21	Trend
Train collision with passenger or goods train on running line	0	0	0	0	0	0	0	0	0	0	
Train/railway vehicle collision in station or possession movement	1	1	1	1	1	2	1	1	4	1	
Train collision with a motor vehicle at a level crossing	2	1	2	0	0	3	1	2	1	0	
Train collision with pedestrian at a level crossing	0	0	0	0	0	0	0	0	0	0	
Train collision with attended gates at a level crossing	0	0	0	1	0	0	0	0	0	0	
Train collision with road vehicle obstructing the line (not at a level crossing)	1	1	0	1	1	0	0	0	0	0	
Train collision with other obstacle on the line	6	7	29	1	31	25	23	8	29	27	
Train collision with large animal(s) on the line	26	29	9	29	35	23	11	11	38	46	
Total	**36**	**39**	**41**	**33**	**68**	**53**	**36**	**22**	**72**	**74**	

Figure 10
Train collision statistics detail by year, part 2

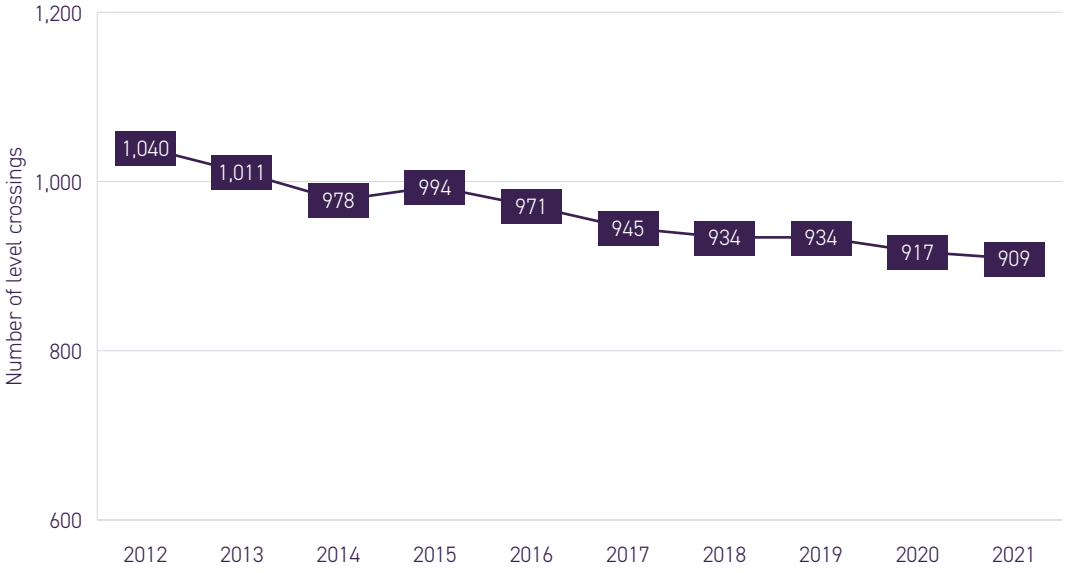


2.2.3.2 Level crossings

Level crossings remain a significant risk to the railway system and to level crossing users of all types. However, there were no fatal accidents at a level crossing in 2021. This continues an ongoing trend for some 10 years, with the exception of an incident in 2020 that was not railway related, as previously reported.

Another ongoing trend, as shown in Figure 11 and Figure 12, is the decrease in the number of level crossings; down from some 1040 level crossings in 2012 to 909 in 2021. Figure 11 illustrates the total number of level crossings on active lines. Sustained efforts by Iarnród Éireann have continued to contribute greatly to reducing the risk presented by level crossings through either closure or upgrade.

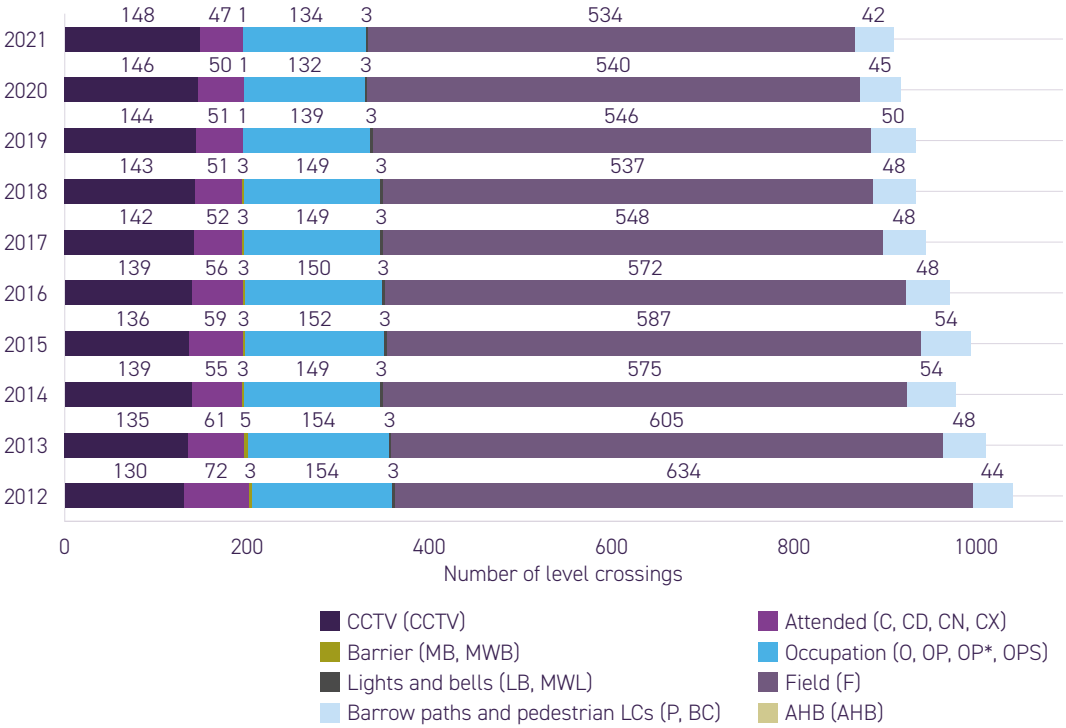
Figure 11 Number of level crossings by year



The breakdown of level crossings by type and year in Ireland is shown in Figure 12. Occupation (OP) level crossings on public roads, that is those that require the road user to manually open and close gates remain the highest risk type of level crossing, closely followed by similarly gated 'Field type' level crossings which are those a farmer might use if they have private land on both sides of a railway. IÉ-IM have continued to install further DSS 'Decision Support System' equipment on their highest risk user worked level crossings. The Decision Support System is a set of visual and audible warnings installed at the crossing to warn users of an approaching train. A broadly similar system ('Miniature Stop Lights (MSLs)') is being installed at crossings in the UK by Network Rail. An initial 8 No. Irish DSS system received final approval and were operational at some individual crossings in 2021. As the project advances, it is expected that further DSS systems will be installed and commissioned at high-risk crossings.

Figure 12 below demonstrates how the higher risk Occupation and Field type crossings have reduced in number while the lower risk CCTV type has increased in line with IÉ's risk management. In the ten years to the end of 2021 CCTV type crossings have increased by 14%, Attended crossings have reduced by 35%, Occupation crossings have reduced by 13% and Field crossings have reduced by 16%.

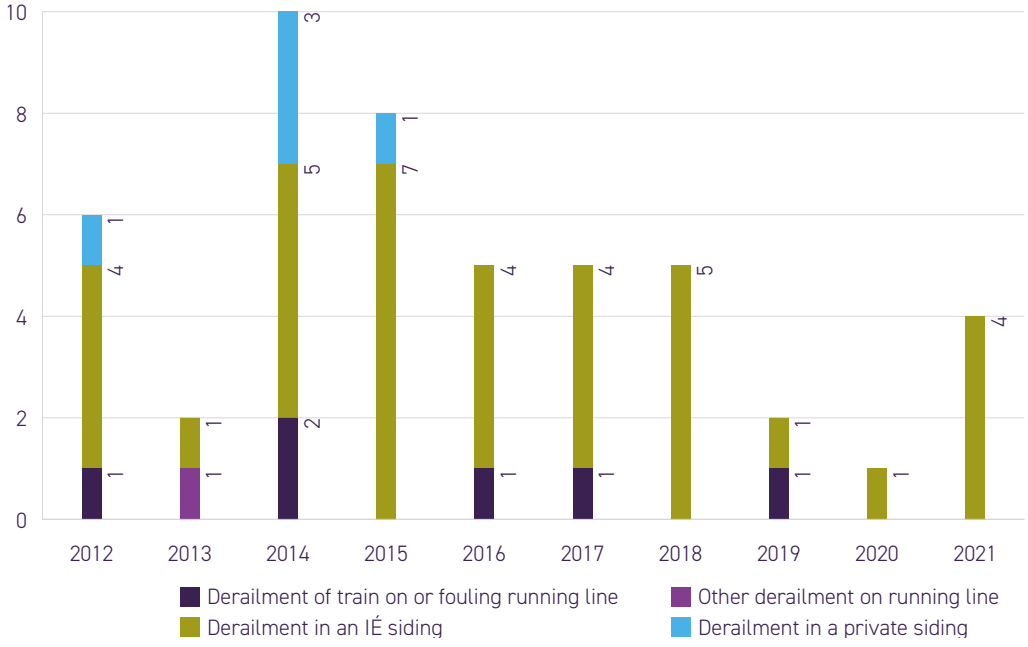
Figure 12
Level crossing by type in Ireland



2.2.3.3 Train derailment

The number of train derailments increased from a record low of 1 in 2020 to 4 in 2021 (Figure 13). The derailments were all located off of the running line, i.e., in a siding, some are still under investigation for cause but provisionally the causes vary from vandalism & misuse of hand points (manually operated switches located in low-speed sidings/yards) to sub-optimal maintenance processes being in place for track located off of the main line.

Figure 13
Train derailments by year



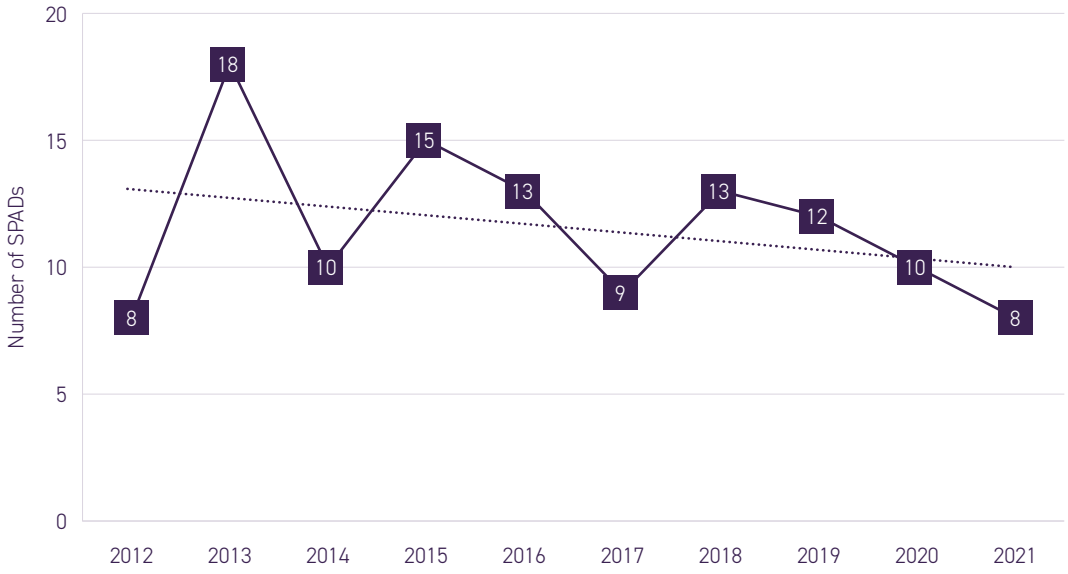
2.2.3.4 Signals Passed at Danger (SPAD)

IÉ-IM define a SPAD as an event where a part of a train proceeds beyond its authorised movement. SPADs are a particular precursor event that the CRR monitors during its supervisory meetings with IÉ-IM, IÉ-RU and other railway undertakings. The trend in recent years has been a steady decline in the overall number of SPAD occurrences and this has been continued in 2021 (Figure 14).

SPAD occurrences are investigated by the infrastructure manager and the railway undertaking involved. IÉ-IM apply their own qualitative evaluation to each SPAD to assess the associated safety risk. Three of the 8 SPAD's that occurred in 2021 were risk ranked as 'high', an unacceptably elevated ranking. Additional to this, one 'medium' ranked SPAD was an anomalous case whereby the train in fact had multiple SPAD's but only the initial SPAD was risk ranked.

IÉ-IM, IÉ-RU, the RAIU and the CRR are all investigating these incidents, to varying degrees, with a view to improving future safety performance and preventing recurrence.

Figure 14
IÉ SPADs by year



2.2.4 Iarnród Éireann rolling stock incidents

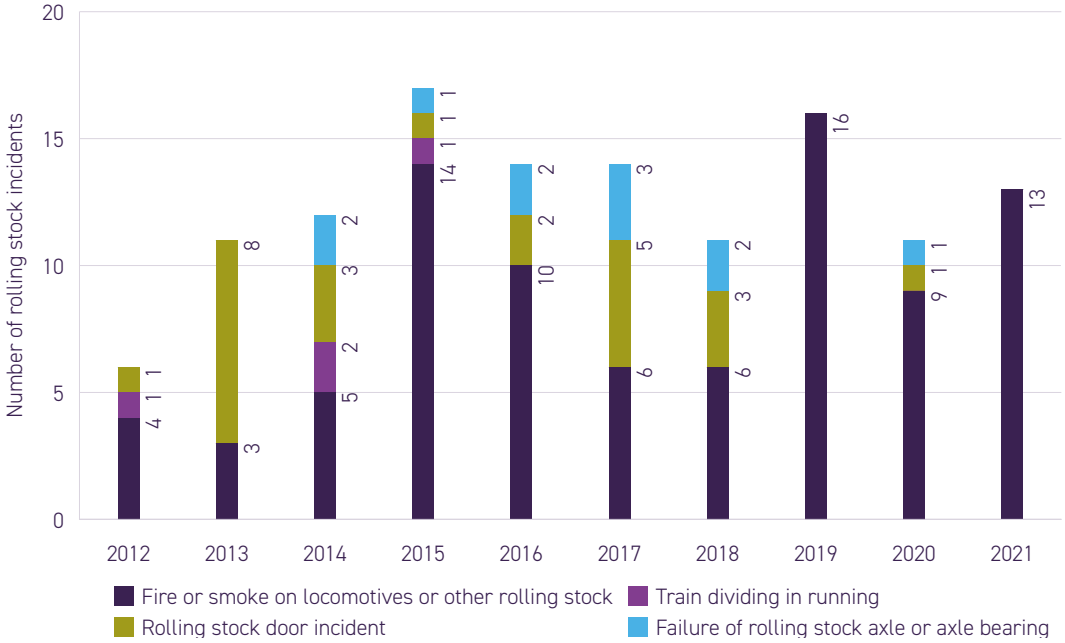
Iarnród Éireann operates several different fleets in provision of rail services and there were no changes to these in 2021. The IÉ-RU fleet include:

- Diesel multiple units (29000, 22000, 2800, 2600 classes), maintained in Portlaoise, Drogheda and Limerick
- Electrical multiple units (8100, 8200, 8500 classes), maintained in Fairview, Dublin
- Locomotives (201, 071 classes), maintained in Inchicore, Dublin
- Passenger carriages (Mark IV and DeDietrich), maintained in Inchicore, Dublin and York Road, Belfast
- Freight wagons (of various types), maintained in Limerick.

There are a number of key safety performance indicators pertaining to rolling stock (Figure 15), specifically:

- Fire or smoke incidents
- Failure of Rolling Stock Axle Bearing
- A train dividing (parting) while in service
- Door issues.

Figure 15
Rolling stock incidents by year



In 2021, all incidents were of the fire or smoke category, 3 of which were reported as fire and 10 reported as smoke. Eleven of the 13 were attributed to rolling stock that utilises internal combustion engines and relating to their relative complexity and use of combustible fuels and lubricants. In many of the events the failures are reliability issues (failed gaskets, pipes, and internal components) which manifested as fire/smoke when combustible fluids made contact with hot engine components. There is a concern with the number of incidents associated with the 29000 DMU Fleet, given all of the fire incidents and 6 of the smoking incidents occurred on 29000's. Whilst it is likely that much of this is due to the design of the 29000 allowing reliability issues to manifest as fire/smoke (multiple internal combustion engines, closely packaged with leak sources directly above hot engine parts), the maintenance practices applied to the 29000's in one of the aforementioned fire incidents did however result in the CRR flagging 29000 maintenance for further investigation. The 29000s are equipped with automatic fire suppression and utilise fire barriers to minimise the risk of harm to passengers in the event that a fire does break out during a journey.

2.2.5 Iarnród Éireann infrastructure incidents

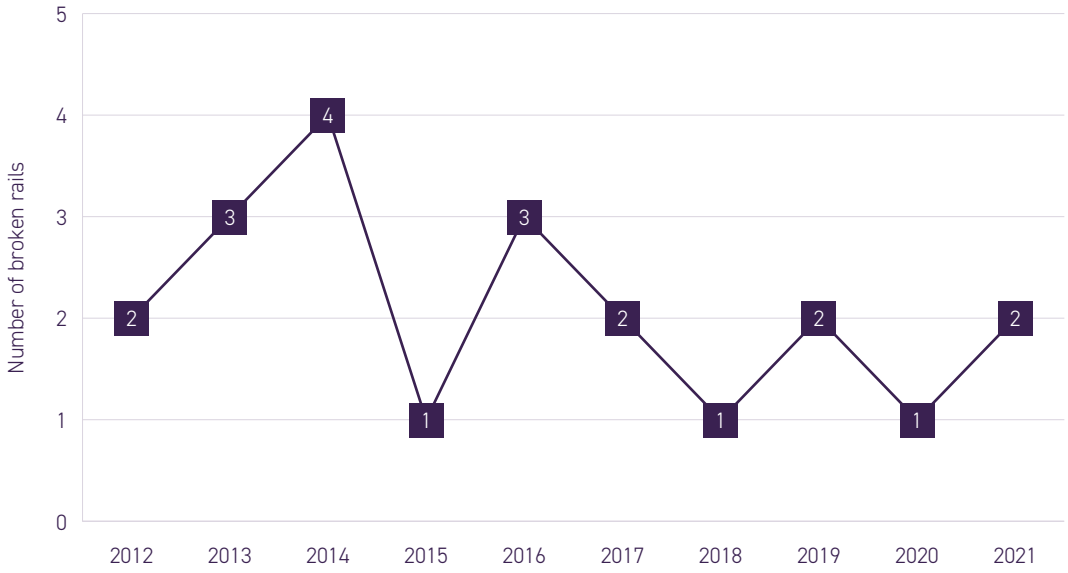
The IÉ-IM network currently extends to approximately 1,680 route kilometres (km) or 2,400 km of operational track and includes c.4,440 bridges, c. 1,100 point-ends, c.909 level crossings, 145 stations, 3,300+ cuttings and embankments, 372 platforms and 13 tunnels. The network is used for passenger and freight services. It has infrastructure designed for long distance fast services, commuter services, urban high frequency services, and freight transport.

The railway network in Ireland is abundant in legacy structures such as bridges, tunnels, and station buildings, many of which are in excess of 100 years old. Given their long history and operational environment, these assets may be vulnerable to failure if not adequately maintained, resulting in significant damage to property or loss of life. Despite the multitude of challenges associated with managing such a wide range of critical assets, all must be inspected and maintained at their prescribed frequencies to ensure the risk of failure is minimised. It is important to note that this risk of failure can only be minimised (not entirely eliminated) and minimising failure risk and its subsequent effect is critical to ensuring a reliable and safe railway service; data relating to some of these is now presented.

2.2.5.1 Broken rails and fishplates

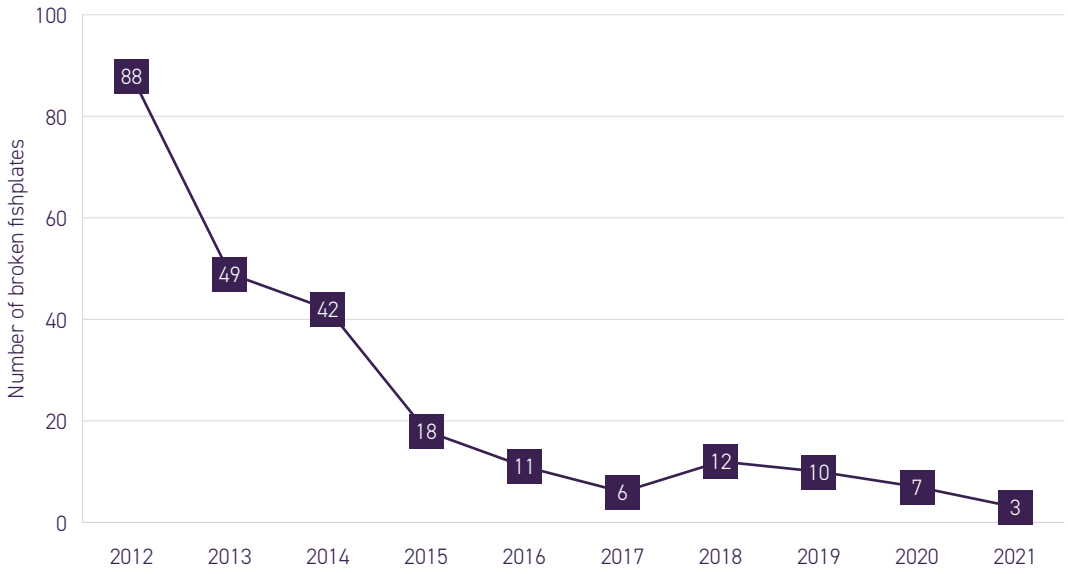
IÉ-IM personnel visually inspect the entire track and its associated assets at least once per week. Engineers for the Infrastructure Manager are also required to inspect the track several times each year using a dedicated Inspection Car. The rails themselves are ultrasonically tested at least every 2 years, with the vast majority tested annually. A broken rail is defined by IÉ-IM as "any rail which is separated in two or more pieces, or any rail from which a piece of metal becomes detached, causing a gap of more than 50 mm in length and more than 10 mm in depth on the running surface. In 2021, there were 2 broken rails reported; one was found during the weekly patrol on the Nenagh branch line and one was found at Galway station. The break at Galway station was attributed to a corroded weld that joined a vintage rail to a younger rail, the break was detected via track circuits.

Figure 16
Broken rails by year



A fishplate is a special bolted connection that joins two rails together. For a fishplate to be considered broken, IÉ-IM defines "any fishplate which is separated in two or more pieces, or any fishplate in which a piece of metal becomes detached, causing a gap of more than 50 mm length and more than 10 mm in depth on the running surface". Should one break then the rail is not continuous and could, in certain circumstances, lead to a derailment. The trend for broken fishplates has decreased in 2021 to a record low (Figure 17). Consecutive years at single digits indicate that this risk is being managed consistently and effectively. Nevertheless, vigilance must be maintained to ensure proactive monitoring and maintenance maintains this level of performance.

Figure 17
Broken fishplates on the IÉ network, by year



As has been noted in previous reports, the large decrease over the 10-year period may be attributed to the installation of continuous welded rail (CWR) initiated under the Railway Safety Investment Programme (1998-2013) which has continued since, albeit in smaller quantities.

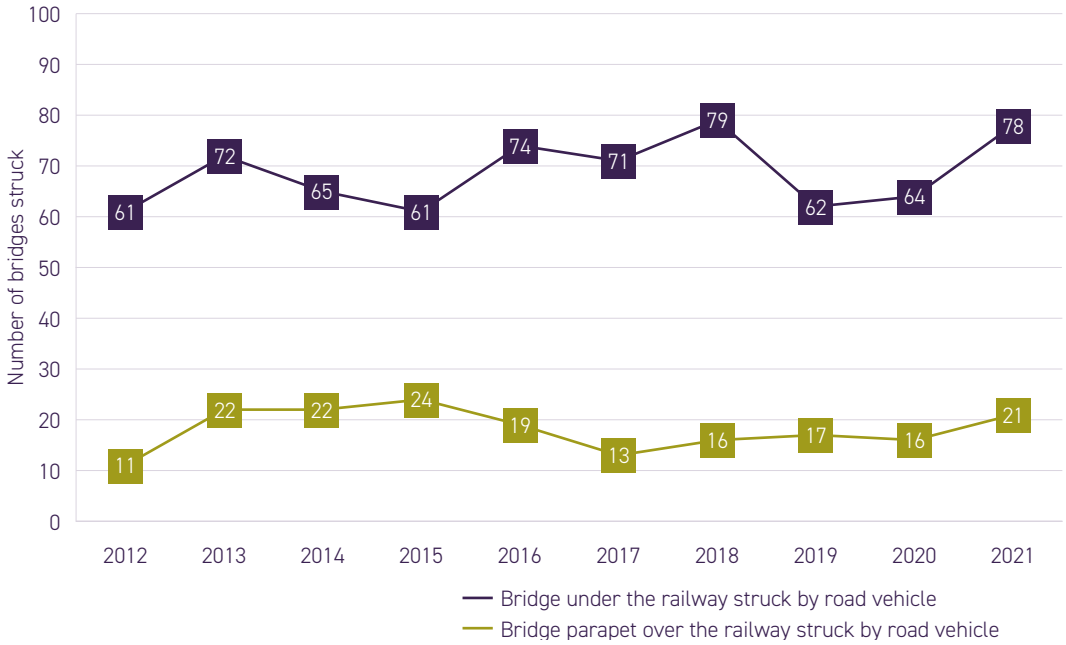
2.2.5.2 Bridge strikes

There are in excess of 4,400 bridges of varying structure types on the Iarnród Éireann railway network. All must be inspected and maintained by IÉ-IM at various periodicities depending on numerous factors such as their age, type, location and risk profile.

In terms of simple categorisation there are two categories of railway bridge to be inspected. The first is a where a road is over the railway (over bridge) and the second is where the railway is over a road (under bridge). A bridge strike is where a road vehicle strikes the parapet or roadside containment of an over bridge or where a road vehicle strikes the underside of a railway bridge over a road (under bridge).

Both types of occurrences can, in certain circumstances, result in very severe consequences such as causing a track misalignment or structural weakness or failure, either of which could result in a train derailment.

Figure 18
Railway bridges struck by road vehicles



Performance has noticeably declined since 2012. There are a multitude of factors that may be driving this increase, possibly related to the change in human behaviour as a result of the pandemic. Review of the data provides evidence that much of the strikes are happening multiple times on the same bridges, in some cases a single bridge can record double digit numbers of strikes in a single year. In addition to the CRR issuing outcomes to the infrastructure manager in 2021 to improve the management of bridge strikes, these particular multi-strike bridges are readily identifiable to the infrastructure manager and action is being taken to address them, although in some cases the fixes are not straightforward and require considerable coordination and planning with local authorities.

In 2020, Iarnród Éireann went out to tender looking for a supplier to provide, install and commission a system to assist in diverting over-height vehicles away from vulnerable bridges in an effort to avoid collisions. Initially this was specifically for installation at Amiens Street Bridge in Dublin city centre and subject to its effectiveness may be rolled out to other vulnerable bridges.

The system was installed and commissioned at Amiens Street Bridge on the 14th September 2020. It displays a message on advance variable message signs and on the bridge itself to any over-height vehicle that has triggered the system, alerting them to the bridge and advising them to divert. Since its installation there have been no reported bridge strikes at Amiens Street and Iarnród Éireann are considering further rollout of the technology to other vulnerable bridges.

2.2.5.3 Third party contractors

IÉ-IM engage numerous contractors, for both labour and plant, to assist in delivering the necessary track and structures maintenance necessary to keep the Irish railway network safe and operational. A significant growth area in recent years has been in mechanised track and lineside maintenance using special machines (road-rail vehicles). Their use does however introduce risk given operatives are typically not from a railway background and they are using machines that have been adapted to work in a very different environment to mainstream construction.

Over the past number of years there has been several dangerous occurrences involving road-rail vehicles (RRVs). These have included, RRV derailments, RRVs damaging track infrastructure, RRVs safe systems of work breaches and even a small number of incidents in which an RRV has over-turned. In 2021, there were 10 reported occurrences involving RRVs. These included 4 derailments, 1 over-turning occurrence, 1 points run-through (infrastructure damage), 1 collision, 2 possession irregularities (safe system of work breaches) and 1 contractor who fell from the bucket of a moving RRV. This area is now receiving a considerable amount of attention from IÉ-IM and the contractors themselves and will be subject to specific oversight by the CRR in 2022.

2.3 Rhomberg Sersa Ireland

Iarnród Éireann – Infrastructure Manager (IÉ-IM) have, since 2014, contracted external railway organisations to operate and maintain their fleet of On-Track Machines (OTMs). Rhomberg Sersa Ireland (RSIE) is currently contracted to provide this service. RSIE underwent conformity assessment and have the required safety certificate issued by the CRR to operate on the Irish railway network.

In 2021, RSIE report that they had 61 staff employed. RSIE does not operate any passenger services and completes most of its operational activity at night, outside peak and daytime periods. RSIE state that their fleet operated 94,886 train kilometres for the OTM fleet in 2021, down 6% from 2021.

Table 3 shows the reported occurrences for RSIE in 2021. No SPAD's, Derailments or Collisions were reported. The amount of Railway Infrastructure Incidents slightly decreased in 2021. It was reported that minor damage was observed in incidents concerning OTM component collisions with sleepers, Hot Axle Box Detectors, and debris. Occupational injuries were reported to be minor and did not result in lost time.

Table 3
OTM occurrences

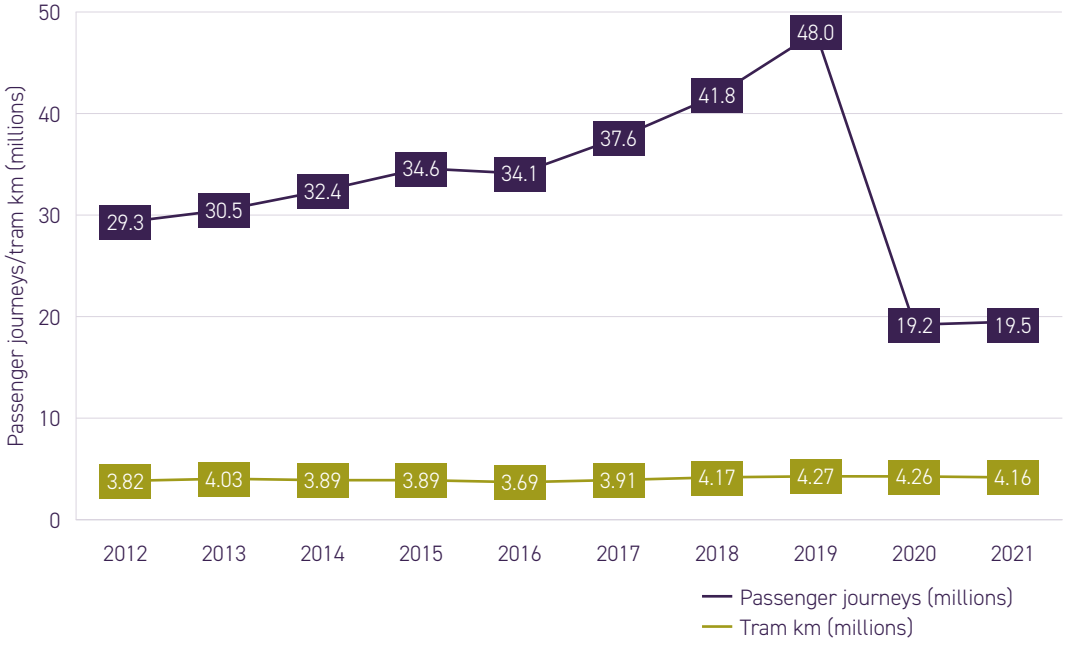
Occurrence	2018	2019	2020	2021
SPAD	2	2	1	0
Derailments	0	0	2	0
Collisions	0	1	0	0
Minor occupational injuries	1	1	3	4
Rail infrastructure damage incidents	4	3	8	6

2.4 Transdev (Luas) statistics

The Luas is owned by Transport Infrastructure Ireland (TII). This includes all trams and tramway infrastructure. Transdev Dublin Light Rail (TDLR) has been operating the Dublin light railway system (Luas), within different corporate structures, since it commenced operation in June 2004. In late 2019, TDLR were contracted to continue operation of the Luas service as well as to undertake infrastructure and rolling stock maintenance.

The Luas comprises two lines, the Red Line which is 20kms in length and has 32 Stops and the Green Line which is 24.5kms in length and has 35 Stops. In line with 2020, public health measures for COVID-19 continued to cause a large decrease in usage of the service. 19.5 million journeys were recorded, a marginal increase on 2020's total of 19.2 million. Tram kilometres travelled did drop slightly, with 4.16 million reported in 2021 versus 4.26 million in 2020 (Figure 19).

Figure 19 Luas passenger journeys and tram-km travelled



2.4.1 Road vehicle collisions

A significant proportion of Luas tracks co-exist with road traffic and pedestrian movements, most notably in Dublin city centre. The Luas operates primarily by 'line of sight' which is a common operational approach in light railway systems and tramways around the world. This is in contrast to heavy rail whereby the stopping distances are regularly greater than the limit of the driver's vision. Given that the Luas shares sections of the carriageway with road vehicles and other road users, there is a risk that collisions with other road users will occur.

The number of road vehicle collisions had been on an increasing trend since 2015 until being abruptly interrupted by the outbreak of COVID-19 (Figure 20). The number of road vehicle collisions in 2021 are unprecedently low which reinforces the theory that reduced vehicle journeys (due to COVID-19) have had a reductive effect on this figure. Indicators such as Road Vehicle Collisions per million km run (Figure 21) have showed a proportional reduction in collisions as the number of tram km's run remained static. Six of the nine collisions were attributed to vehicle drivers breaching red lights, the other three were due to vehicles encroaching the tram line immediately in front of a tram. It is noted that the collisions are evenly distributed among the red and green line (something not previously seen in prior reporting) although for both lines the majority of incidents are within the inner-city centre.

Figure 20
Number of road vehicle collisions involving a tram

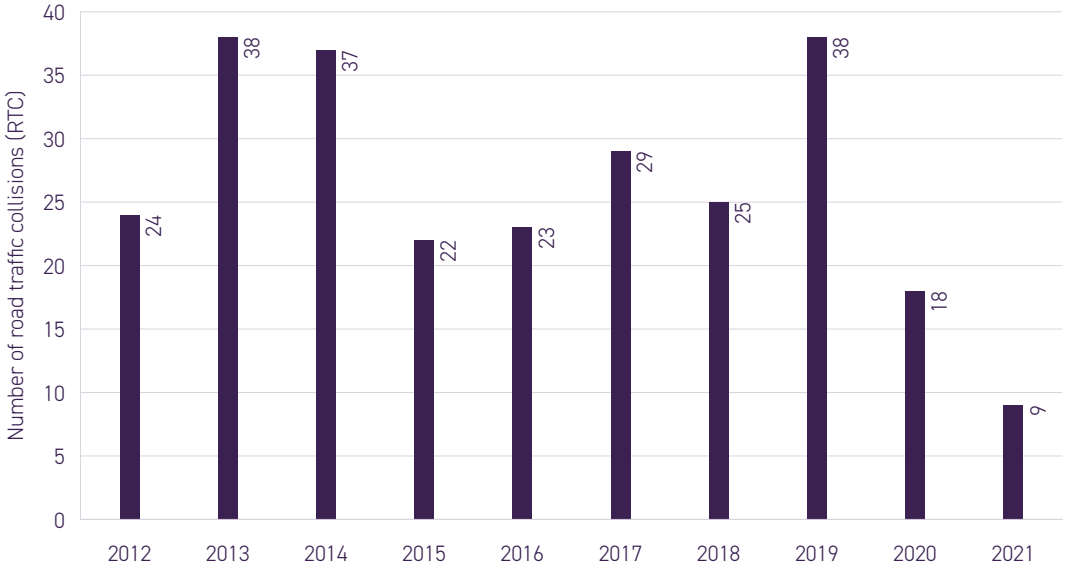
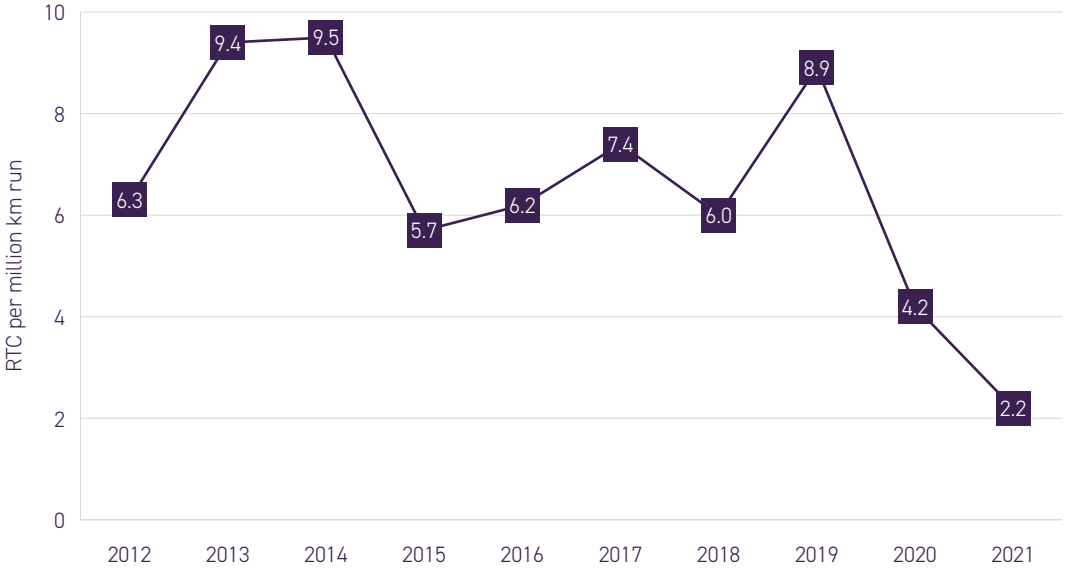


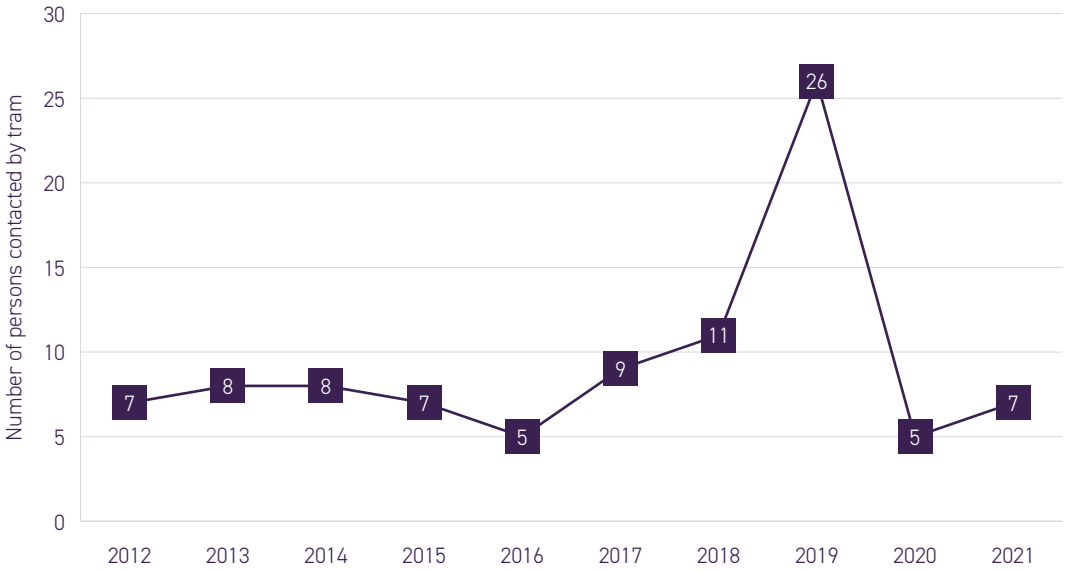
Figure 21
Road vehicle collisions per million km run



2.4.2 Tram contacts with people and cyclists

Seven occurrences of contacts between trams and cyclists and trams and people were reported in 2021. This is again likely a function of public health restrictions in 2021. Two of these occurrences were suspected self-harm whereby persons suddenly stepped in front of trams. Three incidents involved cyclists, one at a pedestrian crossing and two at junctions. In all three cases the cyclists left the scene and did not receive medical assistance. There were two contacts with pedestrians involving persons running in front of or into the trams. On both occasions the pedestrians did not receive medical assistance and left the scene.

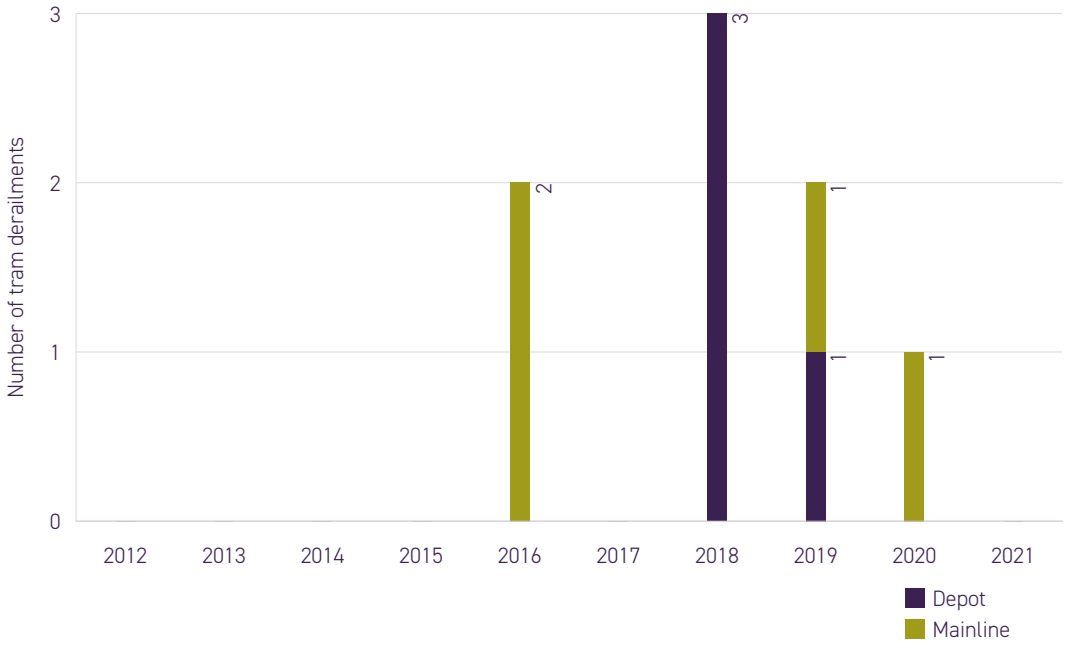
Figure 22
Persons coming into contact with tram



2.4.3 Tram derailments

There were no derailments in 2021 (Figure 23), one less than in 2020. Derailments can be caused by precursors that may or may not be related to road traffic such as maintenance defects, operational errors, intentional acts by 3rd parties (vandalism), etc.

Figure 23
Tram derailments



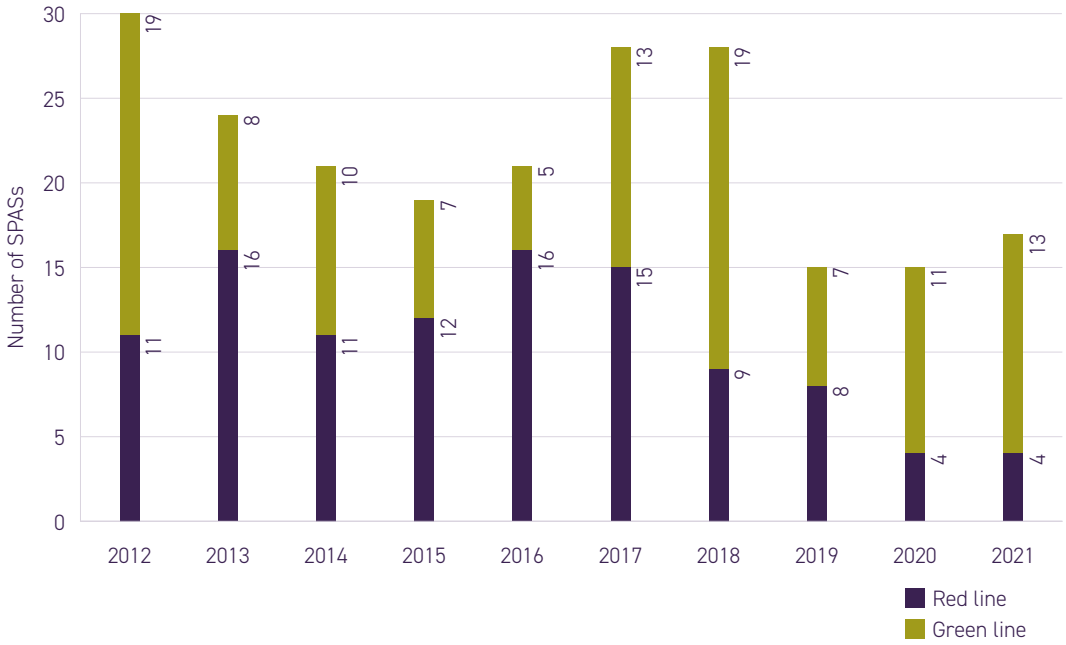
2.4.4 Signals Passed at Stop (SPAS)

A SPAS on the Luas network is where a tram has passed a stop signal without authority. SPASs are a particular precursor event that the CRR monitors regularly during its supervisory meetings with Transdev. The trend since 2018 has been relatively even; 17 SPASs in 2021 being 2 more than in 2019 and 2020, which is still a good reduction on preceding years. (Figure 24).

The SPASs are in the majority grouped into three locations; Glencairn House/Murphystown road, Sandyford LSS and Broombridge Depot Junction with the remaining 5 spread across the network.

In June 2020, the RAIU notified the CRR that they were commencing a Trend Investigation into SPASs on the Luas network, with the report being concluded in 2022.

Figure 24
Tram SPASs



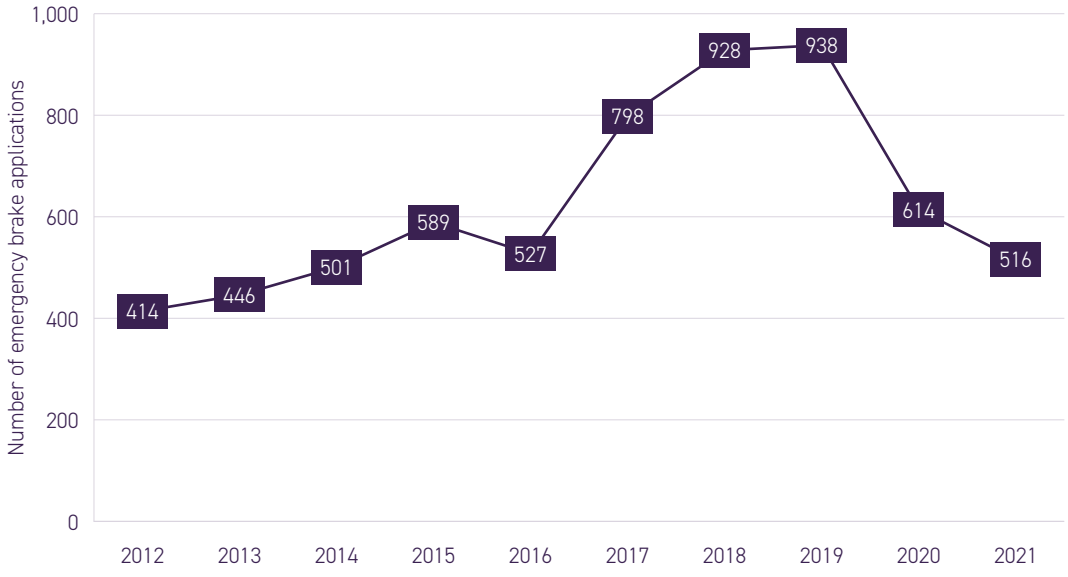
2.4.5 Tram emergency brake applications

An emergency brake application is where a driver commands the tram via the interface in the cab to apply friction, electrodynamic and adhesion independent electromagnetic braking simultaneously. This provides the maximum level of braking available to prevent a harmful incident. The number of Emergency Brake (EB) applications made by tram drivers can be a useful leading safety indicator as it can show there was potential for an unsafe condition to manifest.

In 2021, there was a total of 516 EB applications, which is a further reduction from the 614 in 2020. TDLR figures note that circa. 200 of these are due to technical/other issues with the tram or its operation and the remaining 300 attributable to cyclists/pedestrians/vehicles.

When the technical/other applications are disregarded, the reduction from 2019-2020 is proportional to the reduction in RTCs (circa. 50%), indicating that this safety indicator is also being suppressed significantly by COVID-19 measures and the fewer vehicles on the road since March 2020.

Figure 25 Emergency brake applications



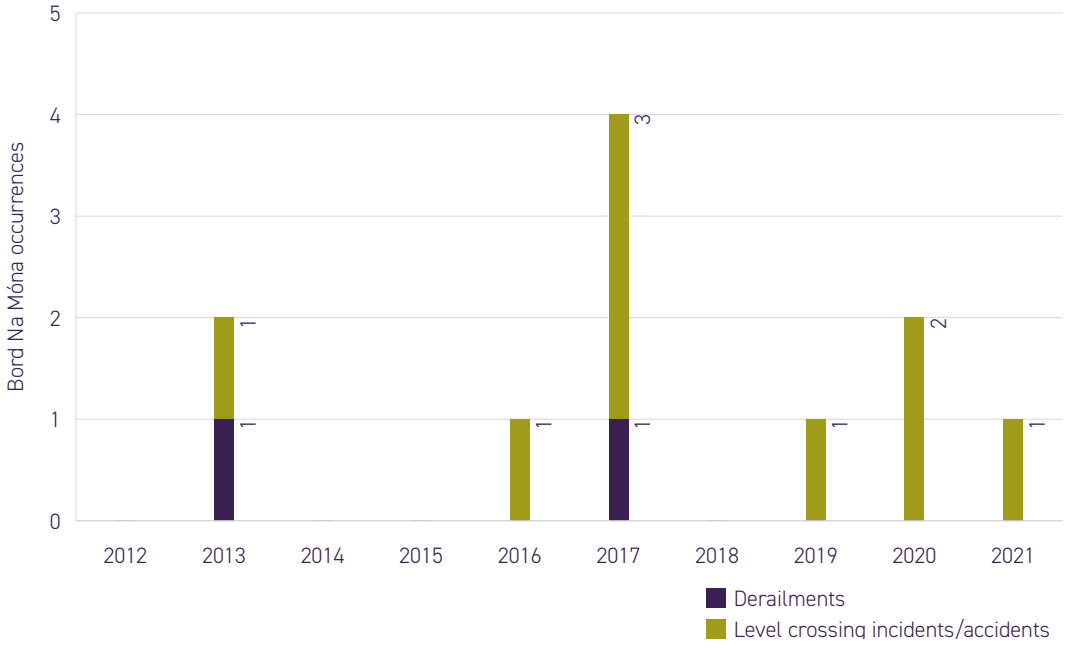
2.5 Bord Na Móna industrial railway statistics

The CRR's remit in terms of its oversight of BNM's industrial railway is limited to where it interfaces with public roads. While it has 557 km of permanent track it is only at its interfaces, i.e., level crossings and where there are road bridges over the industrial railway that the CRR has a regulatory role. In terms of key infrastructure statistics there are 99 level crossings of which 71 are operational and 52 underbridges of which 51 are in use.

The operational figures have reduced from 2020 as BNM has transitioned its business away from peat extraction and bogs are closed. It is expected over the coming years that the operational level crossings and bridges will reduce significantly as bogs are rehabilitated or closed.

BNM reported no derailments in 2021 but did report 1 level crossing occurrence. The incident involved a vehicle crashing through level crossing gates in dense fog, that were in the process of being closed by a BNM employee. The gates subsequently struck and injured the BNM employee.

Figure 26
Bord na Móna derailments and level crossing incidents/accidents



2.6 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 heritage railways. They are:

- Difflin Lake Railway, Oakfield Park, Raphoe
- Finntown & Glenties Railway
- Irish Steam Preservation Society Stradbally
- Listowel Lartigue Monorail
- Waterford & Suir Valley Railway (W&SVR)
- Lullymore Heritage & Discovery Park Ltd.
- Cavan and Leitrim Railway.

Due to the COVID-19 pandemic and government restrictions in place, only Finntown, Difflin Lake Railway and the Waterford & Suir Valley Railway operated passenger services in 2021. All had reduced passenger services, only operating for shorter than normal periods during the summer months and/or during the festive season. No railways reported any notifiable occurrences.

2.6.1 Railway Preservation Society of Ireland (RPSI)

The RPSI are not a self-contained heritage railway rather they operate steam and diesel hauled heritage trains on the Iarnród Éireann rail network and therefore hold a Safety Certificate allowing them to operate as a Railway Undertaking (RU). As an RU under the European Railway Safety Directive, they are subject to a supervision regime that is commensurate with the risks they manage and 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.

As was the case in 2020 the RPSI did not operate in 2021 due to COVID-19 restrictions.

3. PUBLIC REPRESENTATIONS

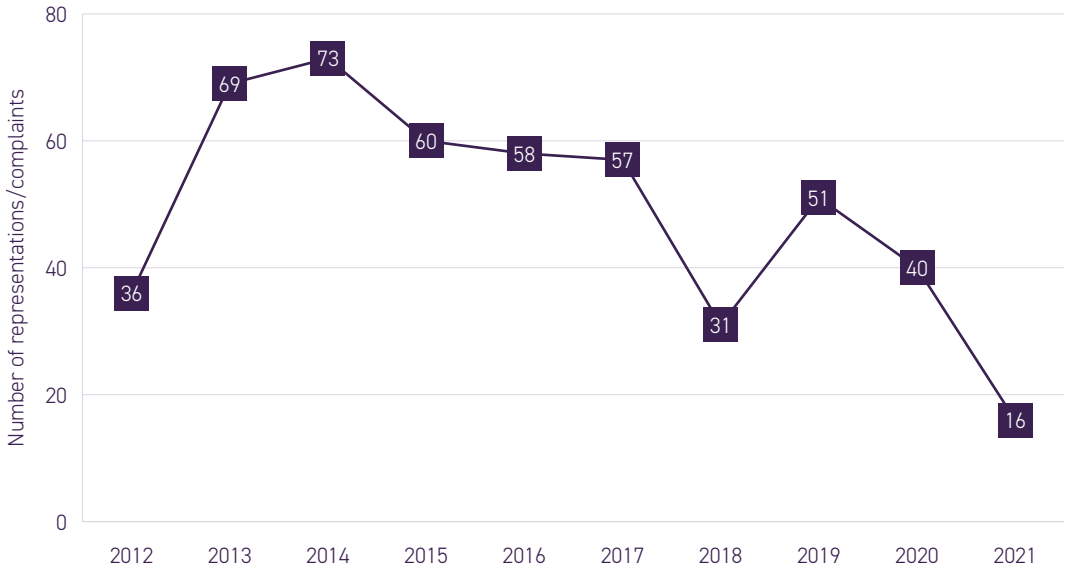
3.1 Introduction

The CRR uses many inputs to undertake risk-based supervision activity and one such source is that from representations the CRR receive from the public, be they passengers or otherwise, railway workers or other entities. Representations can be made to the CRR, with details on how to make a representation being available on our website (www.crr.ie). The contribution from the various stakeholders, including railway workers, passengers, and the general public is a valuable source of information, and all contact is screened and responded to in line with the CRR's charter. Where issues that relate primarily to occupational health and safety arise, the CRR liaises with colleagues in the Health & Safety Authority (HSA). Should issues raised relate to service efficiency or effectiveness, rather than safety, then the CRR directs the representation to the appropriate railway organisation or regulator (typically the National Transport Authority). If after the screening process the issues raised involves railway safety, the CRR endeavours, wherever possible, to deal with the matter directly. If necessary, the CRR will undertake inspections and/or seek information from the appropriate railway organisation(s) for further clarification seeking resolution before responding back to the person who made the representation.

3.2 2021 data and commentary

In 2021, the CRR received 16 representations relating to a range of heavy and light rail infrastructure and operational safety matters (figure 27). These ranged from safety concerns regarding the condition and safety of the IÉ-IM network to general tramway safety. The figure is down significantly on preceding years due to a change in data reporting, which is excluding representations that are non-safety related (Requests for Information – See Figure 28 for a detailed breakdown of representation trend details). Of the 16 representations received in 2021, 12 related to IÉ-IM or IÉ-RU, 2 related to the Luas system and 2 related to the heritage railway sector. The CRR gives a high degree of attention to any representation concerning railway safety made by either railway staff, railway passengers, members of the public, or others.

Figure 27
Public representations to the CRR by year



Note: significant drop in 2021 is due to removal of non-safety related requests for information from the reporting figures.

Representations from 2021 are broken down into 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, track, level crossings or fencing
- Safety of rolling stock: queries relating to Vehicles such as train performance, 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
- Request for information: a request to the CRR for information not specifically related to railway safety (note these are distinct from formal Freedom of Information requests and do not count towards the overall numbers in figure 27).

The numbers of representations/requests for information by category are shown in Figure 28. The primary focus of the CRR is with the 16 safety related representations, which have decreased across all categories. These concerns ranged from the structural safety of bridges to the operation of trains outside of approved instructions.

Figure 28 CRR public representation by category

Note that requests for informatrion are not counted towards the overall figure.

4.
RAILWAY SAFETY TRENDS IN EUROPE

4.1 Introduction

For the railway sector, European Union policy has the principal aim of establishing a Single European Railway Area; this is an EU-wide system of railway networks which would allow the expansion of the railway sector based on competition, technical harmonisation, and the joint development of cross-border connections. The main elements of this policy are:

- An open and restructured rail market
- Increase competitiveness by creating a level playing field for companies
- Develop infrastructure to ensure interoperability
- Improve efficiency in infrastructure use and safety
- Ensure fair prices for consumers.

The main EU legislation supporting the development of EU rail policy consists of four legislative packages adopted by the Council and the European Parliament between 2001 and 2016. These include common provisions on:

- Liberalisation of the rail market
- Licensing of railway undertakings and train driver certification
- Safety requirements
- The creation of the European Union agency for railways and railway regulatory bodies in each Member State
- Rail passenger rights.

In these legislative packages, the CRR is defined as the National Safety Authority (NSA) for the railway network in Ireland. Each European member state has an NSA which, in accordance with the Railway Safety Directive (EU) 2016/798, must submit its annual report on 'Common Safety Indicators' or CSI's of railway safety to the European Union Agency for Railways (ERA). ERA uses this data to analyse railway safety at an EU level and publishes its report on its website. ERA reports do not take into account light rail (Luas) or metro systems, or self-contained heritage railway systems. Some noteworthy statistics are presented from recent reports based on data up to the 2020 reporting period and, where available, up to 2021. 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/.

The results of the assessment of achievement of safety targets carried out by the European Railway Agency in accordance with the Common Safety Method indicate a possible deterioration of safety performance in 8 Member States but not Ireland. The assessment shows that railway safety performance remains acceptable at the EU level for all categories of railway users.

4.1.1 Significant accidents and their outcomes

The Railway Safety Directive (Directive (EU) 2016/798) defines a significant accident as "any accident involving at least one rail vehicle in motion, resulting in at least one killed or seriously injured person, or in significant damage to stock, track, other installations or environment, or extensive disruptions to traffic, excluding accidents in workshops, warehouses and depots." In 2020 (the most recently available dataset), there were 1331 significant accidents resulting in 687 fatalities and 469 serious injuries within the European Union (Figure 29). The annual number of significant accidents has decreased steadily over the 10 years up to 2020. With a statistically significant year-on-year 12% decrease in significant accidents between 2019 and 2020. ERA have observed a decrease across all accident categories both year-on-year and against the average of the four preceding years except for collisions and other accidents. Collisions of trains and 'other' accidents increased in 2020 compared with 2019 and the preceding four-year average.

Figure 29
Significant accidents, fatalities and serious injuries of EU 27, 2010 – 2020

Source: ERA – Report on Railway Safety and Interoperability in the EU, 2010 – 2022.

Figure 30
Significance of change in annual counts of significant accidents of EU 27, 2010 – 2020

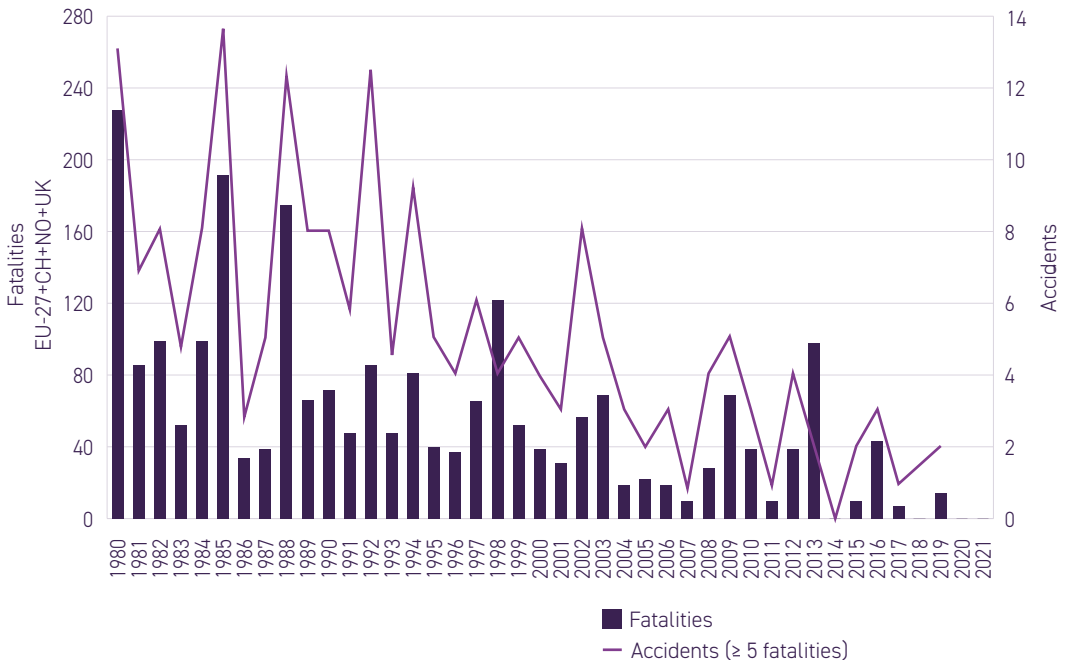
Significance of change in outcomes	2020/2019	2020/(2016 – 2019)
Collisions of trains	7%	7%
Derailments of trains	-5%	-7%
Level-crossing accidents		
Accidents to persons		
Fires in rolling stock		
Other accidents	11%	
All significant accidents		
Fatalities		
Serious injuries		
Suicides		

Note: a Poisson statistical significance test was performed at a significance level of 95%. Statistically significant changes are highlighted in blue. Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the European Union Agency for Railways, published in ERAIL.

4.1.2 Irish railway safety in an EU context

The latest CSI data for the EU suggests Ireland has a good safety performance, however the relatively small network (1,680 route km) leaves a potential for a single serious accident with multiple fatalities to alter Ireland's leading position to one that would trail most other Member States. The trend for major accidents across Europe as a whole remained positive with 2021 being free of major accidents as was also the case in 2020.

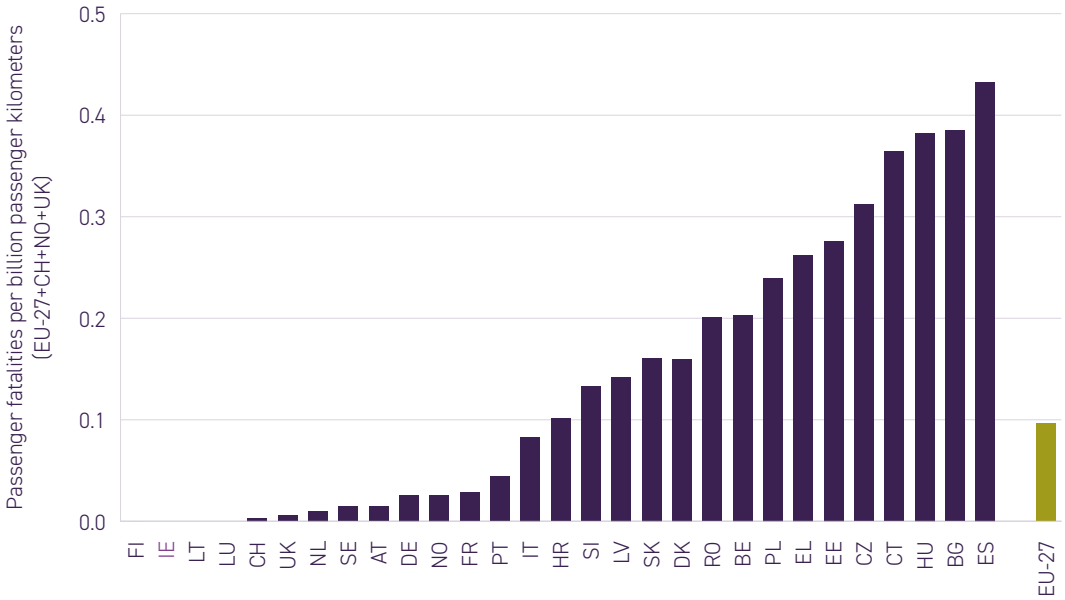
Figure 31
Major accidents in Europe, 1980 – 2021



Note: a Poisson statistical significance test was performed at a significance level of 95%. Statistically significant changes are highlighted in blue. Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the European Union Agency for Railways, published in ERAIL.

Ireland's performance within Europe is also considered positive in comparison to other Member States, with performance consistently well ahead of the EU level. Data for railway passenger fatality rates show that when fatalities are normalised using train kilometres travelled, Ireland is a leading country in terms of performance over the last decade.

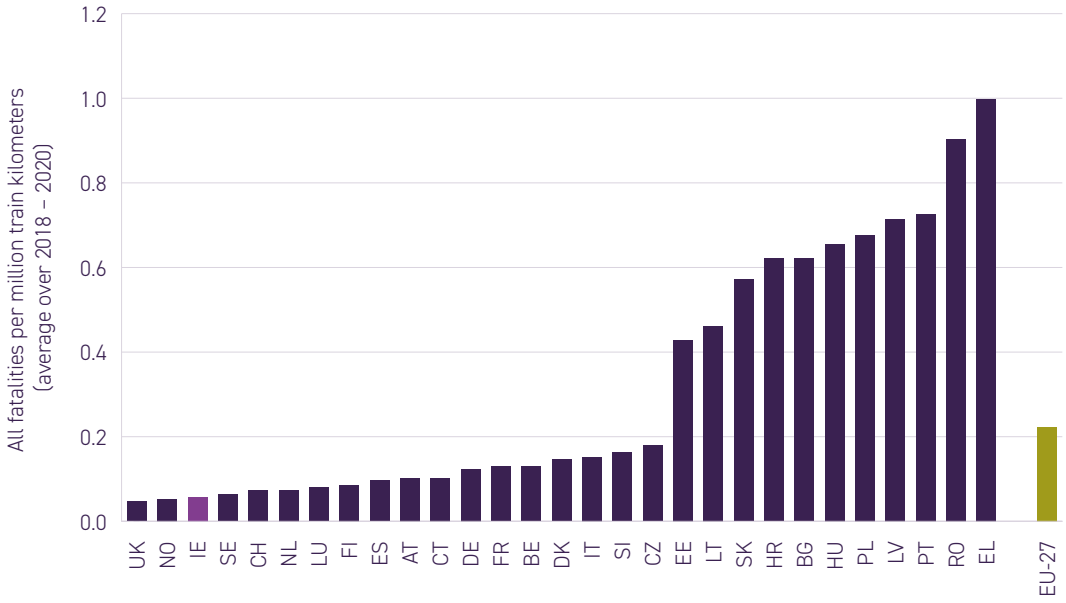
Figure 32
Passenger fatalities rate, 2010 – 2020



Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the European Union Agency for Railways, published in ERAIL.

Over the more immediate term (2018 – 2020) Ireland is also ranked highly within the EU27 and has a normalised fatality rate that is considerably below the EU average. However, note that there is the considerable disparity between low and high fatality rate countries and Ireland is placed within the cluster of other well-below average member states.

Figure 33
Fatalities per million train kilometres



Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the European Union Agency for Railways, published in ERAIL.

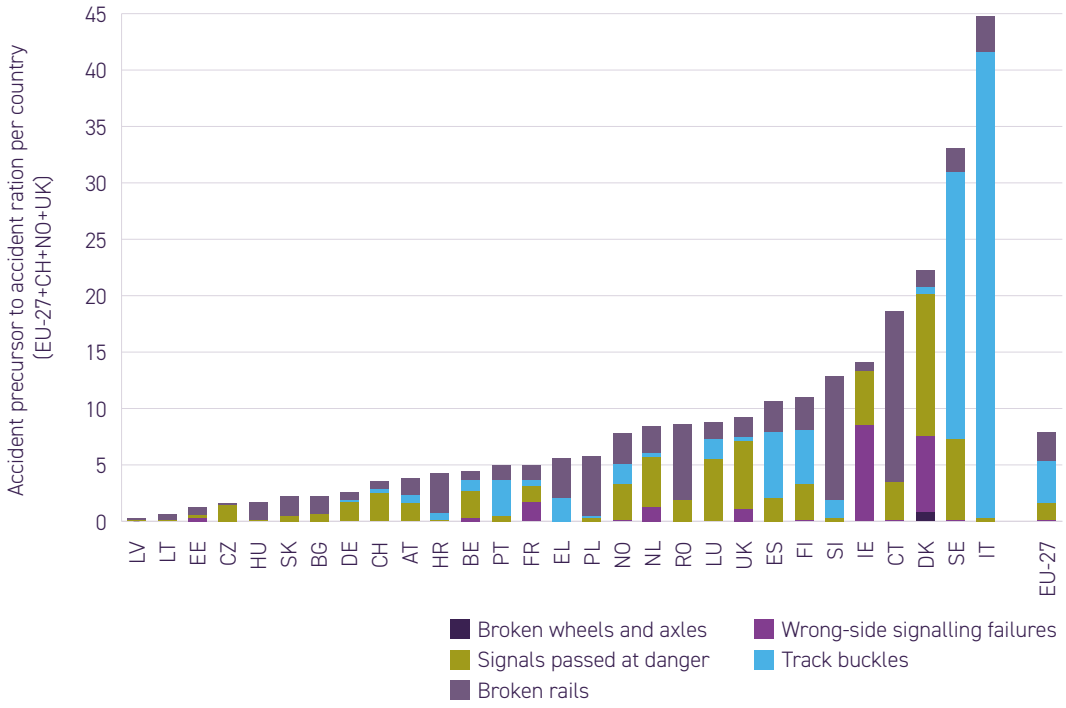
4.1.3 Precursor to accidents

Accidents on railways are rare events and to keep such occurrences as low as possible railway organisations and safety authorities monitor events (precursors) that have no harmful consequences but under slightly different circumstances, could have led to an accident. The following precursors are those reported to the ERA:

- Broken wheels and axles (on trains or wagons)
- Wrong-side signalling failures
- Signal Passed at Danger (SPAD)
- Track buckles (track is out of alignment)
- Broken rails.

As seen in Figure 34, Ireland is at the higher end of the scale in terms of the ratio of accident precursors to accidents. It is the case that, as this metric measures the ratio of accident precursors to accidents, Ireland shares the high end of the scale with other low accident rate countries. Performance could be compared by reviewing the relative performance of similar countries or by identifying areas of relative weakness. ERA report that they have concerns about data quality, hence it is difficult to draw a meaningful conclusion from the data shown.

Figure 34
Total precursor events by country, 2016 – 2020



Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the European Union Agency for Railways, published in ERAIL.

4.2 Major accidents worldwide

A number of accidents on railways in other countries during 2021 reminds us that despite year-on-year improvement in overall safety performance, the potential still exists for serious accidents with catastrophic outcomes. 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 railway sector.

Hualien, Taiwan

At 09:28 (local time) on 2nd April 2021, a Taroko Express train operated by Taiwan Railways Administration derailed as it was entering a tunnel in Hualien County, Taiwan. The train collided with a construction vehicle that was working on a site near the north end of the tunnel and had slid down an embankment onto the railway line. As a result of the collision, 49 people (47 passengers and 2 TRA staff) were killed. Initial investigative findings were that the train only had some 250 meters upon exiting the tunnel to react to the obstacle, which was not sufficient to stop the train in time. The report by the Taiwan Transportation Safety Board is currently at a Final raft stage.

Mexico City, Mexico

On 3rd May 2021, an overpass section of Mexico City Metros line collapsed. The overpass collapsed beneath a passing train, resulting in the last two carriages falling to the road below, killing 26 people and injuring 79. Multiple investigations have been carried out since the incident by both Federal Law Enforcement and private consultancy firms. The investigations found that structural faults such as incomplete welds, improper beam spacing, and missing/misplaced bolts/studs were present since construction. Additionally, inspection reports from periodic inspections of the bridge were found to have not identified these deficiencies.

Montana, United States

At 15:47 (local time) on 25th September 2021, an Amtrak train derailed on a slight curve near Joplin, Montana. The derailment resulted in the death of 3 passengers and injured 44 others. To date the NTSB have not indicated any possible cause of the derailment but confirmed that the train's emergency brake had been activated before the derailment and that the train was travelling below the speed limit at the time of the accident. Whilst indicating that the investigation will analyse the crashworthiness of the railcar, the NTSB is also investigating maintenance, engineering and equipment factors that may also be attributable to the cause of derailment.

Salisbury, United Kingdom

At 18:45 on 31st October 2021, a South Western Railway's Class 159 train failed to stop at a red signal protecting Salisbury Tunnel Junction. This SPAD resulted in the SWR train colliding into the side of a Great Western Railway's Class 158, causing both trains to derail. Thirteen passengers and one driver were hospitalised as a result and significant damage to the trains and railway infrastructure occurred. Initial findings of the Rail Accident Investigation Branch indicate that railhead contamination may have resulted in a low coefficient of friction between the rail and wheels of the train. The resulting increased braking distances of the train then lead to the train passing the signal at danger despite the driver applying the brakes some 1.5km from the signal. The investigation remains ongoing with objectives to consider the actions by the Infrastructure Manager to treat contaminated rails, the condition of the trains sanding and wheel-slip protection system and the actions taken by the driver, among others.

5. ACCIDENT INVESTIGATIONS

5.1 Introduction

The RAIU is a functionally independent organisation within the Department of Transport. 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. An investigation does not attribute blame or liability. The RAIU's investigations are carried out in accordance with Commission Implementing Regulation EU 2020/572 and S.I. No. 430/2020.[2]

5.2 RAIU active investigations

The RAIU conducted 38 Preliminary Examination Reports (PER) and initiated five full investigations into railway accidents and incidents in 2021 (Table 4).

Table 4
RAIU investigations initiated in 2021

Date of incident	Details	Duty holder
5th January 2021	Luas isolation irregularity, Kylemore to Suir Road	Transdev
11th June 2021	Luas overhead contact system failure on the Red Line at Beresford Place	Transdev
21st July 2021	Near miss between a train and an IÉ member of staff, Gormanston	IÉ-IM
27th August 2021	Collision between an IÉ train and rail equipment between Newbridge and Kildare	IÉ-IM
7th December 2021	IÉ operational irregularity, Clontarf Road	IÉ-IM

2. Railway Safety Directive and the Railway Safety Act are supplemented by S.I. No. 430/2020 – European Union (Railway Safety) (Reporting and Investigation of Serious Accidents, Accidents and Incidents) Regulations 2020.

5.3 RAIU investigation reports 2021

In accordance with S.I. 430 2020, the RAIU shall publish an investigation report not later than 12 months after the date of the incident or release an interim statement detailing the investigation progress. In 2021, the RAIU published seven investigation reports which are listed in Table 5. As a result of their investigations the RAIU made a total of 34 safety recommendations which are discussed in section 5.4.

Table 5
RAIU investigation reports published in 2021

Date report published	Date of incident	Title of report	No. of safety recommendations made	Railway organisation
18/02/2021	29th April 2020	Collision between a car and a train at Kilnageer Level Crossing (XM240), Mayo	4	IÉ-IM
18/02/2021	8th June 2020	Collision between a Bord na Móna Flat Wagon and Kilcolgan Level Crossing gates, Offaly	6	Bord na Móna
21/05/2021	24th May 2020	Person entrapped in lowered CCTV level crossing, Ashfield, Offaly	6	IÉ-IM
01/07/2021	7th July 2020	Chassis Plate Fracture on General Motors Class 201, Locomotive 224	3	IÉ-RU
22/09/2021	1st October 2020	Overhead Line detachment, Pearse Station	7	IÉ-IM & IÉ-RU
27/10/2021	2nd November 2020	Luas Overhead Line Failure, Stillorgan	5	Transdev
16/12/2021	5th January 2021	Luas isolation irregularity, Kylemore to Suir Road	3	Transdev

5.4 RAIU safety recommendations 2021

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 safety recommendations and as previously stated, 34 were made in 2021. In accordance with the Railway Safety Directive the RAIU address recommendations to the national 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 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 by the relevant entity.

The CRR categorise the status of recommendations as being either 'Open', 'Submitted', 'FER' or 'Closed'. These are defined as follows:

Open Feedback (evidence) from railway organisation (or another party) is awaited or actions have not yet been completed.

Submitted A railway organisation (or other party) has made a submission to the CRR, advising that it has taken measures to effect the recommendation and the CRR is considering whether to close the recommendation.

FER Further evidence required. The CRR has reviewed a submission (or further submission) but considers that further evidence is necessary to close the safety recommendation.

Closed The CRR has reviewed a submission (or further submission) and is satisfied that the safety recommendation has been addressed.

A summary is presented below of the actions taken (at the time of writing) in relation to the seven RAIU Investigation Reports published in 2021 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 all actions they proposed to take to address the specific safety recommendation.

R202101
Collision between a car and a train at Kilnageer level crossing (XM240), Mayo, 29th April 2020 (Report published 18th February 2021)

Summary	At approximately 13:40 hour (hrs) on the 29th of April 2020, the 13:10 hrs passenger service from Westport to Dublin (Train A809) was approaching Kilnageer Level Crossing (LC) XM240, located approximately six kilometres (km) from Castlebar, County Mayo. At the same time, a car approached LC XM240 with the gates open (left open by a previous user) and began travelling through LC XM240. When the driver of Train A809 (Driver A809) saw the car, he made a full-service brake application; however, the train could not stop in time and struck the car.
Number of recommendations made	4

Recommendation 1 (2020001-01)	The RSA should update the 'Rules of the Road' to include guidance on the DSS.
Action/s taken/ in progress	June 2021 – RSA provided new infographic material to be included in new RotR publication.
Status	Open/In progress.

Recommendation 2 (2020001-02)	Iarnród Éireann Infrastructure Manager should update the 'The SAFE use of Unattended Railway Level Crossings' booklet to include guidance on the Decision Support System.
Action/s taken/ in progress	IÉ-IM advise the CRR that they intend to revise said document by the stated PCD.
Status	Open/In progress.

Recommendation 3 (2020001-03)	Iarnród Éireann Railway Undertaking should put systems in place to ensure Intercity Railcar train horns meet the current standards for sound pressure levels.
Action/s taken/in progress	Sept 2021 – Submitted Action Plan. Nov 2021 – Rolling out fix over two years via Heavy Maintenance cycles. April 2022 – On target to meet PCD.
Status	Open/In progress.

Recommendation 4 (2020001-04)	The CRR should review and update Section 5, Level Crossings, of their Guidelines for the Design of Railway Infrastructure and Rolling Stock, to ensure that guidance/reference on the Decision Support System is included.
Action/s taken/in progress	CRR Guidance Document No. CRR-G-006 Rev C updated to include references to the Iarnród Éireann Decision Support System (DSS).
Status	Closed.

R202102
Collision between a Bord na Móna Flat Wagon and Kilcolgan Level Crossing gates, Offaly, 8th June 2020 (Report published 18th February 2021)

Summary	At approximately 13:15 hours (hrs) on the 8th June 2020 a Bord na Móna (BnM) double rake system travelled through Kilcolgan Level Crossing, closing and opening the derailing points to allow passage through the crossing. At some stage after the passage of the double rake through Kilcolgan Level Crossing, the derailing points were placed in the closed position (possibly by trespassers). Approximately two kilometres away, works were being undertaken at BnM Worksite 610A, Lemonaghan, in preparation for track renewal work. The works included the transport and unloading of ballast at Worksite 610A by means of a Locomotive, a Flat Wagon, and an excavator. During the ballast unloading, ballast fell from the Flat Wagon onto the track, which in turn resulted in the Flat Wagon derailing during a shunting manoeuvre. The Locomotive was uncoupled from the Flat Wagon to facilitate the rerailing and a lifting chain was placed around the excavator bucket and the Flat Wagon coupling. The Flat Wagon was then lifted, aligned with the track, and lowered onto the rail. The chain was removed from the Flat Wagon coupling and the Flat Wagon rolled away towards Kilcolgan Level Crossing. On approach to Kilcolgan Level Crossing, the Flat Wagon passed over the derailing points (in the closed position) allowing the Flat Wagon to continue towards the gates. The Flat Wagon collided with the first gate at Kilcolgan Level Crossing forcing the gate across local road, L70075, before colliding with the second gate forcing it open away from the road. The Flat Wagon came to a stop approximately 50 metre (m) past Kilcolgan Level Crossing.
Number of recommendations made	6
Recommendation 1 (202102-01)	Bord na Móna should identify locations where derailing points are vulnerable to unauthorised movements and provide a means of securing the derailing points at these locations.
Action/s taken/ in progress	July 2021 – Review carried out. Further evidence required around the provision/ availability of locks for derailing points.
Status	Further Evidence Requested.
Recommendation 2 (202102-02)	Bord na Móna should review and update its Procedure for Rerailing Wagons/ Rail Stock to ensure that there are clear instructions in relation to how to: visually check the lifting chains; rerail; and, safety secure rerailed stock.
Action/s taken/ in progress	July 2021 – Procedures updated and requirements added.
Status	Closed.
Recommendation 3 (202102-03)	Bord na Móna should develop a training, assessment and continuous assessment programme related to the Procedures for Rerailing Wagons/ Rail Stock.
Action/s taken/ in progress	July 2021 – Training developed and in place.
Status	Closed.

R202102
Collision between a Bord na Móna Flat Wagon and Kilcolgan Level Crossing gates, Offaly, 8th June 2020 (Report published 18th February 2021)

Recommendation 4 (202102-04)	Bord na Móna should review its level crossing Risk Register updating where necessary to sufficiently capture all reasonably foreseeable risks. In addition, Bord na Móna should consider adding a requirement within its Rail Safety Case Document that requires regularised Risk Management Workshops at which risks, mitigation measures, etc, are reviewed and updated when necessary.
Action/s taken/ in progress	July 2021 – Further evidence required of finalised Interface Management Document.
Status	Further Evidence Requested.

Recommendation 5 (202102-05)	The Engineering Department of Bord na Móna should carry out the technical evaluation into the efficacy of the derailing points, etc. identified in Bord na Móna internal investigation report into the collision between a Bord na Móna locomotive and the gates of Endrim Gates on the 21st September 2017.
Action/s taken/ in progress	July 2021 – Technical evaluation carried out. Request for copy of said evaluation pending.
Status	Further Evidence Requested.

Recommendation 6 (202102-06)	Bord na Móna should update their Specification for Crossings to include the requirements of the Department of Transport's Traffic Signs Manual; based on this Bord na Móna should update the signage on the approaches to all Bord na Móna level crossings.
Action/s taken/ in progress	July 2021 – Intention to update key documents submitted. Further evidence of the documents being updated requested.
Status	Further Evidence Requested.

R202103
Person entrapped in lowered CCTV level crossing, Ashfield, Offaly, 24th May 2020
(Report published 21st May 2021)

Summary	At approximately 12:13 hour (hrs) on the 24th May 2020, a Level Crossing Control Operative (LCCO), located at Athlone Local Control Centre (ALCC) cleared Closed-Circuit Television (CCTV) Level Crossing (LC) XA068, located in Ashfield, Offaly for the passage of the 11:00 hrs passenger service from Galway to Heuston (Train A703) while a member of the public (MOP) was inside the barriers of the level crossing. The MOP had requested assistance from LCCO1 using the telephone provided at the level crossing. LCCO1 advised the MOP that they would raise the barriers and instructed the MOP to stand beside some level crossing equipment (clear of the tracks, but within the confines of the level crossing). LCCO1 did not raise the barriers and allowed Train A703 to pass through LC XA068. The MOP was uninjured as a result of this incident.
Number of recommendations made	6
Recommendation 1 (202103-01)	Iarnród Éireann Infrastructure Manager (IÉ-IM) Signalling, Electrical and Telecommunications (SET) Department should, using a risk-based approach, consider the suitability of the 'Signal Controls' functions for Mid-Section CCTV Crossings; should they be deemed to have an unacceptable level of risk, they should be removed from the LCCO's console.
Action/s taken/ in progress	July 2021 – Workshop held and evidence of final decision to be submitted.
Status	Open/In progress.
Recommendation 2 (202103-02)	Iarnród Éireann Infrastructure Manager (IÉ-IM) Signalling, Electrical and Telecommunications (SET) should, consider introducing a time delay between the 'Crossing Clear' buttons to prevent the LCCO pressing the second Crossing Clear button until the first Crossing Clear button times out. This time can be spent checking the confines of the level crossing for vehicles, pedestrians or other obstructions.
Action/s taken/ in progress	July 2021 – Time delay considered and rejected. Considering other mitigation options. Awaiting evidence.
Status	Open/In progress.
Recommendation 3 (202103-03)	Iarnród Éireann Infrastructure Manager (IÉ-IM) Chief Civil Engineer's (CCE) Department should examine the feasibility of installing signage inside the barriers of CCTV level crossings warning MOP what actions to take in the event of becoming trapped.
Action/s taken/ in progress	July 2021- Review to be held.
Status	Open/In progress.

R202103
Person entrapped in lowered CCTV level crossing, Ashfield, Offaly, 24th May 2020
(Report published 21st May 2021)

Recommendation 4 (202103-04)	Iarnród Éireann Infrastructure Manager (IÉ-IM) should develop a means to make MOPs more visible should they become trapped inside level crossing barriers and position themselves adjacent to level crossing furniture or other infrastructure; where this cannot be achieved consideration should be given to examining possible initiatives or technologies that could be introduced to provide aid and assistance to Level Crossing Control Operatives (LCCOs) in identifying persons/obstacles that maybe trapped within the confines of a level crossing.
Action/s taken/ in progress	July 2021 – Review to be undertaken. December 2021 – Addressing obsolescence issues and accessibility to CCTV.
Status	Open/In progress.

Recommendation 5 (202103-05)	Iarnród Éireann Infrastructure Manager (IÉ-IM) should introduce measures to deter pedestrians from using unauthorised routes onto CCTV Level Crossings.
Action/s taken/ in progress	July 2021 – Review to be held.
Status	Open/In progress.

Recommendation 6 (202103-06)	IÉ-IM should conduct a focussed review on the instances of MOP entrapment at Sydney Parade (LC XR004) and Serpentine Avenue (LC XR002) with a view of identifying any actions that can be taken to prevent the re-occurrence of MOP entrapments.
Action/s taken/ in progress	July 2021 – Addressing obsolescence issues and accessibility to equipment. New warning signage recently installed on barriers in Dublin, pending result of trial it may be installed at other crossings.
Status	Open/In progress.

R202104
Chassis Plate fracture on General Motors Class 201, Locomotive 224, 7th July 2020
(Report published 1st July 2021)

Summary	Iarnród Éireann (IÉ) 201 Class Locomotives were manufactured by General Motors (GM) in Canada and entered service in 1994. Locomotive 224 had its engine and generator removed in 2010 and 2019 for maintenance. When the engine and generator was removed cracks were identified in the Bed Plate (non-structural component) between the two Chassis Plates (structural component) of the Locomotive. IÉ carried out weld repairs to the Bed Plate but the weld repair did not conform to the EN15085 2007 standard series, entitled, 'Railway applications – Welding of railway vehicles and components' or any IÉ approved written specification; and, on one occasion (in 2010 or 2019) the weld repair was unnecessarily continued from the Bed Plate into the chassis plate. On 6th July 2020, the 14:25 hrs Cork Kent to Dublin Heuston passenger service operated with Locomotive 224 at the rear. Locomotive 224 experienced a coolant leak and electrical fault that caused the locomotive to shut down while approaching Limerick Junction. The train was deemed a failure and hauled to Heuston Station, Dublin. On the 7th July 2020, while Locomotive 224 was at Heuston Station awaiting transfer to Inchicore Works, a driver observed the body of Locomotive 224 was sagging near the centre point and reported it to his supervisor who in turn alerted the relevant parties. On inspection, by the Chief Mechanical Engineer's (CME) Department's maintenance staff a main frame crack was identified. Locomotive 224 was then shunted to Inchicore Works for a more thorough examination. At Inchicore Works, the Locomotive's engine and generator were removed to give a clear view of the damage. The crack was examined by IÉs Chief Chemist and Metallurgist, who was independently supervised by a metallurgist specialist, contracted by the RAIU. The metallurgical investigation identified that the failure occurred in the weld repair of the Bed Plate that was continued into the Chassis Plate. In service, cyclic loading, particularly bending stress on the underside of the Chassis Plate (that had high residual tensile stresses generated from within the repair weld), resulted in multiple fatigue initiation sites developing and merging into a common crack that propagated through the Chassis Plate during the journey causing the Chassis Plate to fracture. The loss of integrity to the structure of Locomotive 224 resulted in a coolant pipe been disturbed and subsequent leak and the misalignment of the generator resulting in and electrical shut down fault.
Number of recommendations made	3
Recommendation 1 (202104-01)	Iarnród Éireann Railway Undertaking (IÉ-RU) Chief Mechanical Engineer (CME) should review all weld repairs carried out to structures of all rolling stock to assess the risk posed by such weld repairs and mitigate against the failure mode.
Action/s taken/ in progress	Sep 2021 – Review ongoing and on target to achieve by projected completion date.
Status	Open/In progress.
Recommendation 2 (202104-02)	Iarnród Éireann Railway Undertaking (IÉ-RU) Chief Mechanical Engineer (CME) should develop a procedure for evaluating maintenance advice received from Original Equipment Manufacturers (OEMs) or other railway organisations to determine applicability to IÉ fleets and assess any associated risks.
Action/s taken/ in progress	Nov 2021 – CME Technical Standards updated.
Status	Closed.

R202104
Chassis Plate fracture on General Motors Class 201, Locomotive 224, 7th July 2020
(Report published 1st July 2021)

Recommendation 3 (202104-03)	Iarnród Éireann Railway Undertaking (IÉ-RU) Chief Mechanical Engineer (CME) and Iarnród Éireann Infrastructure Manager (IÉ-IM) Chief Civil Engineer (CCE) should carry out a risk assessment on the implications of the increased axle load of a 201 Locomotive.
Action/s taken/ in progress	Aug 2021 – Recommendation added to agenda of interface group. Assessment pending outcome of group.
Status	Open/In progress.

R202105
Overhead line detachment, Pearse Station, 1st October 2020
(Report published 22nd September 2021)

Summary	At approximately 12:55 hours (hrs) on Thursday 1st October 2020, the 12:04 hrs Iarnród Éireann (IÉ) DART service from Greystones to Howth (Train E920) was coming to a stop in Pearse Station when the second pantograph (Pantograph 396) of the train set (Unit 8128) lost contact with the Contact Wire of the Overhead Line Equipment (OHLE). The Pantograph Head and Upper Arm lowered rapidly resulting in the Pantograph Lower Arm extending to its maximum reach and contacting the OHLE. This action caused the Pantograph Lower Arm to flip, driving the Upper Arm and Pantograph Head on to the roof of the train resulting a short circuit and a large flashover. The short circuit caused a loss of power to the OHLE in the section. Train E920 coasted before been brought to a stop, on Platform 1, by the driver (Driver E920). Driver E920, having heard the noise from the flashover, stepped onto Platform 1 to check the train and after observing the OHLE vibrating, returned to the cab and pressed the 'Pan Down' button. This resulted in the lead and rear pantographs lowering but the Lower Arm of the Pantograph 396 did not lower (which was later determined to be as a result of the failure of the pantograph chains). The DART electrification system is fitted with an Auto Reclose function which allows a high speed circuit breaker to automatically reclose after a tripping event provided a successful Line Test has been passed. After the pantograph failure, and following a successful Line Test, the Auto Reclose restored power to the OHLE causing a second short circuit. This resulted in the Catenary Wire from the OHLE breaking and falling onto Platform 1. While the Catenary Wire was on Platform 1 a second Auto Reclose resulted in power been restored to the fallen Catenary Wire. The Catenary Wire remained live on Platform 1 for approximately forty-six seconds before the Electrical Control Operator (ECO) isolated the section. There were two passengers on Platform 1 at the time but not in the vicinity of the fallen Catenary Wire. Passengers were detained on the train until confirmation of an isolation had taken place. There were no reports of injuries.
Number of recommendations made	7

Recommendation 1 (202105-01)	Iarnród Éireann Railway Undertaking, Chief Mechanical Engineer's Department should in conjunction with the Original Equipment Manufacturer (OEM) develop a maintenance regime for the pantographs, taking into consideration the operational conditions and traceability of safety critical components.
Action/s taken/ in progress	Nov 2021 – Engineering Change Request to be reviewed and updated. Serial numbers for every pan included in asset management system.
Status	Further Evidence Requested.

R202105
Overhead line detachment, Pearse Station, 1st October 2020
(Report published 22nd September 2021)

Recommendation 2 (202105-02)	Iarnród Éireann Railway Undertaking (IÉ-RU), Chief Mechanical Engineer's Department should carry out, in conjunction with the Original Equipment Manufacturer (OEM), a condition assessment to determine the correct period for the overhaul of the IÉ-RU pantographs.
Action/s taken/ in progress	Nov 2021 – Engineering Change Request to be reviewed and updated. Commentary being sought from OEM on suitability of current regime.
Status	Open/In progress.

Recommendation 3 (202105-03)	Iarnród Éireann Railway Undertaking and Iarnród Éireann Infrastructure Manager should review the current Engineering Change Request and Safety Approval of Changes documents, to ensure that the appropriate stakeholders are consulted, and the correct processes followed.
Action/s taken/ in progress	Nov 2021 – Engineering Change Request to be reviewed and updated. Commentary being sought from OEM on suitability of current regime. ECR will be presented to RU Safety Approval Panel.
Status	Open/In progress.

Recommendation 4 (202105-04)	Iarnród Éireann Railway Undertaking, Chief Mechanical Engineer's Department to include requirements to check pantograph maintenance activities in the Compliance Coordinators documentation records/check sheets.
Action/s taken/ in progress	Nov 2021 – Task is now included in compliance checks. Samples of checks to be provided.
Status	Further Evidence Requested.

Recommendation 5 (202105-05)	Iarnród Éireann Infrastructure Manager, Signalling, Electrical and Telecommunications (SET) Department, should evaluate the auto-reclose function of the Overhead Line Equipment (OHLE) control system on the DART network to ensure the safe operation in the event of failures which could expose staff and passengers to live OHLE.
Action/s taken/ in progress	Nov 2021 – Auto reclose to be reviewed as part of overall review process. Consultants appointed in late October.
Status	Open/In progress.

Recommendation 6 (202105-06)	Iarnród Éireann Railway Undertaking Chief Mechanical Engineer's Department to include requirements to check Class 8100 EMU Forward Facing CCTV maintenance activities in the Compliance Coordinators documentation records/ check sheets.
Action/s taken/ in progress	Nov 2021 – Included in compliance checks. Dec 2021 – Samples provided.
Status	Closed.

Recommendation 7 (202105-07)	Iarnród Éireann Railway Undertaking (IÉ-RU) Chief Mechanical Engineer's Department to review and develop a maintenance strategy for the 8100 EMU On Train Date[sic] Recorders (OTDRs) to ensure that the correct information is recorded.
Action/s taken/ in progress	Nov 2021 – New OTDR exam added to maintenance regime. Dec 2021 – Documents of exam being carried out provided.
Status	Closed.

R202106
Luas Overhead Line Failure, Stillorgan, 2nd November 2020
(Report published 27th October 2021)

Summary	On 2nd November 2020 the 14:31 hours (hrs) Luas Service 65 (operated by Tram 5010) from Brides Glen to Broombridge served Stillorgan inbound platform before moving forward to Signal B11. The driver of Tram 5010 (Driver 5010) noticed the Main Circuit Breaker (MCB) had opened in the driving cab (the MCB opened due to its failure to detect 750 volts (V) Direct Current (DC) from the Overhead Contact System (OCS)). The loss of 750V DC was the result of the OCS Electrical Supply System, High Speed Circuit Breaker (ESS HSCB) L1 (L1 signifies into the City Centre) Sandyford opening automatically due to the OCS breaking and short circuiting against the roof of Tram 5010. Driver 5010 also noticed the OCS was sagging and advised the Traffic Supervisor at the Luas Network Management Central (LNMC). The Traffic Supervisor viewed the images from the Close Circuit Television (CCTV) cameras located at the Stillorgan Stop and saw the OCS had broken and was lying across the top of Tram 5010, the outbound track and platform. The Traffic Supervisor instructed Driver 5010 not to open the passenger doors and to keep all passengers inside the tram until otherwise advised. The Supervisory Control And Data Acquisition (SCADA) system indicated that the section in the area of Stillorgan was de-energised. The Traffic Supervisor identified other trams operating in the vicinity of Stillorgan and requested they stop; which they did. Shortly afterwards, the Traffic Supervisor began attempting to reform service and requested that Service 88, Brides Glen to Parnell, (operated by Tram 5003) continue to Sandyford Stop and stop there. At approximately 14:37 hrs, Tram 5003 passed the Insulated Overlap (two OCS contact wires from two electrical sections which provide a continuous supply of power to the tram when the tram passes from one section to the next and also allows for de-energising of one section at a time) between Sandyford and Central Park. As the pantograph head of Tram 5003 traversed the Insulated Overlap, the pantograph bridged both contact wires and electrically connected the two sections together, re-energising the section at Stillorgan where Tram 5010 was located. The re-energising of the section at Stillorgan resulted in a second short circuit between the OCS wire and the roof of Tram 5010. The second short circuit resulted in HSCB L2 (L2 signifies out of City Centre) Sandyford and HSCB L1 Glencairn also tripping out due to overcurrent. The On Tram Data Recorder (OTDR) download was requested by the RAIU but the data relating to the incident was overwritten and not available as Transdev had not downloaded the data post-incident.
Number of recommendations made	5
Recommendation 1 (202106-01)	Transdev, along with S2M, should conduct a full review of their inspection processes for Overhead Contact System (OCS) wires to ensure pre-cursors, likely location and faults with the OCS are referenced.
Action/s taken/ in progress	Awaiting Evidence.
Status	Open/In progress.
Recommendation 2 (202106-02)	Transdev should conduct a full review and update of their dewirement/ incident management documents, to ensure that dewirement incidents are fully addressed, in particular in relation to zone identification for de-energised sections of track in the event of an incident. These documents should then be fully briefed to the Traffic Supervisors.
Action/s taken/ in progress	Awaiting Evidence.
Status	Open/In progress.

R202106
Luas Overhead Line Failure, Stillorgan, 2nd November 2020
(Report published 27th October 2021)

Recommendation 3 (202106-03)	Transdev should put a process in place that all trams involved in serious incidents have the On Tram Data Recorder (OTDR) downloaded as soon as possible to prevent overwriting of the data.
Action/s taken/ in progress	Dec 2021 – Update on action proposed to be taken.
Status	Open/In progress.

Recommendation 4 (202106-04)	Transdev should include the electrical resistance measuring of vehicle earth bonding in the planned preventative maintenance regime for all trams.
Action/s taken/ in progress	Dec 2021 – Update on action proposed to be taken.
Status	Open/In progress.

Recommendation 5 (202106-05)	Transdev should investigate the reason for the build-up of Cupric Oxide on the Overhead Contact System (OCS) wire. The investigation should include but not limited to: • Impact of longer trams, and congestion of trams in electrical sections. • Electrical resistance monitoring of tram to identify if high current demand is an issue. • Consequence of trams working in degraded mode on current demand. • The pantograph carbon bands and OCS interface.
Action/s taken/ in progress	Dec 2021 – Update on action proposed to be taken.
Status	Open/In progress.

R202107
Luas isolation irregularity, Kylemore to Suir Road, 5th January 2021
(Report published 16th December 2021)

Summary	A planned inspection of the Overhead Contact System (OCS), between Kylemore and Suir Road, was scheduled to occur, during a possession and isolation, between 02:00 hrs and 03:50 hrs on Tuesday 5th January 2021. As part of the planning process a Switching Programme Form was sent to the Traffic Supervisor (responsible for granting and receiving back possessions) located in the Luas Network Management Centre (LNMC) in the Red Cow. At 01:07 hrs on 5th January 2021 the Authorised Person (responsible for carrying out all electrical switching in order to apply or remove authorised isolations) phoned the Traffic Supervisor to enquire about the starting time for the planned isolation of the Kylemore to Suir Road section. The Traffic Supervisor asked the Authorised Person to give him a second as he was dealing with another request. When the Traffic Supervisor had completed the task, he contacted the Authorised Person and asked, "Looking for a little switch there Kylemore yeah?" (throughout the conversations a news broadcast could be heard playing in the background of the LNMC). The Authorised Person agreed and the Traffic Supervisor de-energised the Suir Road to Kylemore Road sections at 01:09 hrs. During this time, Tram 4010, the empty Service 24 (departing the Point Depot at 00:54 hrs and due to arrive at the Red Cow Depot at 01:33), had departed James's Stop on route to the Red Cow Depot. The location of all trams, including Tram 4010, was available to the Traffic Supervisor on the Automatic Vehicle Locating System (AVLS) but the Traffic Supervisor did not carry out a check of the screen. The Authorised Person and his team, at Kylemore, commenced the isolation process, including the placing of Isolation Signage, switching to local mode, removing the keys, testing the lines for conformation of de-energising and applying the Short Circuit Straps on both in Inbound and Outbound OCS at Kylemore. This process would also have to be repeated at the Suir Road ESS. Tram 4010 passed through Suir Road Outbound Stop at 01:14:50 hrs before engaging the Section Insulators located after Suir Road Stop approximately twelve seconds later. The pantograph of Tram 4010 bridged the energised Heuston section to the de-energised Kylemore section. The connection caused a large flashover and Tram 4010 lost power, resulting in the Main Circuit Breaker (MCB) opening in Tram 4010 and the Tram coming to a stop before Golden Bridge Stop. Driver 4010 contacted LNMC and advised the Traffic Supervisor of the loss of power. The Traffic Supervisor realised he had granted the de-energising of the Suir Road to Kylemore Road section without first checking that the line was clear of trams, through the AVLS. The Traffic Supervisor contacted Network Maintenance Centre (NMC) and requested the Authorised Person to contact him. The Authorised Person contacted the Traffic Supervisor and the section was re-energised at 01:19 hrs allowing Tram 4010 to continue on its journey to the Red Cow depot. The Traffic Supervisor did not immediately report the incident to the Transdev On-call Officer or log the incident on the Traffic Event Database (TED). The Traffic Supervisor did notify the Luas Duty Manager, by text, at 06:15 hrs after he had completed his shift at 06:00 hrs and left the LNMC premises; as a result no drugs and alcohol tests were carried out. As part of the initial investigation, the RAIU found that safety critical communications were, in part, causal to the incident. Consequently, the RAIU issued an Urgent Safety Advice Notice (USAN) on 1st March 2021 requesting that Transdev "should urgently undertake a review of their safety critical communications for all modes of communication".
Number of recommendations made	3

R202107
Luas isolation irregularity, Kylemore to Suir Road, 5th January 2021
(Report published 16th December 2021)

Recommendation 1 (202107-01)	Transport Infrastructure Ireland (TII), in conjunction with Transdev, should consider fitting Section Insulators with diodes to prevent the passage of current from an energised section into a de-energised section when bridged by a pantograph.
Action/s taken/ in progress	Awaiting Evidence.
Status	Open/In progress.

Recommendation 2 (202107-02)	Transdev should consider increasing the visibility of the Isolation Signage (through illuminating); as well as providing a means to secure the Isolation Signage (to prevent the signage being removed by unauthorised persons).
Action/s taken/ in progress	Awaiting Evidence.
Status	Open/In progress.

Recommendation 3 (202107-03)	Transdev should review and update the suite of documents related to earthing, switching, possessions and isolations to ensure that the documents are consistent in terms of the actions to be taken, referencing and terminology.
Action/s taken/ in progress	Awaiting Evidence.
Status	Open/In progress.

5.5 RAIU recommendations summary

For further details on the status of RAIU Safety Recommendations please consult the CRR's Annual Report to the Minister for Transport, which is available on our website, www.crr.ie.

It should be noted that many safety recommendations made by the RAIU may require strategic planning, engineering design, public consultation, planning permission and/or government funding, all of which may result in it taking several years to fully 'close' a safety recommendation.

6. REFERENCES

6.1 Documents Used

— CRR (2021) Annual Report

— Report on Railway Safety and Interoperability in the EU, 2022

— RAIU (2021) Annual Report.

7. GLOSSARY

BNM	Bórd na Mona
CRR	Commission for Railway Regulation
CSI	Common Safety Indicators
CWR	Continuous Welded Rail
DMU	Diesel Multiple Unit
DSS	Decision Support System
EB	Emergency Brake
ECM	Entity in Charge of Maintenance
ERA	European Union Railway Agency
IÉ IM	Iarnród Éireann Infrastructure Manager
IÉ RU	Iarnród Éireann Railway Undertaking
NIR	Northern Irish Rail
NSA	National Safety Authority
OTM	On Track Machine
RAIU	Railway Accident Investigation Unit
RPSI	Railway Preservation Society of Ireland
RRV	Rail Road Vehicle
RSIE	Rhomberg Sersa Ireland
RTC	Road Traffic Collision
SPAD	Signal Passed at Danger
SPAS	Signal Passed at Stop
TDLR	Transdev Dublin Light Rail
TII	Transport Infrastructure Ireland

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