AN COIMISIÚN UM RIALÁIL IARNRÓID
COMMISSION FOR RAILWAY REGULATION

RAILWAY SAFETY PERFORMANCE IN IRELAND 2022

CRR
AN COIMISIÚN UM RIALÁIL IARNRÓID
COMMISSION FOR RAILWAY REGULATION

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Foreword

The Commission for Railway Regulation is pleased to publish its Annual Safety Performance Report for 2022. 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.

With the COVID-19 pandemic somewhat behind us, 2022 saw passenger numbers increasing again on both the heavy and light rail networks. In the case of the Irish Railway network, blended working patterns have altered passenger numbers travelling during peak hours albeit there are now more discretionary journeys being made outside peak travelling times. Consequently, railway operators remain confident that passenger numbers will recover from the covid period. With significant investment in rail foreseen over the coming years in terms of new trains, stations, and services, there is optimism that Irelands railways will prosper in the coming decades.

In terms of safety performance, on the Iarnród Éireann network, sector safety performance continued to be consistent with previous years and with European statistics. However, tragically, there were several fatal injuries involving trespassers. There were also increases in the number of Signals Passed at Danger and train collisions with large animals, with deer continuing to be be the primary animal involved. As in previous years there were multiple occurrences involving road rail vehicles with two notable occurrences taking place. The first, in Tivoli, Cork involved a member of Irish Rail Staff being struck by a Road Rail Vehicle (RRV). The Iarnród Éireann employee became distracted and moved from a place of safety into the path of the moving vehicle. The RRV knocked them to the ground and drove over them. Fortunately, they sustained only minor injuries. Another, more serious accident occurred near Gort, Co. Galway. An Iarnród Éireann employee was walking past a machine when they came in contact with the RRVs hedge cutting equipment. They sustained serious injuries to their upper body. Both these occurrences serve as a reminder to all staff to ensure safe systems of work are established and followed, particularly when they are working in an environment where machinery is operating.

The other noteworthy occurrence in 2022 was the self-evacuation of a number of Dart Trains during the Bray Air Show. Comprehensive investigations were completed, and numerous recommendations were made which are currently being implemented.

Safety performance on the LUAS network was broadly consistent with previous years. There was a reduction in the number of tram contacts with pedestrians or bicycles to its lowest level in ~10 years. There was, however, 1 fatal accident involving a trespasser on the line. There were increases in the number of road vehicle collisions (tram and car), tram derailments and signals passed at stop categories. There was also a ~20% increase in the number of emergency brake applications which indicates tram drivers are encountering higher levels of pedestrian incursions and road vehicle red light infringements.

On a positive note, there were no passenger or worker fatalities on our railways in 2022.
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 Commission for Railway Regulation (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 2022 included Iarnród Éireann Infrastructure Manager, Iarnród Éireann Railway Undertaking, Transdev Dublin Light Rail (Luas Operator), Rhomberg Sersa Ireland, Translink (NIR), Transport Infrastructure Ireland, Bord Na Móna (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 remains broadly positive. For the third consecutive year the COVID-19 pandemic has had a tangible effect on the analysis of statistics. In this particular year, the removal of all restrictions in Q1 2022 has resulted in a marked increase in rail travel for the remainder of 2022, which in turn has led to the relative increase in reporting of certain safety indicators when compared to the previous two years.

There were no passenger fatalities in 2022. However, there were six fatal occurrences on the conventional railway network where trespass or suspicious death was indicated, and another single fatality of a person who was discovered on the railway network, but no train movements were involved. All of the above seven fatalities occurred on the Iarnród Éireann network. On the Dublin Light Railway (Luas) network there was a single fatality on the green line which was the result of a tram-pedestrian contact.

Iarnród Éireann saw a further increase in the number of train collisions, 90 in 2022 which is up from 74 in 2021. The data suggests this is being driven by collisions with large animals on the line. Iarnród Éireann have engaged with the Irish Deer Commission and are sharing data on deer strikes with them, with a view to improve the risk management of deer adjacent to the railway. Signals Passed at Danger (SPADs) have increased year-on-year for the first time since 2018, increasing 50% from 8 in 2022 to 12. Eleven of these SPADs involved Iarnród Éireann Railway Undertaking trains and Iarnród Éireann have commissioned an independent analysis on SPAD performance which is due for completion mid-July 2023. Another Railway Undertaking, Rhomberg Sersa Ireland, had one SPAD on the Iarnród Éireann network during track maintenance works.

Transdev's safety performance indicators saw an increase in road traffic collisions between trams and vehicles however the overall numbers remain significantly lower than pre-pandemic levels. The majority of collisions involved either a car breaching a red light or involved cars undertaking conflicting movements with trams. Tram Signals Passed at Stop (SPAS) have increased again year-on-year to 28, which is a five year high. The overall increase is primarily driven by increases on the red line. On a positive note, tram contact with a pedestrian/cyclist has decreased to 4 which is the lowest number since records began. Three of the four incidents were reported as minor in nature however one serious incident resulted in a fatality for the pedestrian involved.

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, Signals Passed at Danger (SPADs), wrong-side signalling failures, track buckles and broken rails. Recent European Union Railway Agency reports noted concerns regarding variations in accident precursor data collection practice between Member States. It is foreseen that further harmonisation of the data collection will be implemented in the future to improve data consistency and quality.

In 2022, the RAIU concluded 3 investigations. These resulted in 16 new safety recommendations, 10 directed to Transdev the Dublin Light Railway operator, 5 directed to Transport Infrastructure Ireland and 1 directed to Iarnród Éireann Infrastructure Manager. The RAIU also commenced 3 investigations in 2022.

1. INTRODUCTION

1.1 Introduction

This is the fourteenth 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. These safety performance indicators are based on the Common Safety Indicators (CSI) defined in EU Directive 2016/798 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 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 2022 is presented, while in Chapter 4 the safety performance of the Irish heavy rail system is reviewed in the context of European Union member states. This chapter also includes a brief overview of significant accidents that occurred worldwide in 2022. Finally, Chapter 5 concerns the Railway Accident Investigation Unit (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 Commission for Railway Regulation was established on the 1st of January 2006 under the Railway Safety Act 2005. 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 2022 Safety Performance and COVID-19

COVID-19 related restrictions continued in early 2022 and remained a factor influencing statistics, however, it was significantly less so than the preceding two years. As was the case in 2020 and 2021, certain indicators are skewed by the reduction in passenger numbers, vehicles interfacing with trams, etc. It is hoped that 2022 will be the last year whereby COVID-19 restrictions will have had a tangible effect on the statistics, although the post-COVID phenomenon of increased working from home may exert an effect for the foreseeable future.

There are several indicators that continue to be lower than pre-COVID times and it will take further years of analysis to identify which are positive results of improvements in safety and which are functions of the change in societal norms. Conversely, some indicators have increased somewhat significantly year-on-year, which can likely be attributed to the reopening of society in 2022 and removal of all COVID-19 restrictions from Q1 onwards. So, whilst positive safety indicators are still met with some caution, a similar level of caution is applied to those indicators which have performed negatively in 2022.

2. RAILWAY SAFETY TRENDS IN IRELAND

2.1 Introduction

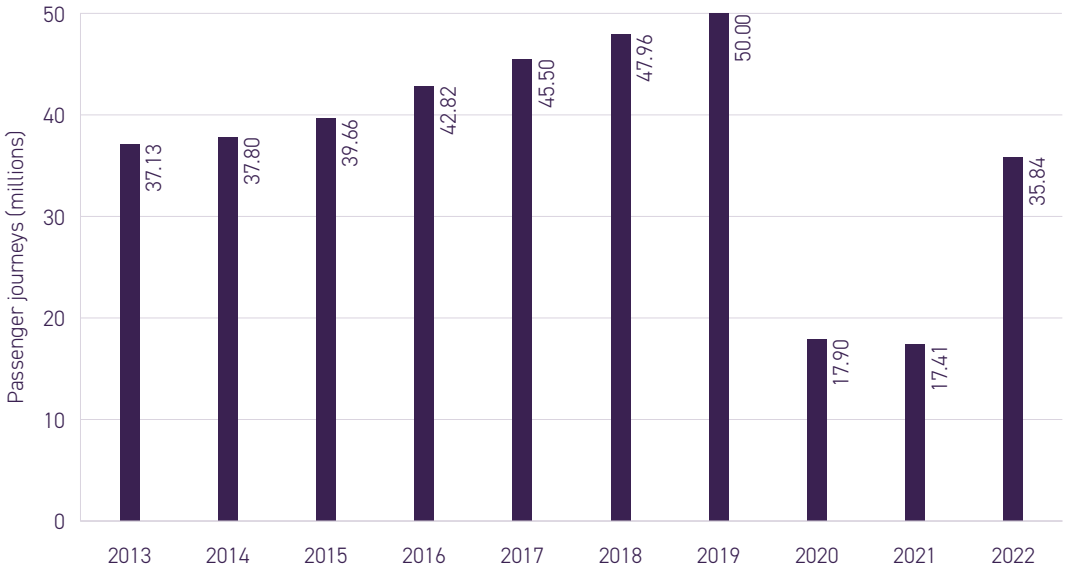
The safety performance of the Railway Organisations in the Republic of Ireland is considered for the four principal railway sub-sectors that the CRR regulates: heavy rail, light rail, public highway interfaces with industrial railway systems, and heritage railways.

2.2 Iarnród Éireann Railway (Ireland's Conventional System)

2.2.1 Operational statistics

At the end of 2022, the Iarnród Éireann – Infrastructure Manager (IÉ-IM) reported to the CRR that its operational network remained 1680 route-kilometres, or 2400 km of operational track based upon the Iarnród Éireann Network Statement for 2022.

Figure 1
IÉ Passenger journeys, 2013 – 2022



Passenger Journeys increased significantly in 2022 relative to the previous two years although they remain lower than pre-pandemic levels. The year was not entirely restriction free and working from home has become a norm for many workers throughout the country, therefore it is not surprising that the passenger numbers have remained low. It is anticipated that this figure will likely increase year-on-year going forward however may not reach 2019 levels again for some time.

Figure 2 shows that IÉ passenger train kilometres returned to a level more in line with pre-pandemic figures. The increase is approximately 9% from 2021 to 2022. When Figure 1 and Figure 2 are considered together it indicates that rail travel has returned to a timetable more in line with pre-pandemic levels however the return of passengers has been less so. That is not to say that passenger loading is lower globally across the network, there will be some passenger types which have reduced significantly more than others, for example, weekday commuters would be expected to be significantly down on 2019 figures whereas leisure passengers may be less so. The data reported does not however have the granularity required to investigate further.

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

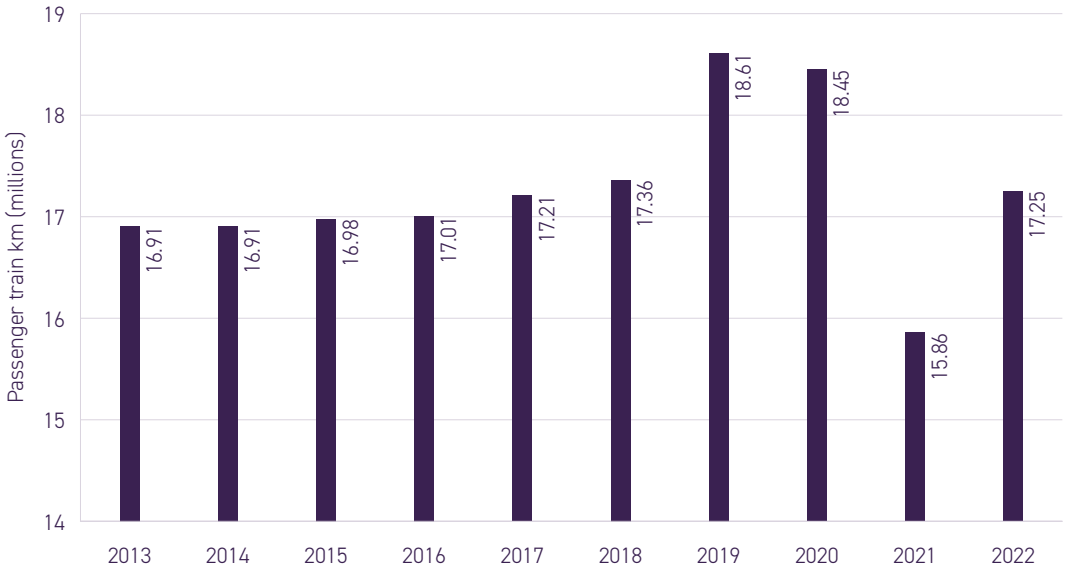
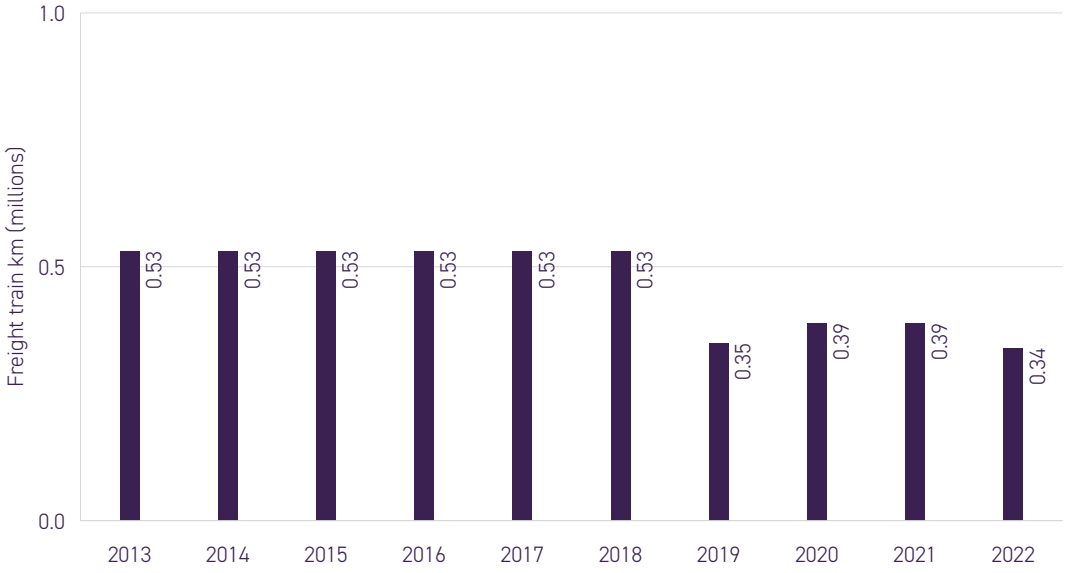
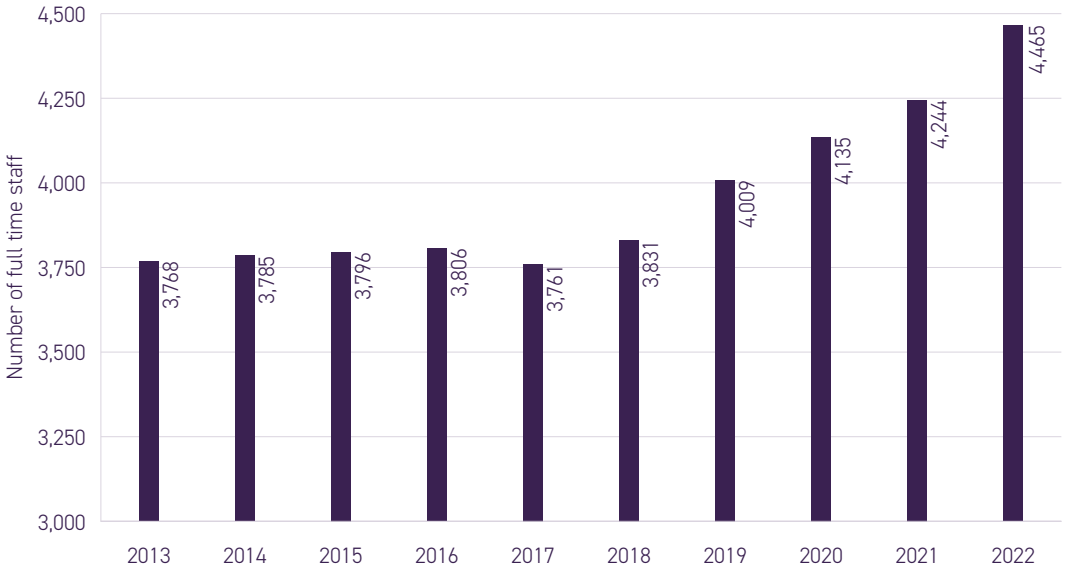


Figure 3
Freight train-km on the IÉ-IM network



Freight kms have decreased slightly to a level not seen since 2010. IÉ are currently working towards increasing freight utilisation on the network through its Rail Freight 2040 Strategy and therefore it is expected that this figure will increase over time.

Figure 4
Personnel engaged in full time employment with IÉ (2013 – 2022)



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 and is now at a level that has not been seen since the late 00'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. Statistics involving interfaces between passengers/visitors and Iarnród Éireann's trains and infrastructure have all increased which is a result of the significantly increased passenger numbers. It is of note that these increased statistics are still below pre-pandemic values (albeit the overall passenger numbers are also below pre-pandemic levels). It is also noted that some injuries (injury to customers or visitors to premises, to passengers attempting to board or alight from a train, or to passengers travelling on a train other than due to a railway accident) have significantly increased year-on-year, effectively doubling, which is proportional to the increase in total passenger numbers from circa 17 m to 35 m. This demonstrates that there is a strong relationship between overall passenger numbers and passenger-railway interface injuries. The reporting of injuries is non-weighted therefore little evaluation can be made at a regulatory level other than to consider that those statistics with a relationship to passenger numbers have remained stable.

Table 1
IÉ operational fatality and injury statistics by year (2012 – 2022)

Category	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22	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	
Fatal injury to passenger due to a train accident at level crossing	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	
Fatal injury to passenger attempting to board or alight from train	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	1	0	0	
Fatal injury to third party at a level crossing not involving a train	0	0	0	0	0	0	0	0	0	0	
Fatal injury to employee at a level crossing due to train in motion	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	
Fatal injury to employee not due to train in motion	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	
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	
Fatal injury to employee not due to train in motion	0	0	0	0	0	0	0	0	0	0	

Table 1
IÉ operational fatality and injury statistics by year (2012 – 2022)

Category	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22	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	
Fatal injury to customer or visitor, no train involved	0	0	0	0	0	0	0	0	0	1	
Fatal injury involving train in motion on railway or level crossing where trespass or suspicious death was indicated	4	6	2	5	12	9	4	7	5	6	
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	
Injury to passenger travelling on train due to railway accident at level crossing	0	0	0	0	0	0	0	0	0	0	
Injury to passenger attempting to board or alight from train	39	45	48	79	57	74	76	42	32	62	
Injury to passenger travelling on train, other than due to a railway accident	43	18	15	31	33	46	38	9	0	30	
Railway infrastructure: third party non fatal injuries											
Third party at level crossing injury involving a train	0	0	0	0	0	1	1	0	0	0	
Level crossing user injury not involving a train	1	0	0	0	0	1	1	2	1	2	
Railway infrastructure: non fatal injuries to other persons											
Injury to customer or visitor to premises	193	205	146	192	321	199	288	122	96	172	
Injuries to other persons including unauthorised persons	3	0	1	2	6	0	2	0	0	2	

Table 1
IÉ operational fatality and injury statistics by year (2012 – 2022)

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

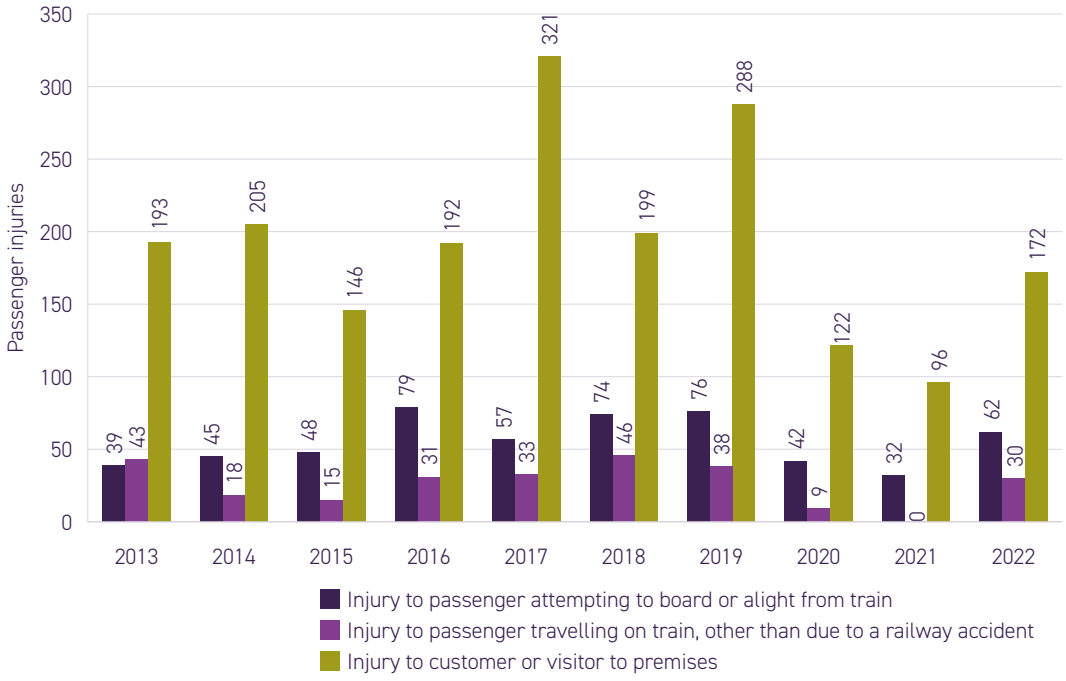
2.2.2.1 Fatal injuries

There was a single fatality of a visitor to railway property reported to the CRR in 2022. This was not a railway related incident. Tragically, there were a further 6 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 2022 this was no different. Thirty injuries were reported by passengers travelling on a train in 2022 which is an increase (from zero) that is in line with the total passenger numbers for the year. As explained earlier, the increased passenger journeys are very likely a factor in the increase of injuries to passengers travelling on a train, other than due to a railway accident, and Figure 5 demonstrates how they still remain within reasonable levels when the past ten years are taken into consideration.

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.

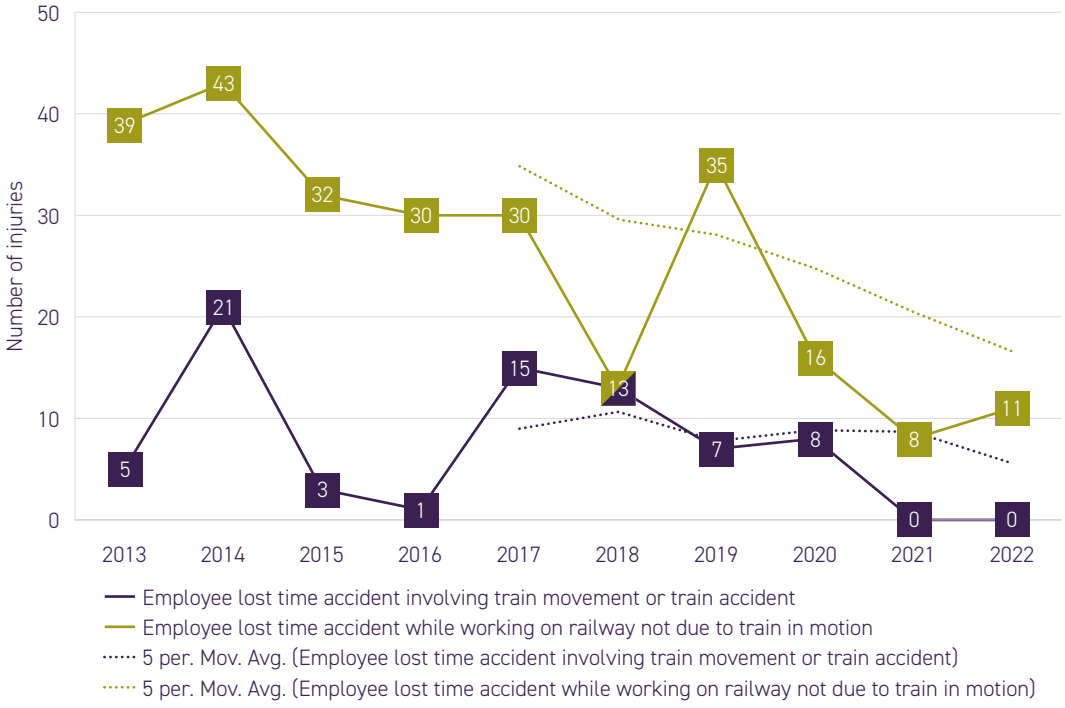
Injuries to persons (customers or visitors) on railway premises remain the largest single group with slips, trips and falls of various sorts being the dominant cause of these injuries.

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)



Despite a slight increase in 2022, Railway Operations incidents continued to reduce to record lows when the numbers are averaged over a 5-year period.

Railway Infrastructure accidents (Figure 7) has returned to a value more in line with the recent flat trend and the Infrastructure Manager has introduced a number of safety initiatives in 2022.

The IÉ-RU Entity in Charge of Maintenance has also had a reduction in accidents, which continues a recent downward trend. As with other injury statistics, these are quite low relative to the size of the operation involved so it is welcome to see that all three sectors are continuing to improve when reviewed by moving average.

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

Figure 7
Employee injury statistics by year (railway infrastructure)

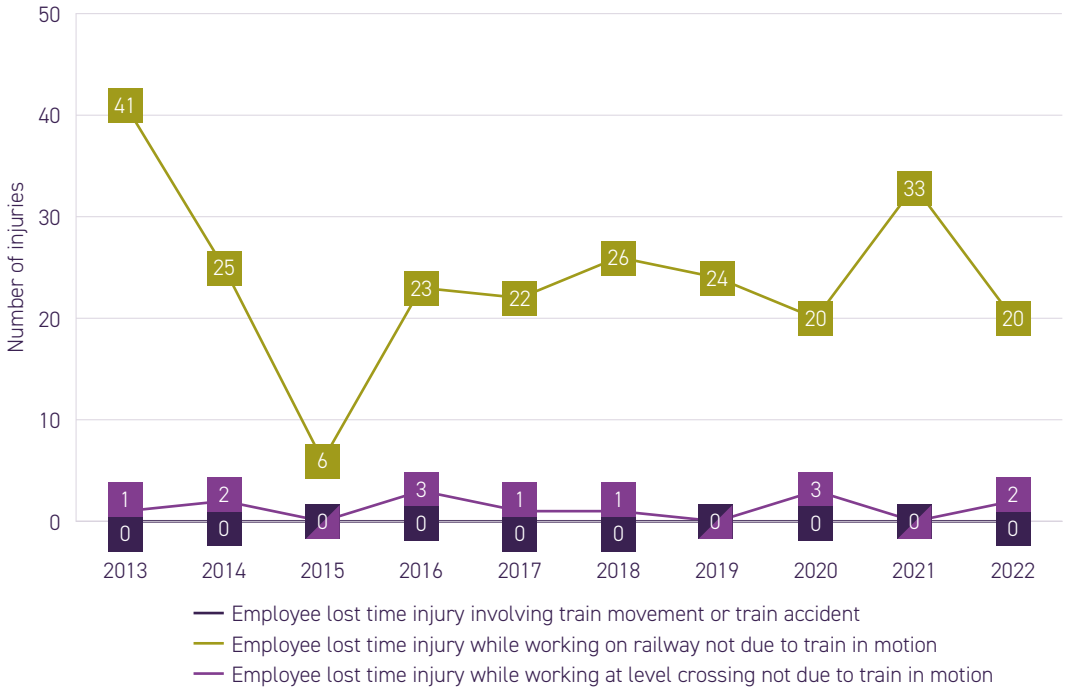
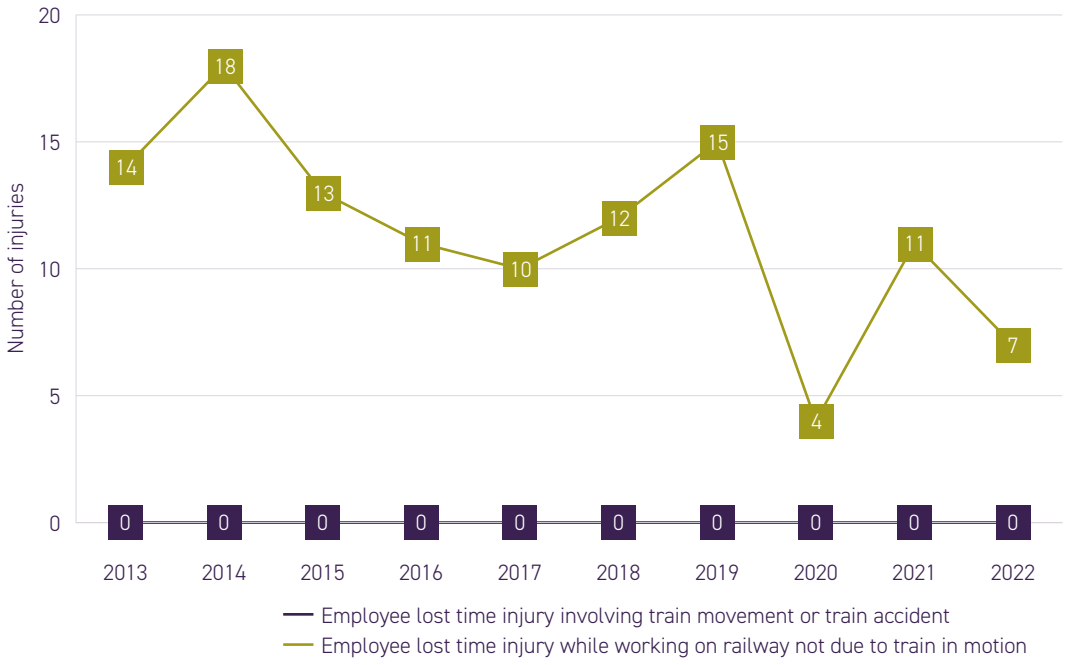


Figure 8
Employee injury statistics by year (IÉ-RU ECM)

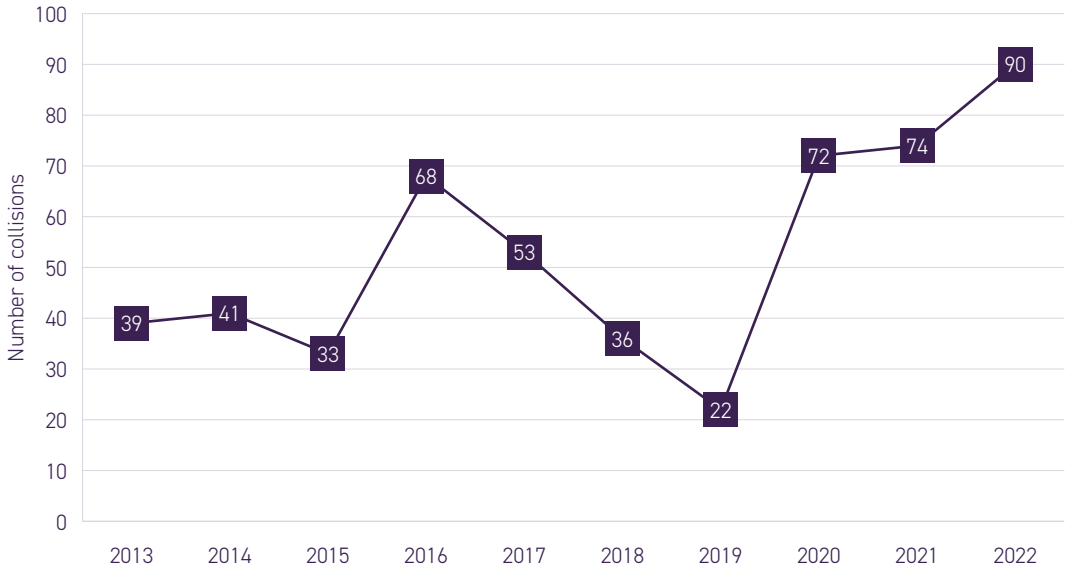


2.2.3 Iarnród Éireann operational incident statistics

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 marked increase this year on what was already a historically high number.

Figure 9
Total collisions by year



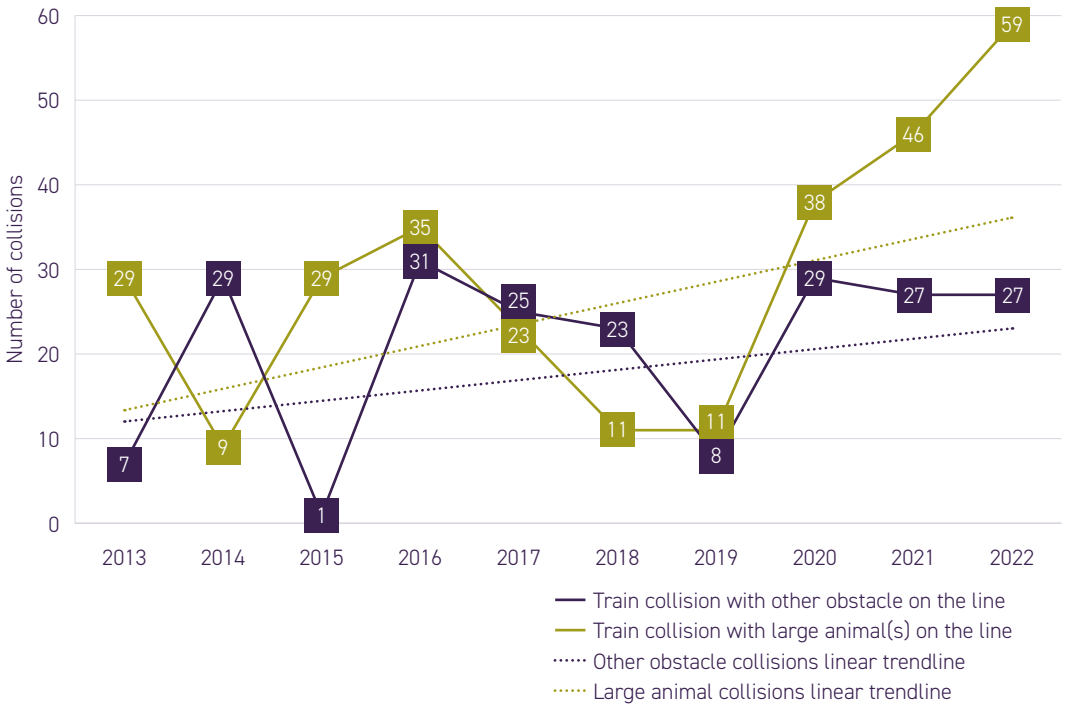
The data provided shows 2022 was another year with a high number of collisions. Large animals are the category driving this observable increase over the past three years.

The specific large animal driving this increase has been deer, where Iarnród Éireann's primary mitigation has been the erection of deer fencing. This is an activity that is carried out on an annual basis. In addition, Iarnród Éireann have been engaging with the Irish Deer Commission and are sharing data with them with a view to better manage the risk of deer adjacent to the railway line.

Table 2
Train collision statistics detail by year, part 1

Category	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22	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	2	1	1	4	1	4	
Train collision with a motor vehicle at a level crossing	1	2	0	0	3	1	2	1	0	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	1	0	0	0	0	0	0	0	
Train collision with road vehicle obstructing the line (not at a level crossing)	1	0	1	1	0	0	0	0	0	0	
Train collision with other obstacle on the line	7	29	1	31	25	23	8	29	27	27	
Train collision with large animal(s) on the line	29	9	29	35	23	11	11	38	46	59	
Total	**39**	**41**	**33**	**68**	**53**	**36**	**22**	**72**	**74**	**90**	

Figure 10
Train collision statistics detail by year, part 2

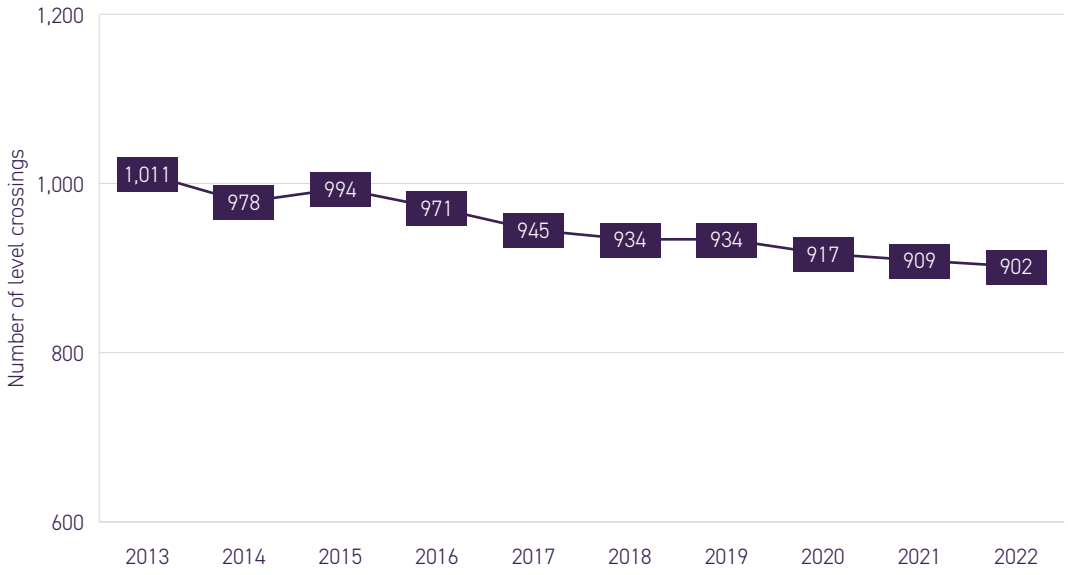


2.2.3.2 Level crossings

Level crossings remain a significant risk to the railway system and to level crossing users of all types. There were no fatal accidents at a level crossing in 2022, which continues an ongoing trend over the past ten years.

Another ongoing trend, as shown in Figure 11 and Figure 12, is the decrease in the number of level crossings; down from some 1011 level crossings in 2013 to 902 in 2021. Figure 11 illustrates the total number of level crossings on active lines.

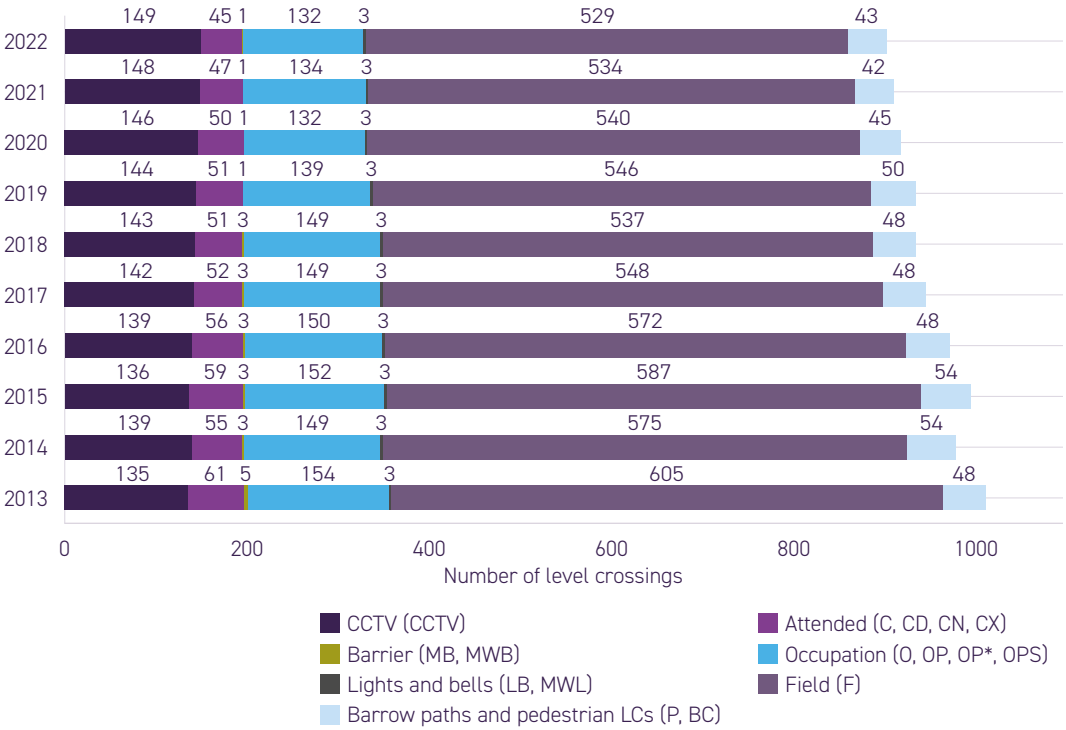
Figure 11 Number of level crossings by year



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. There was a total of 27 DSS type crossings operational at the end of 2022 which is up 19 from the previous year.

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 2022 CCTV type crossings have increased by 15%, Attended crossings have reduced by 38%, Occupation crossings have reduced by 14% and Field crossings have reduced by 17%. The rate of removal of crossings is also increasing slightly over a rolling ten years, indicating that efforts to reduce the numbers are being sustained.

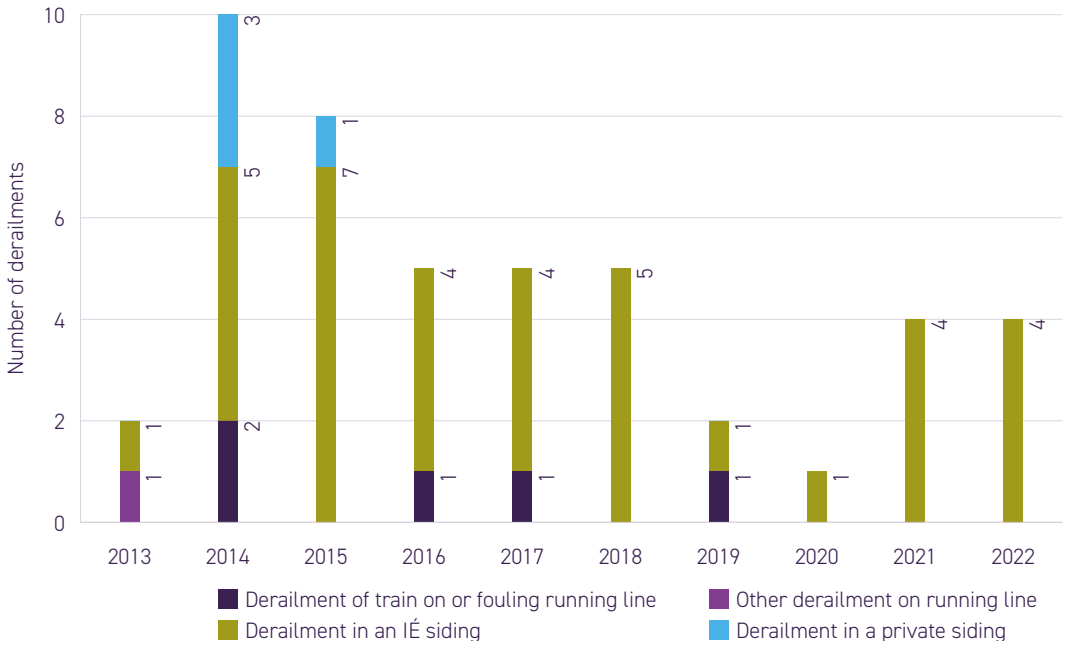
Figure 12
Level crossings by type in Ireland



2.2.3.3 Train derailment

The number of train derailments remained unchanged at 4 for 2022 (Figure 13). The derailments were either located within sidings (off of the running line) or within possessions (track isolated from passenger service during maintenance). The causes for these derailments ranged from track geometry in the sidings to operator error during possession movements.

Figure 13
Train derailments by year



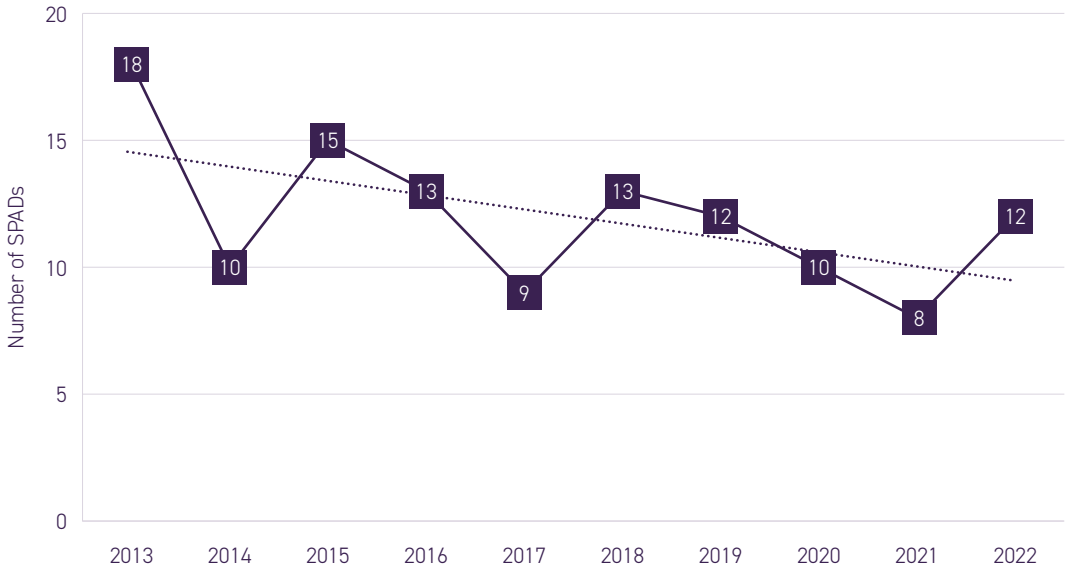
2.2.3.4 Signals Passed at Danger (SPAD)

IÉ-IM define a SPAD as an event where a part of a train proceeds beyond the limit of 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. In 2022, the number of SPADs increased to 12 (from 8 in 2021) which is the first increase in 4 years. Although the trend remains on a downward trajectory when previous years' performance is considered, the increase is nonetheless unwelcome. IÉ have commissioned an independent analysis on SPAD performance which is due for completion in mid-2023.

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. One of the IÉ SPAD's that occurred in 2022 was risk ranked as 'high', two less than in 2021 although even a single SPAD of this level is considered unacceptable.

Rhomberg Sersa Ireland, another regulated entity which carries out on track maintenance, was involved in 1 SPAD in 2022 on the IÉ network. The incident was attributed a root cause relating to non-application of IÉ rules.

Figure 14
IÉ SPADs by year



2.2.4 Iarnród Éireann rolling stock incidents

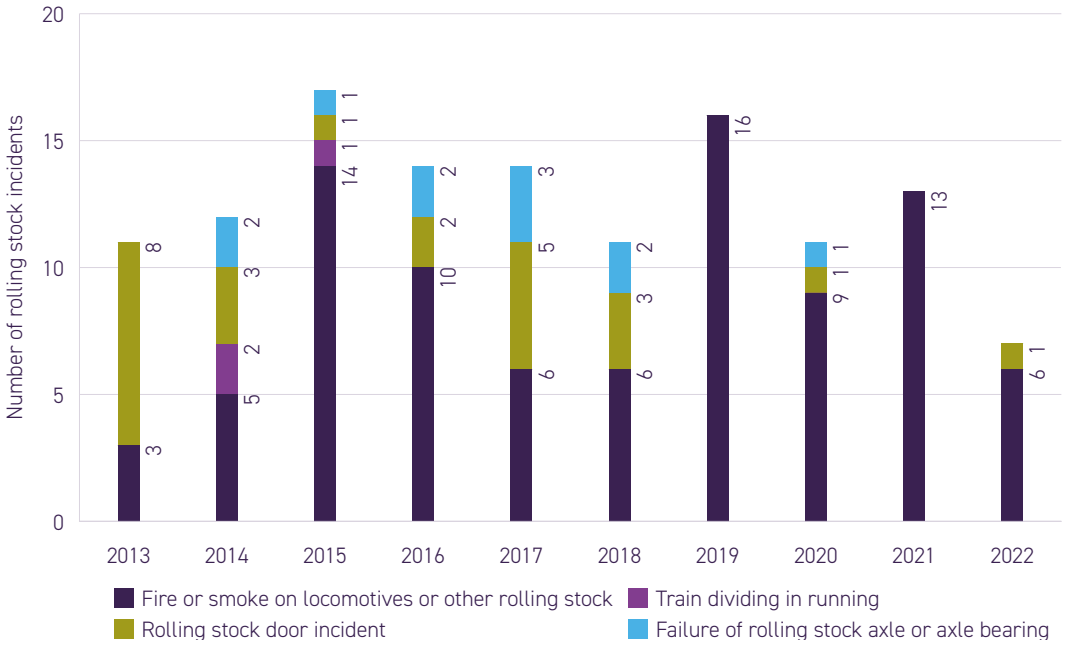
Iarnród Éireann operates several different fleets in provision of rail services and there were no changes to these in 2022. The IÉ-RU fleet include:

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

Figure 15 Rolling stock incidents by year



Fire and smoke related incidents remained the dominant incident type reported in 2022, 1 incident of fire was reported and 5 reported as smoke. Whilst the 29000 DMU remained the most prolific of the rolling stock involved in fire/smoke incidents (with 3 incidents in 2022) this is down considerably on previous years. The rolling stock type and failure mode varied such that there is no particular trend identified in 2022. When reviewed over a number of years the incident rate remains somewhat static for all rolling stock types whereby some rolling stock types, by virtue of their design, are more prone to having reliability issues manifest as smoke or fire.

The single rolling stock door incident was fully investigated by IÉ and found to be the result of a failure during maintenance whereby the correct instructions were not applied by an external contractor.

2.2.5 Iarnród Éireann infrastructure incidents

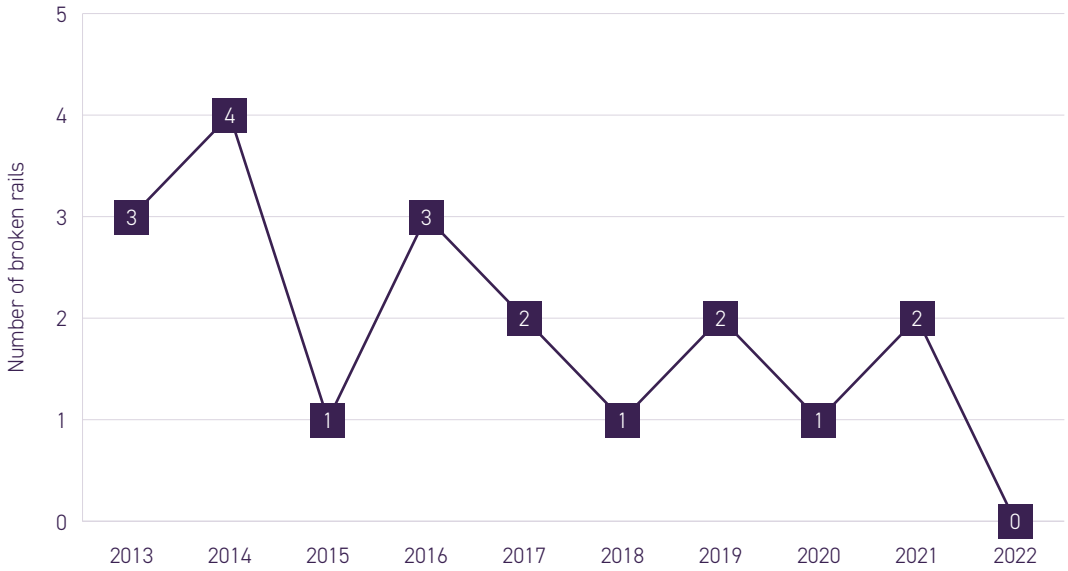
The IÉ-IM network, as detailed in its Network Statement, currently extends to approximately 1,680 route kilometres (km) or 2,400 km of operational track and includes c.4,440 bridges, c. 1,100 point-ends, c.902 level crossings, 145 stations, 3,300+ cuttings and embankments, 372 platforms and 13 tunnels. 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

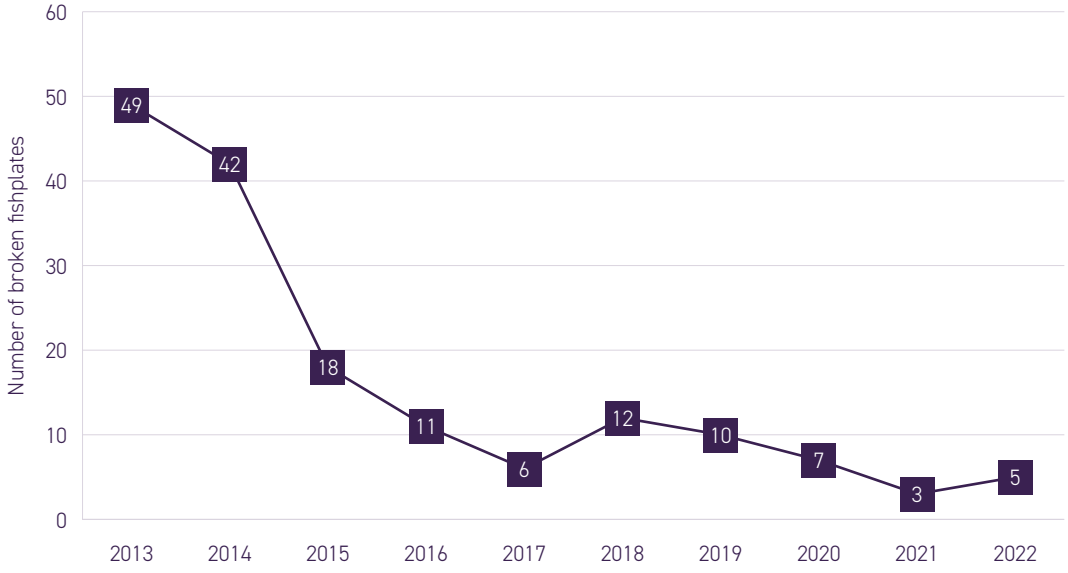
IÉ-IM personnel visually inspect the entire track and its associated assets at least once per week. Engineers for the Infrastructure Manager are also required to inspect the track several times each year using a dedicated Inspection Car. The rails themselves are ultrasonically tested at least every 2 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 2022, there were no broken rails reported which is a welcome milestone, the first such instance since reporting began in 2003.

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 maintained a historically low level albeit the number of incidents has increased year-on-year to 5 from a record low of 3 (Figure 17). Three consecutive years at single digits indicate that this risk is being managed consistently and effectively.

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.

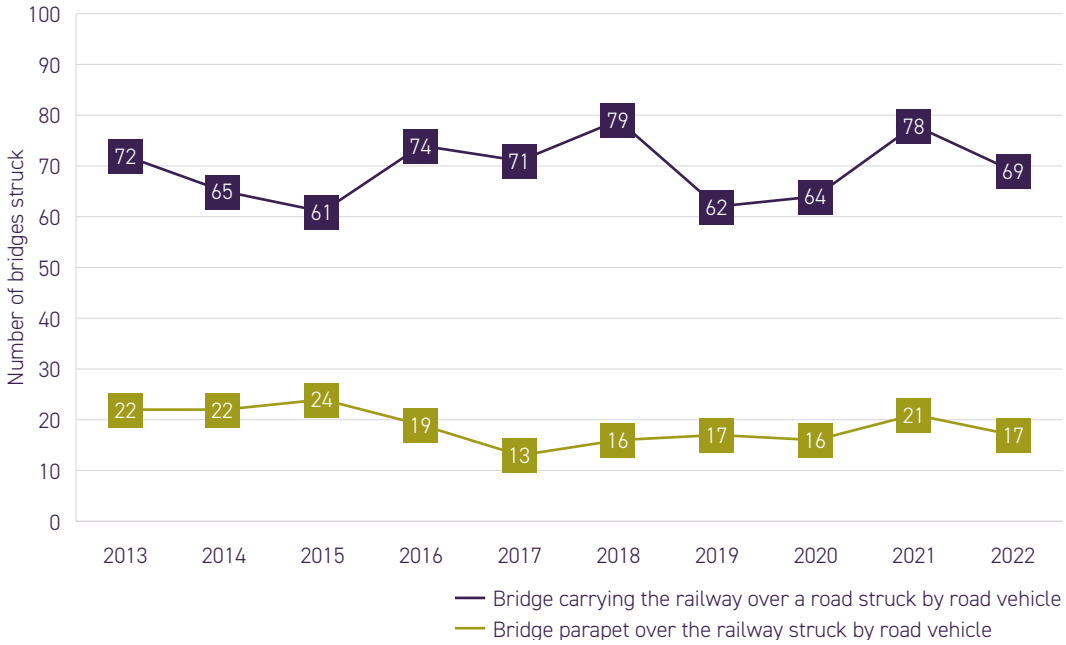
2.2.5.2 Bridge strikes

There are in excess of 4400 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 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



The number of bridge strikes reduced in 2022, in both category of bridges. The reduction has brought the total number of bridge strikes to a level more in line with the flat trend of c.90 strikes per year. As has been previously reported, some bridges are more susceptible to strikes than others and these are well known to IÉ, although the risk control measures can be reasonably complex to implement, involving planning and coordination with local authorities.

A system had been commissioned for IÉ in 2020 which assists in diverting over-height vehicles away from Amiens Street Bridge, a particularly vulnerable bridge in Dublin City Centre.

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 needed 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 RRVs. 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 settings.

Over the past number of years, there has been several incidents involving RRVs. These have included, RRV derailments, RRVs damaging track infrastructure, RRVs injuring track workers and even a small number of incidents in which an RRV has over-turned. In 2022, there were 16 incidents reported to the CRR involving RRVs. These included 8 derailments, 4 collisions, 1 points run-through (infrastructure damage), 1 incident of an RRV being on the live railway before a safe system of work was established, 1 incident of a hedge cutter colliding with a trackworker and a particularly serious case whereby an RRV ran over an Engineer who, luckily survived with only minor injuries.

This area was subject to particular focus by the CRR in 2022 in its supervision activities.

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 and have done since 2019. RSIE have been issued a safety certificate by the CRR to operate on the Irish railway network.

In 2022, RSIE report that they have 62 staff employed. RSIE does not operate any passenger services and completes most of its operational activity at night, outside of peak and daytime periods. RSIE state that their fleet operated 91569 train kilometres for the OTM fleet in 2022, down 5% from 2021.

Table 3 shows the reported occurrences for RSIE in 2022. No Derailments or Collisions were reported. One SPAD was reported by an RSIE OTM which was attributed a root cause relating to a failure to apply IÉ network rules. The amount of Railway Infrastructure Incidents increased to 10. It was reported that minor damage was observed in incidents concerning OTM component collisions with objects such as temporary fencing, platform ends, and marked/unmarked buried objects during tamping. Occupational injuries were reported to be minor and did not result in lost time.

Table 3
OTM occurrences

Occurrence	2019	2020	2021	2022
SPAD	2	1	0	1
Derailments	0	2	0	0
Collisions	1	0	0	0
Minor occupational injuries	1	3	4	5
Rail infrastructure damage incidents	3	8	6	10

2.4 Transdev (Luas) statistics

The Dublin Light Railway System, or 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, 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 of two lines, the Red Line which is 20kms in length and has 32 Stops and the Green Line which is 24.5km in length and has 35 Stops. The passenger journeys in 2022 effectively doubled on 2020/2021's unprecedently low numbers due to the removal of COVID-19 restrictions in Q1 2022. Tram kilometres travelled continued to drop slightly, with 4.13 million reported in 2022 versus 4.27 million in pre-pandemic 2019 (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 contrasts with 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). Despite the removal of COVID-19 restrictions in early 2022 a reasonably low number of road vehicle collisions have been reported which suggests potential improved performance by Transdev. Although there may have been residual effects of the restrictions suppressing the number of interfaces with the trams longer into 2022.

The majority of incidents involved conflicting movements between vehicles and trams at junctions or vehicles breaching red lights. As was the case with 2021, the collisions are somewhat evenly distributed among the red and green line which is a recent trend. It is also noted that the number of collisions at the outer regions of the city have increased relative to collisions in the city centre.

Figure 20
Number of road vehicle collisions involving a tram

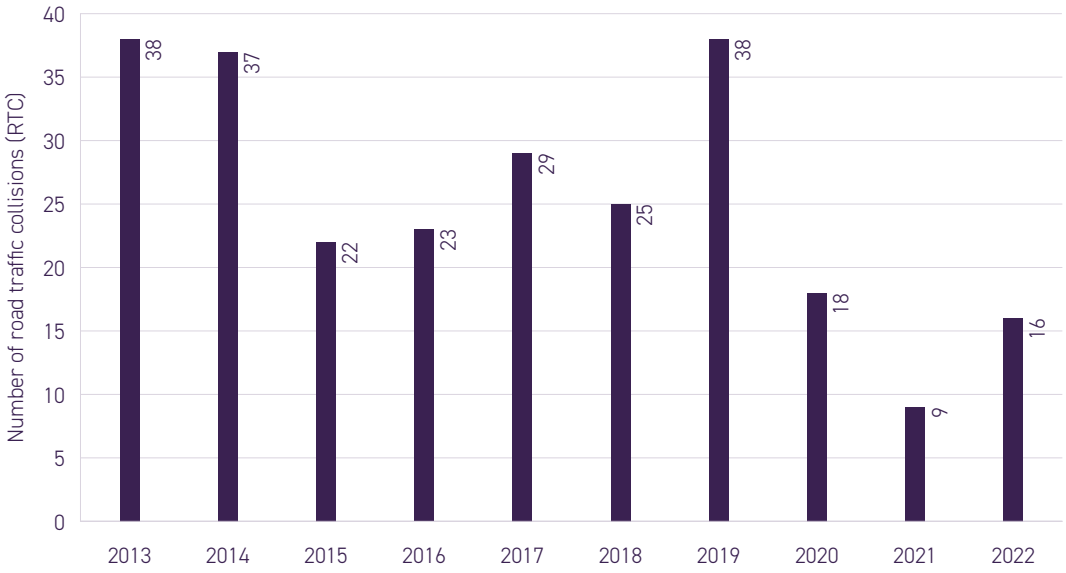
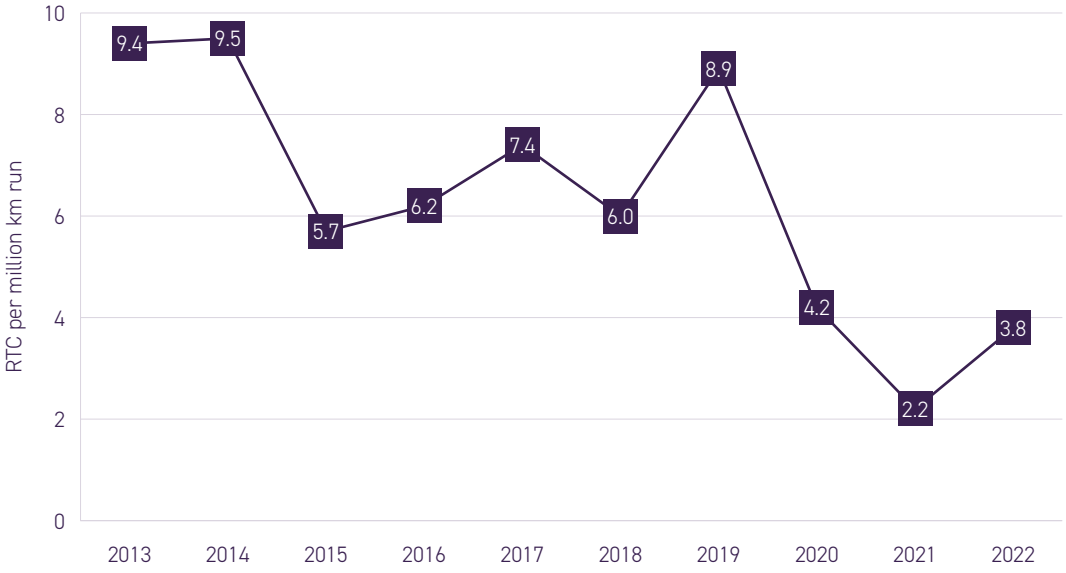


Figure 21
Road vehicle collisions per million km run

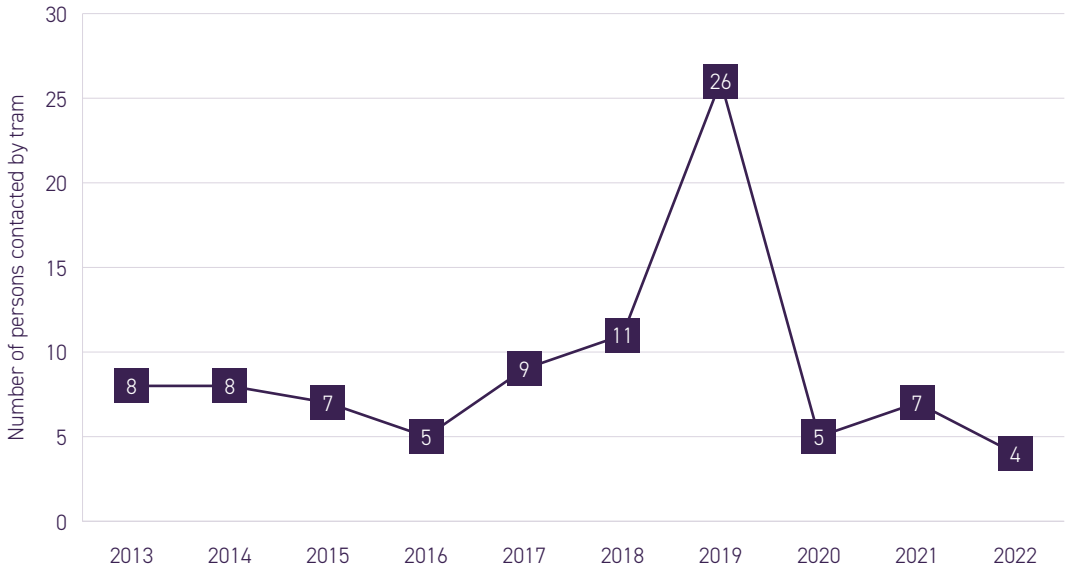


2.4.2 Tram contacts with people and cyclists

Tram contact with a pedestrian/cyclist has decreased to 4 which is the lowest number since records began. Three of the four incidents were reported as minor in nature however one serious incident resulted in a fatality for the pedestrian involved.

Two incidents involved cyclists breaching red lights. One incident involved a pedestrian stepping off the footpath and the other was a collision between a tram and a pedestrian who was trespassing on the track which sadly resulted in a fatality.

Figure 22
Persons coming into contact with tram

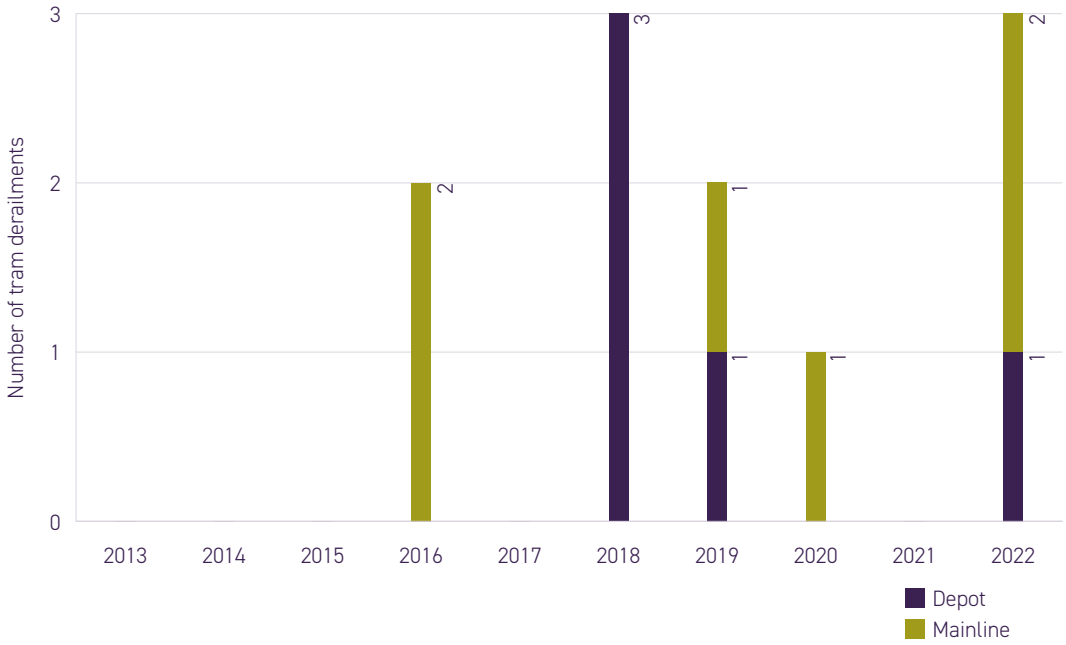


2.4.3 Tram derailments

There were two derailments on the mainline in 2022. One was attributed to a defective set of points and the other was due to a process failure during a maintenance movement. The first incident involving a defective set of points was also found to technically be a SPAD as the signalling system displayed a restrictive aspect, however the driver continued through the restriction and subsequently derailed. The second incident involving a maintenance movement was the result of a combination of human errors which led to a tram derailing when it was transferring from the Red line to the Green line.

Both failures represent potential precursors to more serious incidents and Transdev have investigated both for cause with a view to improving their systems and processes.

Figure 23
Tram derailments



2.4.4 Signals Passed at Stop (SPAS)

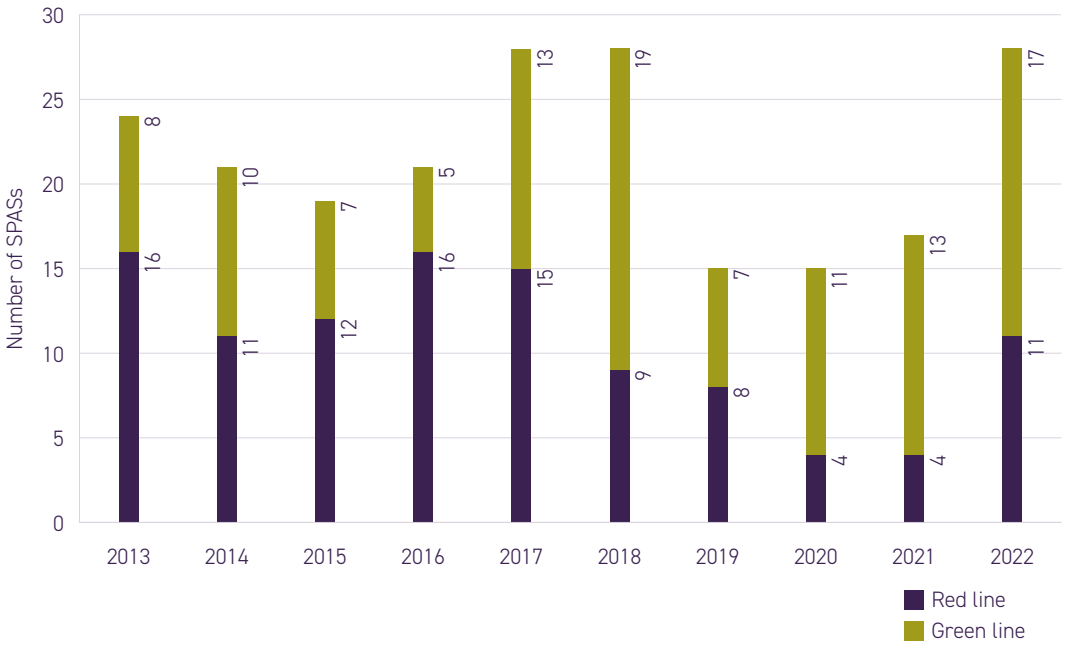
A SPAS on the LUAS network is where a tram has passed a stop signal without authority. SPAS are a particular precursor event that the CRR monitors regularly during its supervisory meetings with Transdev. 2022 was a particularly bad year for SPAS on the LUAS network with the number increasing on both lines to levels not previously seen since 2018 (Figure 24).

The level of risk associated with any given SPAS is not assessed by Transdev and therefore the picture regarding the level of risk associated with the incidents is not entirely clear. In October 2022, the Railway Accident Investigation published their trend investigation into SPAS on the LUAS network. One recommendation following from the investigation is that Transdev introduce a risk scoring process for SPAS on the network.

The SPAS reported are also mostly those which have been detected at Line Signalling System locations, which is only located in a small part of the network. For the majority of the network there is no system in place to detect SPAS incidents and Transdev are reliant on drivers being aware of their SPAS to self-report them.

The RAIU trend investigation resulted in a total of fifteen recommendations for Transdev or Transport Infrastructure Ireland to address and it is anticipated that these recommendations will result in better data quality on this topic.

Figure 24
Red and Green line tram SPAS



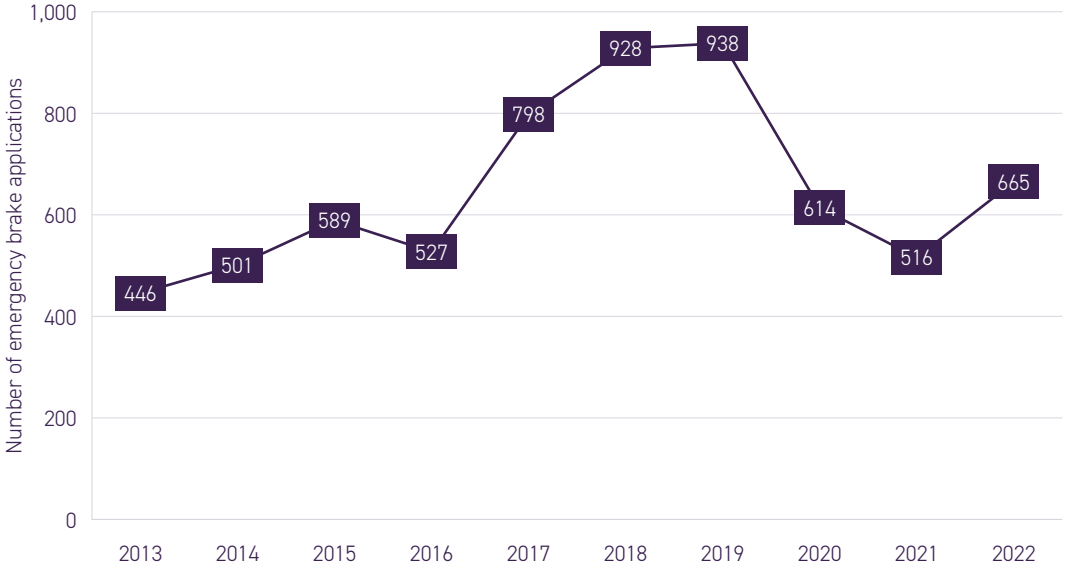
2.4.5 Tram emergency brake applications

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 2022, there was a total of 665 EB applications, which is the first increase in this figure since 2019. TDLR figures note that 214 of these are due to technical/other issues with the tram or its operation and the remaining 451 attributable to cyclists/pedestrians/vehicles.

Whilst the Technical/Other applications has remained static at c.200 per year, the number due to other road users has increased approximately 50% on the previous year. As was the case with the increase in collisions, consideration must be given to the increase in interfacing road users since the removal of Covid-19 restrictions. When broken down on a month-by-month basis it becomes clear that the number of EB applications per month has been steadily increasing throughout the year. This indicates that there may still be residual effects of Covid-19 reducing the amount of interfacing vehicles with trams on the road. As the months progress into 2023 and onwards it is expected that this number will flatten out somewhat.

Figure 25
Tram emergency brake applications



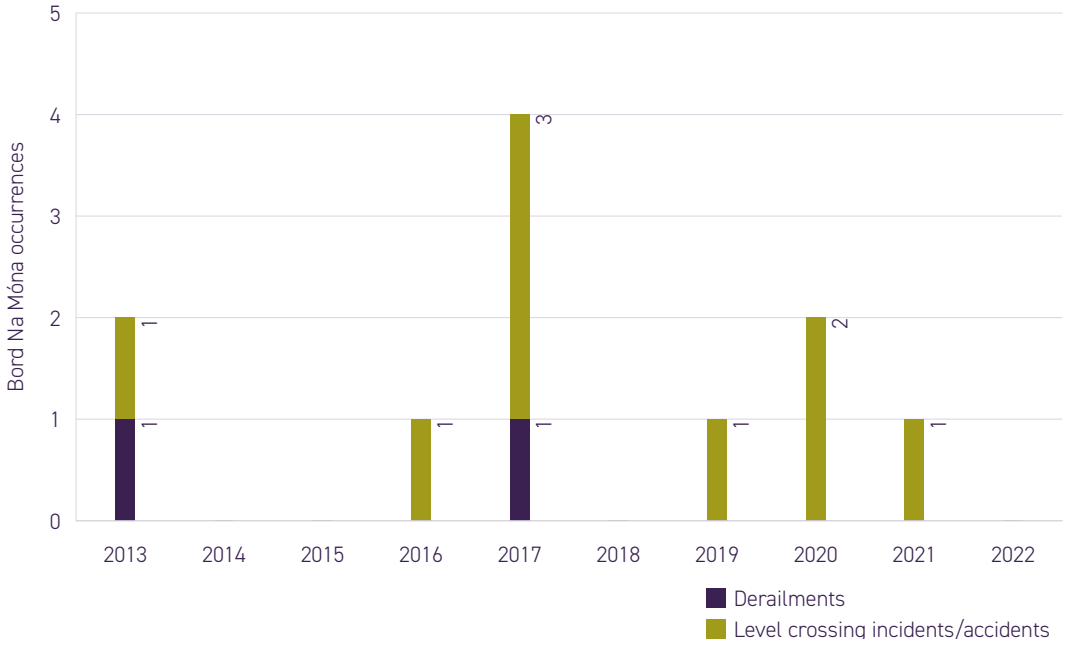
2.5 Bord Na Móna industrial railway statistics

The CRR's remit in terms of its oversight of Bord Na Móna's (BNM) industrial railway is limited to where it interfaces with public roads. While it has 515 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 is involved. In terms of key infrastructure statistics there are 99 level crossings, of which 54 are operational, and 52 underbridges.

The operational figures have been steadily reducing as BNM transitions away from solid fuel production. Operational level crossings have reduced from 90 to 54 and track has been reduced by 42km since 2020. It is expected over the coming years that the operational level crossings and track kilometres will reduce significantly after peat movements by rail cease in 2023.

Bord Na Móna reported no incidents or occurrences in 2022.

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)
- Cavan and Leitrim Railway
- Midlands Great Western Railway.

Several heritage railways recommenced operations in 2022 and were subject to CRR supervision. Difflin Lake Railway reported one collision between a locomotive and a stationary carriage. The incident was low speed and was due to the locomotive driver misjudging their braking distance during shunting.

2.6.1 Railway Preservation Society of Ireland (RPSI)

The RPSI are not a self-contained heritage railway and 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 risk-based 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.

The RPSI returned to mainline operations in 2022 and ran approximately 2,937 miles (4,727 km) carrying 14,043 passengers. Whilst the number of passengers returned to pre-COVID levels the mileage ran was significantly lower that previously achieved up until 2019.

The RPSI reported a single incident which involved a passenger receiving a cut finger requiring local first aid.

3. PUBLIC REPRESENTATIONS

3.1 Introduction

The CRR uses many inputs to undertake risk-based supervision activity. One source of information are representations received from the public, be they passengers or otherwise. 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) with whom there is a memorandum of understanding. Should issues be raised related to passenger services, rather than safety, 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.

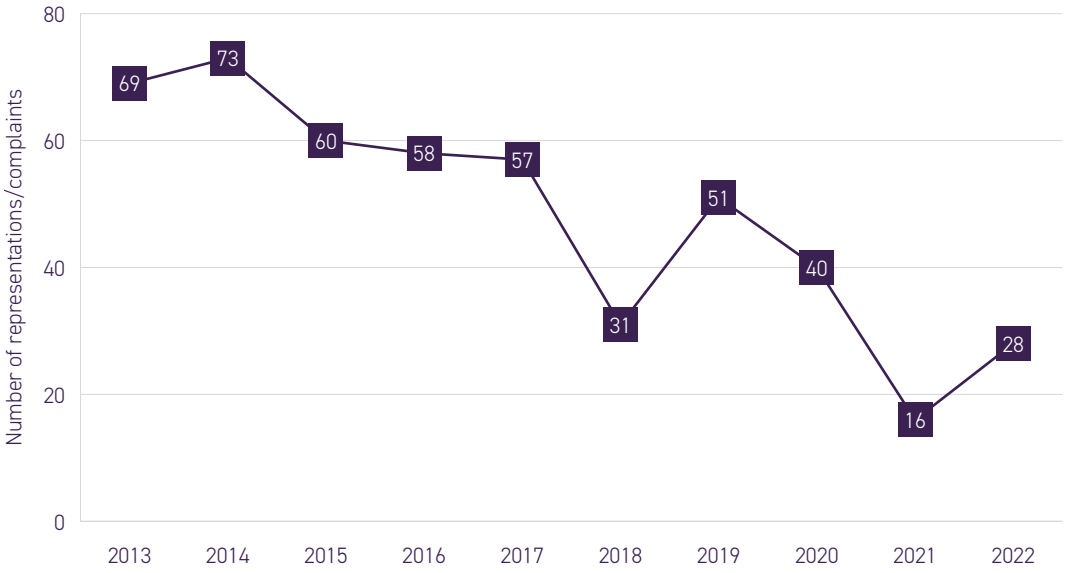
3.2 2022 data and commentary

In 2022, the CRR received 28 representations relating to a range of safety issues, from heavy to light rail, infrastructure to rolling stock and heritage railway safety matters (figure 27). The figure remains 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 details).

The number of safety related representations has increased since the change to data reporting in 2021 although some representations in 2022 are related to the same concern/observation/ incident multiple times over which makes the real increase appear slightly more significant.

Of the 28 representations received in 2022, 20 related to IÉ-IM or IÉ-RU and 8 related to the LUAS system. 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



Representations from 2022 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 noise, carriage alignment 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/complaints by category are shown in Figure 28. The primary focus of the CRR is with the 28 safety related representations. These representations ranged from areas of corrosion on trains and noise concerns, to the overheating of carriage interiors during hot weather.

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

European Union legislative packages adopted by the European Council define the CRR 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, have a legal obligation to report to the Agency a set of defined data that can be used to assess the development of railway safety in the Single European Railway Area (SERA). Every year each NSA submits their annual report on 'Common Safety Indicators' or CSIs 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 consider 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 2021 reporting period and, in the case of major accidents, up to February 2022. Definitions for data categories used, where not stated, can be found in the document 'Implementation Guidance for CSIs', which is available on the ERA website.

The results of the assessment of CSI's carried out by the ERA indicated year-on-year increases for some headline figures (significant accidents, serious injuries) in the SERA for 2021, noting however that the previous year (2020) was impacted by the COVID-19 pandemic in terms of rail/traffic volume. Despite this apparent drop in performance (most likely due to the aforementioned reasons), based on the available data to date, the safety level of the European Union railway system remains high and is one of the safest railway systems in the world[2].

4.1.1 Significant accidents and their outcomes

The railway safety directive (Directive (EU) 2016/708) 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 2021 (the most recently available dataset), there were 1389 significant accidents resulting in 683 fatalities and 513 serious injuries within the European Union (Figure 29). The annual number of significant accidents, despite increasing in 2021 continues on a downward trend when considered over the 10 years leading to 2021.

2. This comment is made on the basis of validated CSI statistics reported by ERA which are for 2021 and partially for 2022.

Figure 29
Significant accidents, fatalities, and serious injuries of EU 27, 2010 – 2021

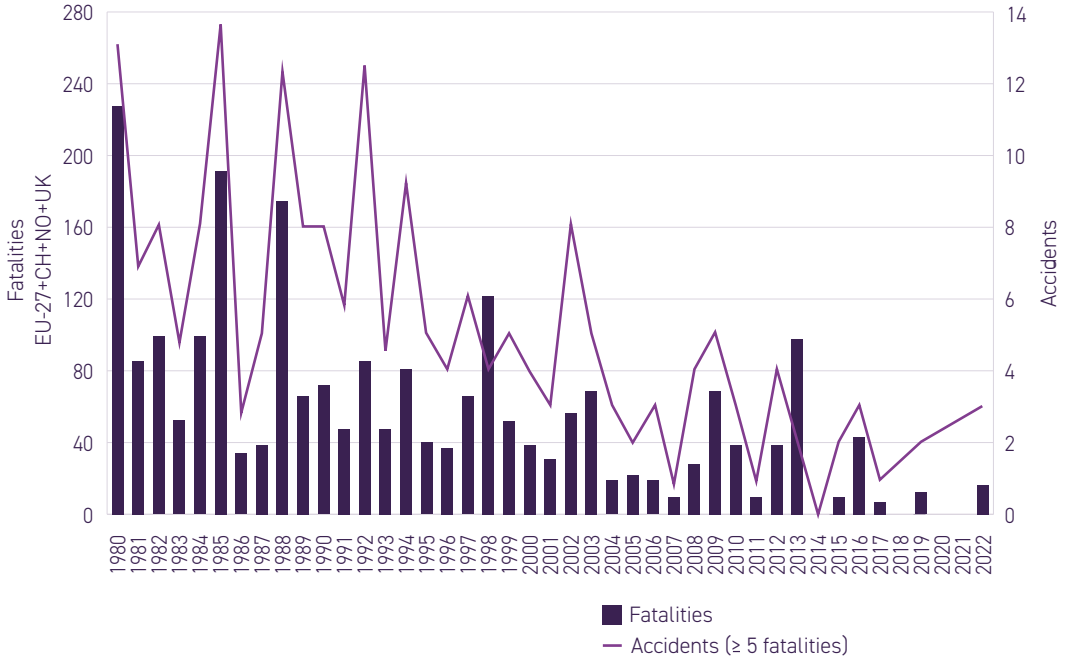
Source: ERA – Safety Overview 2023.

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 (1680 route km) leaves a potential for a single major accident with multiple fatalities to alter Irelands leading position to one that would trail most other Member States. The trend for major accidents across Europe as a whole was positive at the end of 2021, being free of major accidents, as was also the case in 2020. However, the most recent data available (February 2022) indicated three accidents with five or more fatalities were recorded in 2022.[3]

3. ERA, Safety Overview 2023 (pg. 4).

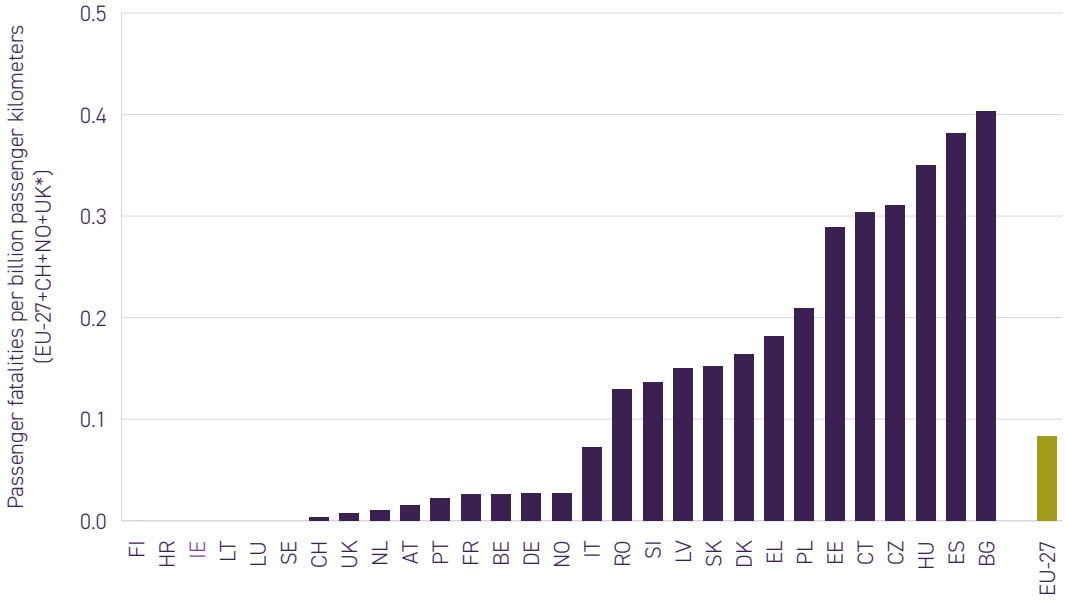
Figure 30
Major accidents in Europe



Note: data for UK available until end 2020.
Source: ERA – Safety Overview 2023.

Ireland's performance within Europe also remains 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 passenger fatalities are normalised using train kilometres travelled, Ireland is a leading country in terms of performance over the last decade.

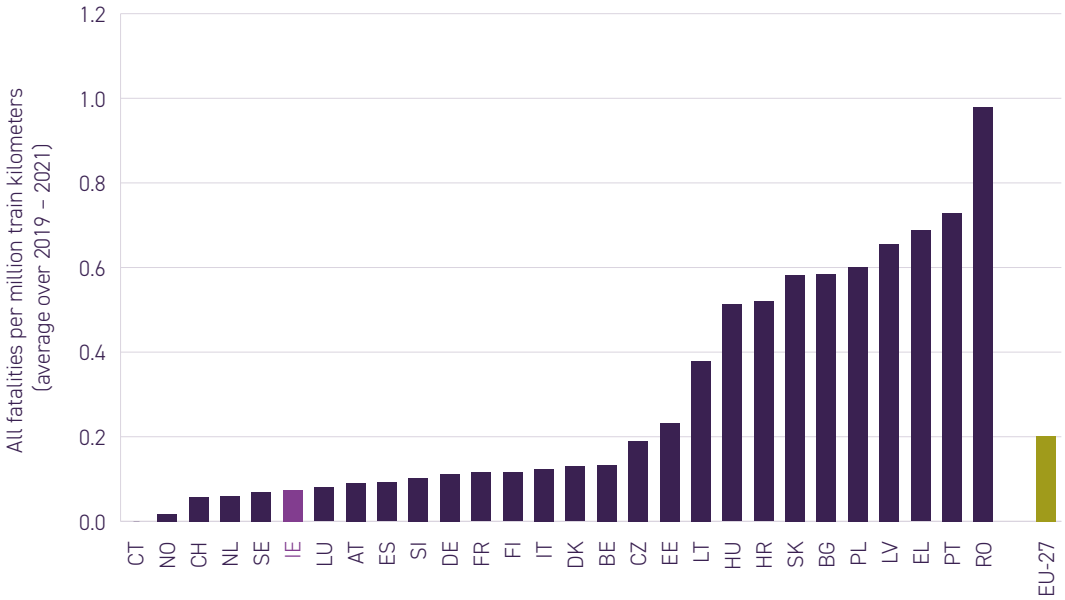
Figure 31
Passenger fatalities rate, 2011 – 2021



*Data for UK available until end 2020. Source: ERA – Safety Overview 2023.

Over a three-year period (2019–2021) Ireland is also ranked highly within the EU27 and has a normalised fatality rate (all fatalities, not just passenger) that is considerably below the EU average. However, it is noted that there is considerable disparity between low and high fatality rate countries, resulting in a somewhat binary categorisation of countries either considerably above or below the average.

Figure 32
Fatalities per million train kilometres (average 2019 – 2021)



Source: ERA – Safety Overview 2023.

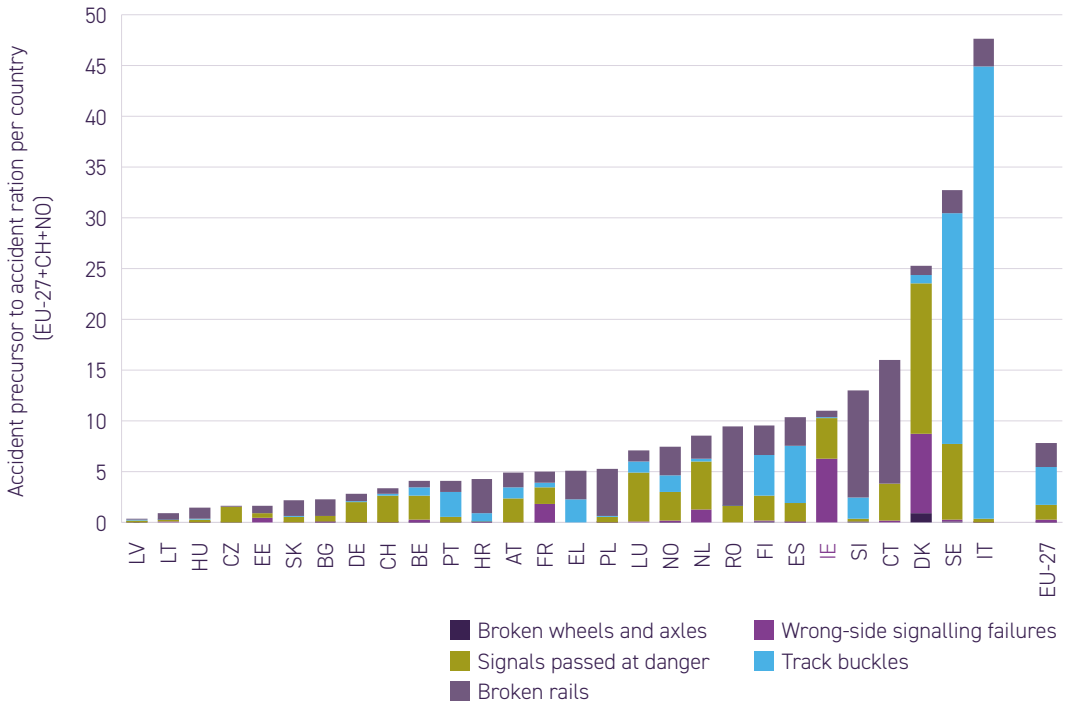
4.1.3 Precursor to accidents

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 33, Ireland is sixth highest of the EU-27 plus Switzerland and Norway, 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 low accident rate countries. Or identifying areas of relative weakness in comparison to other member states. Concerns regarding the quality of reporting of precursor events continues to be expressed by ERA in their most recent reports. Therefore, any comparison between Member States in terms of precursor events should be interpreted with the caveat that precursor event reporting is of varying quality from country to country.

Figure 33
Total precursor events by country, 2017 – 2021



Source: ERA – Safety Overview 2023.

4.2 Major accidents worldwide

Whilst safety performance of railways has improved worldwide over the years, a number of accidents on railways in other countries (both EU and worldwide) during 2022 reminds us that 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. It should be noted that reference is made to European accidents, however these accidents are not accounted for in the most recent ERA safety reporting figures as they occurred after February 2022.

Münchendorf, Austria

Around 18:20 (local time) on 9th May 2022, a passenger train derailed as it changed tracks at a set of points near Münchendorf station. All carriages were badly damaged, one passenger died, the driver was seriously injured, two passengers were seriously injured, and 22 other passengers were injured. The maximum permissible speed in the area of the derailment was 60 km/h however the derailment was such that an estimated €10.7m damage was done to the rolling stock and €1.7m damage done to the infrastructure. The National Investigation Body of Austria has yet to publish a preliminary investigation report but did publish an interim report in April 2023 before the first anniversary of the incident. The report outlined the steps taken by the NIB to date and the planned steps to be taken in the future, no safety recommendations have been made and no indication as to a cause has been published.

Garmisch-Partenkirchen, Germany

On 3rd June at around 12:16 (local time), a passenger train on the way to Munich Hbf derailed at a curve between stations Garmisch-Partenkirchen and Farchant. Several carriages slid down an embankment during the derailment onto a national highway below, causing significant disruption. The casualties were significant; 5 passengers died, 16 people were seriously injured and 62 people were injured. The damage to vehicles and infrastructure was also considerable, such that a precise assessment of the value has still not been possible. The National Investigation Body of Germany has yet to publish a preliminary investigation report but did publish an interim report in June 2023 before the first anniversary of the incident. The report identified a possible cause as being related to the prestressed concrete sleepers, which showed signs of damage indicating a loss of tension within the sleeper. The loss of tension reduces the amount of force, initiated by the train, that the structure can support safely.

South Khorasan, Iran

At approximately 05:30 (local time) on 8th June 2022, an Iranian passenger train derailed after colliding with an excavator that was near the track. The accident resulted in the death of 22 passengers and injured 87 others. The use of heavy construction equipment on or near railway lines is a risk that exists globally and must be managed in order for efficient railways to function. This accident serves to demonstrate the catastrophic potential construction machinery can have when operating in the vicinity of the railway.

Missouri, United States

On June 27th 2022, at 12:42 (local time) the Southwest Chief, an Amtrack passenger train, collided with a truck that was obstructing a level crossing. The collision force was significant enough to cause the entire train, which consisted of two locomotives and eight carriages, to derail. The accident resulted in 4 deaths (three passengers and the truck driver) and 150 injuries. The estimated material loss associated with the accident was approximately €3.6m. The National Transportation Safety Board (NTSB) released a preliminary report in July 2022 which reported that the level crossing involved was one which was uncontrolled, i.e., does not have any active controls to warn users of incoming trains. National news sources have reported that in the three years preceding the incident, the crossing was in fact subject to discussion among local government officials regarding upgrades to be introduced to alleviate residents' safety concerns. These concerns primarily related to a lack of visibility available to users when crossing.

5. ACCIDENT INVESTIGATIONS

5.1 Introduction

The Railway Accident Investigation Unit (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 the European Railway Safety Directive (EC) 2016/798 and the Railway Safety Act 2005 as amended by S.I. No.258 of 2014 and S.I. No. 430/2020.[4]

All RAIU investigation reports are made publicly available at www.raiu.ie and, due to the nature of their investigations, may contain highly technical terminology and acronyms. When reading this section, one should consult the relevant RAIU report for a full understanding of the Safety Recommendations made.

5.2 RAIU active investigations

The RAIU conducted 54 Preliminary Examination Reports (PER) and initiated three full investigations into railway accidents and incidents in 2022 (Table 4).

Table 4
RAIU investigations initiated in 2022

Date of incident	Details	Duty holder
6th July 2022	Collision of an RRV Dumper with a member of Iarnród Éireann infrastructure maintenance staff, Tivoli, Cork	IÉ
24th July 2022	IÉ impromptu evacuations of passengers from DART trains, Bray	IÉ
25th October 2022	TDLR Luas tram current return circuit failure at Connolly Stop	Transdev

4. 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 2022

In accordance with the Railway Safety Act 2005, the RAIU endeavours to publish an investigation report not later than 12 months after the date of the incident. In 2022, the RAIU published three investigation reports which are listed in Table 5. As a result of their investigations the RAIU made a total of 16 safety recommendations which are discussed in section 5.4.

Table 5
RAIU investigation reports published in 2022

Date report published	Date of incident	Title of report	No. of safety recommendations made	Railway organisation
4/05/2022	11th June 2021	Luas pantograph collision with railway bridge, Beresford Place	0	Transdev
8/07/2022	21st July 2022	Near miss with an Iarnród Éireann CCE Worker near Gormanston Station	1	IÉ-IM
21/10/2022	24th May 2020	Trend investigation into Signals Passed At Stop on the LUAS network	15	Transdev & TII

5.4 RAIU safety recommendations 2022

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, 16 were made in 2022. 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.

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 affect 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 three RAIU Investigation Reports published in 2022 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.

2022-R002
Near miss with an Iarnród Éireann CCE Worker near Gormanston Station, 21st July 2021 (Report Published 8th July 2022)

Summary	At approximately 10:04 on the 21st July 2021, an IÉ-IM CCE worker went onto the railway line to collect temperature gauges. At that same time, the A124 09:30 (hrs) service from Connolly Station to Belfast Lanyon Place travelled through Gormanston Station at 142km/h. The CCE worker upon noticing the approaching train cleared the line, four seconds before the train travelled past him.
Number of recommendations made	1
Recommendation 1 (2022002-01)	The IÉ – Infrastructure Manager (IM) CCE Department should develop a formalised process, through their Safety Management System (SMS) suite of documents, for IÉ-IM CCE staff walking/working alone, which should be completed prior to any member of CCE staff going on or near the line; at a minimum consideration should be given to: – Whether it is necessary to go on or near the line to conduct the walk/work – What local knowledge is required to walk/work safely – Whether all the requirements of the IÉ Rule Book/SSOW can be met – What special protection arrangements are required either at night or during the day.
Action/s taken/ in progress	August 2022 – Action plan submitted by IÉ-IM to CRR
Status	Open/In progress

2022-R003
Trend Investigation into Signals Passed at Stop on the LUAS network (Report Published 21st October 2022)

Summary	In February 2020, the RAIU received the monthly occurrence notifications from Transdev Dublin Light Rail (TDLR) in relation to incidents and accidents on the Luas network in January 2020; here it was notified that there had been a SPAS at Cookstown Interchange, County Dublin, with a conflicting movement. After the RAIU conducted a Preliminary Examination Report, the RAIU made the decision to conduct a full investigation into the incident. On review of SPAS history on the Luas network, the investigation was expanded to a trend investigation into all SPAS events in the previous year, 2019; SPAS events in 2020 and SPAS events in the first six months of 2021; a total of thirty-six SPAS incidents.
Number of recommendations made	15
Recommendation 1 (2022003-01)	TII should determine if in-cab technological and/or mechanised systems could be introduced to assist drivers with the prevention of SAS SPAS incidents, taking into account requirements for ensuring safety risk is ALARP. Analysis should include an appraisal of available systems and the effect they may have on mitigating sub – standard driver performance.
Action/s taken/ in progress	Dec 2022 – Evidence Form detailing actions taken submitted to CRR
Status	Further Evidence Requested

2022-R003
Trend Investigation into Signals Passed at Stop on the LUAS network
(Report Published 21st October 2022)

Recommendation 2 (2022003-02)	TDLR should enhance the TSI Manual operating instructions for all depot and LSS locations based off site-specific risk assessments for the different locations. These enhancements should include step-by-step guidance on how trams are moved at these locations; this should include how verbal permissions are granted by LNMC.
Action/s taken/ in progress	Dec 2022 – Action plan submitted to CRR
Status	Open/In progress
Recommendation 3 (2022003-03)	TII should review the technical specification of the onboard AVLS console to see if it is possible to limit the inputting of the AVLS service files to when the tram is stationary; and if so, implement this change.
Action/s taken/ in progress	Dec 2022 – Evidence Form detailing actions taken submitted to CRR
Status	Further Evidence Requested
Recommendation 4 (2022003-04)	TDLR should, with the assistance of a qualified human factors expert, review the timings and locations of SPAS incidents to establish reasons as to why drivers are involved in SPAS incidents at certain times and locations.
Action/s taken/ in progress	Dec 2022 – Action plan submitted to CRR
Status	Open/In progress
Recommendation 5 (2022003-05)	TDLR should, with the assistance of a qualified human factors expert, introduce training in relation to error prevention techniques as a tool for drivers to manage distraction, pre-occupation, and incorrect expectation.
Action/s taken/ in progress	Dec 2022 – Action plan submitted to CRR
Status	Open/In progress
Recommendation 6 (2022003-06)	TDLR should review its current training regime with a view to increasing training and competency assessment of drivers, in particular in terms of driving in depots and LSS locations and in degraded mode.
Action/s taken/ in progress	Dec 2022 – Action plan submitted to CRR
Status	Open/In progress
Recommendation 7 (2022003-07)	TII should, as part of the increased driver training and competency assessment, consider the introduction of a driver training simulator which would assist in driving training in depots, LSS locations and in degraded mode.
Action/s taken/ in progress	Dec 2022 – Evidence Form detailing actions taken submitted to CRR
Status	Further Evidence Requested

2022-R003
Trend Investigation into Signals Passed at Stop on the LUAS network
(Report Published 21st October 2022)

Recommendation 8 (2022003-08)	TDLR should ensure that tram signals are referenced correctly in the TDLR suite of documents, this in turn should reinforce, to the drivers, which signals are Stop signals.
Action/s taken/ in progress	Dec 2022 – Action plan submitted to CRR
Status	Open/In progress

Recommendation 9 (2022003-09)	TDLR should establish a formalised SSC, to include stakeholders from the relevant internal and external departments (e.g., TII and local authorities) to ensure that: — In the event of a SPAS event an SSC is convened, where appropriate, to determine if any immediate actions can be taken at the signal location which may prevent a SPAS re-occurrence — Any changes to signalling sequencing (including the introduction of new signals) are carried out as per the relevant SMS procedure to ensure that risks are not inadvertently introduced at signals — Multi-SPAS signals are reviewed to see if there are any trend to the SPAS incidents — Previous recommendations, related to SPAS events, from internal investigations have been addressed.
Action/s taken/ in progress	Dec 2022 – Action plan submitted to CRR
Status	Open/In progress

Recommendation 10 (2022003-10)	TDLR should update the TSI Manual and training and competency management suite of documents to include clear instructions on when emergency brake applications should be made in relation to the prevention of SPAS incidents; these instructions should be properly communicated to the drivers.
Action/s taken/ in progress	Dec 2022 – Action plan submitted to CRR
Status	Open/In progress

Recommendation 11 (2022003-11)	TDLR should introduced a SPAS risk scoring process for high-risk SPAS events on the Luas network, to ensure that the severity of a SPAS can be measured (best – practice should be applied if available). This scoring process can be used to assess if risks associated with the SPAS conform to TDLR risk acceptance criteria and are ALARP. The scoring process will also ensure that correct system interventions are applied, where required.
Action/s taken/ in progress	Dec 2022 – Action plan submitted to CRR
Status	Open/In progress

2022-R003
Trend Investigation into Signals Passed at Stop on the LUAS network
(Report Published 21st October 2022)

Recommendation 12 (2022003-12)	TII should research if technological and/or mechanised systems could be implemented for the entire Luas network to ensure SPAS events are immediately detected, taking into account requirements for ensuring safety risk is ALARP. Analysis should include appraisal of available systems, including systems that report detection of SPAS events to LNMC and to the driver in the cab.
Action/s taken/ in progress	Dec 2022 – Evidence Form detailing actions taken submitted to CRR
Status	Further Evidence Requested

Recommendation 13 (2022003-13)	TII should evaluate if it is possible to introduce an audible alarm for suspected SPAS incidents at LNMC.
Action/s taken/ in progress	Dec 2022 – Evidence Form detailing actions taken submitted to CRR
Status	Further Evidence Requested

Recommendation 14 (2022003-14)	TDLR to review and strengthen the current process for the management of drivers post SPAS incident, to ensure drivers skills are further developed (through adequate re-training) and they are supported (through increased monitoring) post SPAS incident
Action/s taken/ in progress	Dec 2022 – Action plan submitted to CRR
Status	Open/In progress

Recommendation 15 (2022003-15)	TDLR should develop their internal investigation processes, to develop a: — Training and competency management system for internal investigators — Manual, or similar, outlining internal investigation processes and report writing.
Action/s taken/ in progress	Dec 2022 – Action plan submitted to CRR
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 (2023) Annual Report 2022. Dublin: CRR

— ERA (2023), Safety Overview 2023

— ERA (2023), Report on Railway Safety and Interoperability in the EU 2022

— Sicherheitsuntersuchungsstelle des Bundes (2023), Zugentgleisung Z 7657 im Bf Münchendorf am 09. Mai 2022

— BEU (2023), Zwischenbericht Zugentgleisung, 03.06.2022, Bf Garmisch-Partenkirchen – Bf Farchant

— IÉ-IM (2023), IÉ-IM Annual Safety Report 2022

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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