Railway Accident Investigation Unit

Ireland

Annual Report

2021

RAIU

Railway Accident Investigation Unit

Summary

The purpose of the Railway Accident Investigation Unit (RAIU) is to independently investigate occurrences on Irish railways with a view to establishing their cause/s and make safety recommendations to prevent their reoccurrence or otherwise improve railway safety. It is not the purpose of an investigation to attribute blame or liability.

In 2021, thirty-eight pre-liminary examination reports (PERs) were completed by the RAIU based on reports of incidents, accidents and serious accidents from Transdev (Luas), Iarnród Éireann Infrastructure Manager (IÉ-IM), IÉ Railway Undertaking (IÉ-RU) and Bord Na Móna.

Five full investigations into reported occurrences were commenced in 2021:

- Luas isolation irregularity, Kylemore to Suir Road, 5th January 2021;
- Luas pantograph collision with railway bridge, Beresford Place, 11th June 2021;
- Near miss with an Iarnród Éireann CCE Worker near Gormanston Station, 21st July 2021;
- Collision between an IÉ train and rail equipment between Newbridge and Kildare, 27th August 2021;
- IÉ operational irregularity (double SPAD), Clontarf Road, 7th December 2021.

The RAIU published seven investigation reports in 2021, which resulted in a total of thirty-four new safety recommendations, the investigations are as follows:

- Collision between a car and a train at Kilnageer, Level Crossing (XM240), Mayo, 29th April 2020;
- Collision between a Bord na Móna Flat Wagon and Kilcolgan Level Crossing Gates, Offaly, 8th June 2020;
- Person entrapped in lowered CCTV level crossing, Ashfield, Offaly, 24th May 2020;
- Chassis Plate Fracture on General Motors Class 201, Locomotive 224, 7th July 2020;
- Overhead Line detachment, Pearse Station, 1st October 2020;
- Luas Overhead Line Failure, Stillorgan, 2nd November 2020;
- Luas isolation irregularity, Kylemore to Suir Road, 5th January 2021.

One further safety recommendation was made as a result of an Urgent Safety Advice Notices (USAN).

A total of 240 safety recommendation have been issued since the appointment of a Chief Investigator for the RAIU in 2007.

The Commission for Railway Regulation (CRR) monitors the implementation of safety recommendations and has advised that of the 240 safety recommendations issued to date: 146 have been closed out as having been addressed (61%); further evidence has been requested by the CRR for thirty-six recommendations (15%); and, fifty-eight recommendations remain open or in progress (24%).

The COVID-19 pandemic did not affect the operational activities of the RAIU.

David Murton
Chief Investigator 18th August 2022

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General Information & Non-Investigation Activities

The Organisation

The Organisation

The RAIU is an independent investigation unit within the Department of Transport (DoT) which conducts investigations into accidents and incidents on the national railway network, the Dublin Area Rapid Transit (DART) network, the LUAS light rail system, heritage and industrial railways in Ireland. Investigations are carried out in accordance with the Railway Safety Directive (EU) 2016/798 enshrined in the European Union (Railway Safety) (Reporting and Investigation of Serious Accidents, Accidents and Incidents) Regulations 2020; and, where relevant, by the application of the Railway Safety (Reporting and Investigation of Serious Accidents, Accidents and Incidents Involving Certain Railways) Act 2020.

The RAIU comprises of a Chief Investigator, three Senior Investigators and an administrator.

The RAIU's remit

The RAIU investigate all serious accidents. A serious accident means any train collision or derailment of trains, resulting in the death of at least one person or serious injuries to five or more persons or extensive damage to rolling stock, the infrastructure or the environment, and any other similar accident with an obvious impact on railway safety regulation or the management of safety.

During an investigation (full investigation or PER), if the RAIU make some early findings on safety issues that require immediate action, the RAIU will issue an USAN or SAN outlining the associated safety recommendation(s).

The RAIU may investigate and report on accidents and incidents which under slightly different conditions might have led to a serious accident.

The RAIU may also carry out trend investigations where the occurrence is part of a group of related occurrences that may or may not have warranted an investigation as individual occurrences, but the apparent trend warrants investigation. The purpose of RAIU investigations is to make safety recommendations, based on the findings of investigations, in order to prevent accidents and incidents in the future and improve railway safety. It is not the purpose of an RAIU investigation to attribute blame or liability.

The following railway systems within the RAIU's remit:

- The Iarnród Éireann (IÉ) national heavy rail network;
- The Luas light rail system in Dublin operated by Transdev;
- The Bord Na Móna (BnM) industrial railway;
- Seven operational heritage & minor railway systems.

For further information on these organisations see Appendix 1.

Non-investigation Activities

As part of its role as an NIB, the RAIU actively participates in the development of accident investigation processes and procedures through the work of European Union (EU) Agency for Railways. To this end, the RAIU participated in the 2021 NIB plenary meetings and provided input on the direction of NIB related work.

The RAIU is also a member of the EU Agency for Railways taskforce set up to develop a system of peer review of the NIBs.

The RAIU continues to participate in Memorandums of Understanding with the Transportation Safety Board of Canada, the Rail Accident Investigation Branch of the United Kingdom and with the Irish Health and Safety Authority (HSA).

The RAIU also continued to work with both An Garda Síochána and the Coroner's Society of Ireland.

Investigation Activities

RAIU

Investigation Activities

Notification of incidents and accidents to the RAIU

The RAIU must be notified of incidents and accidents, either through immediate notification; monthly bulk notifications (see Appendix 2 for schedules); or, the reporting after the death of an individual within thirty days of an accident.

In terms of immediate notification of an incident or accident (an in some instances a monthly bulk notification), the on-call investigator with create a Preliminary Examination Report (PER).

PERs include information on: who and when reported the occurrence; details of the occurrence (including the relevant asset information, times, locations and relevant parties); the categorisation of the occurrence (see Appendix 3); and the RAIU decision on whether a full investigation is warranted.

In 2021, the RAIU compiled thirty-eight PERs as outlined in the following pages.

2021 Preliminary Examination Reports in 2021

1st January 2021 to 31st December 2021

Reporting Railway Body	Date of occurrence	Location of Occurrence	Classification of Occurrence	Classification subset	Summary	Fatalities/ Injuries
IÉ-IM	1 January 2021	Between Pearse and Tara Street Stations, Dublin	Serious Accident	To persons due to rolling stock in motion	A male accessed the railway line from the Tara Street Station platform ramp and walked on along the track; the male was leaning against the bridge parapet when he was struck and fatality injured by the train.	**1 Fatality** to trespasser
Transdev	5 January 2021	Suir Road, Dublin	Incident	Traffic Operations & Management	A section of Luas track near Suir Road was isolated to facilitate high level inspection of the Overhead Contact System (OCS) when a tram was permitted to enter the isolated section which resulted in the pantograph bridging the isolated section causing a large flashover and the tram coming to a stop. The PER found that an USAN was warranted in relation to safety critical communications related to this incident, see page 36. A full investigation was also carried out by the RAIU which was published in 2021, see page 32.	0
Transdev	6 January 2021	George's Dock, Dublin	Accident	To persons due to rolling stock in motion	A female, wearing earphones, walked off the footpath and into the side of a tram.	**1 Injury** to pedestrian
IÉ-RU	17 January 2021	Ballyhaunis, Mayo	N/A	N/A	A body was reported close to Ballyhaunis Station, however, it was later found to be unrelated to train movements.	N/A
BnM	25 January 2021	Boora, Offaly	Accident	Level Crossing	A van collided with the closed gates of a BnM level crossing (X15-21 on the Cloghan to Boora Road), which opened and struck a BnM employee.	**1 Injury** to BnM employee
IÉ-IM	03 February 2021	Balbriggan, Dublin	Incident	Others	The 10:35 hrs passenger service from Belfast Central to Dublin Connolly (Train ID A125) made an emergency brake application on seeing IÉ-IM CCE staff and contractors on the line who were carrying out vegetation management on a wall south of Balbriggan Station. On investigation, it was found that the staff were in a position of safety and not in any danger of being struck by the train.	0
IÉ-IM	03 February 2021	Sallins Station, Kildare	Serious Accident	To persons due to rolling stock in motion	As the 15:30 hrs passenger service from Heuston to Limerick (Train ID A406) approached Sallins Station (non-stop through Sallins service), a male jumped off the Down platform and stood in the five-foot with his back to the oncoming train. The person was struck and fatally injured.	**1 Fatality** due to apparent self-harm
Transdev	07 February 2021	Belgard Stop, Dublin	Accident	Fire	Infrastructure staff attended and corrected a power outage at Belgard Stop, twenty minutes later a fire started in the area of the Surge Arrestor. The fire was extinguished by Infrastructure staff, there was no danger to members of the public. The fire was as a result of staff following procedures correctly.	0

Railway Body	Date of occurrence	Location of occurrence	Classification of occurrence	Classification subset	Summary	Fatalities/ Injuries
Transdev	21 March 2021	Cheeverstown / Embankment Rd Junction, Dublin	Accident	Collision	A road vehicle breached the road junction and collided with Tram 4007.	**2 Injuries** to tram driver and Luas passenger
Transdev	22 March 2021	Sandyford Depot, Dublin	Incident	Rolling Stock	While a Unilock (rail shunter) was towing unbraked Tram 5008 the tram detached from the Unilock and rolled out of the workshop onto the apron, as a result of the tram not being coupled to the Unilock correctly.	0
IÉ-RU	27 March 2021	Inchicore, Dublin	Accident	Derailment	During site preparation works a Road Rail Vehicle (RRV) Excavator was digging at the side of the line; the RRV was situated over Points 700. While excavating the RRV either overreached or the bucket got stuck in the ground and in the lifting movement the machine derailed. A stretcher bar on the points was damaged.	0
IÉ-IM	13 April 2021	Inchicore, Dublin	Accident	Derailment	While Locomotive 086 was been driven form Road 1 to Road 8 at the rear of the Running Shed, Inchicore, the leading wheelset derailed on slab track. There was an accumulation of dirt on the slab track allowing the flange of the leading wheel to ride up on the dirt at a curve on the track.	0
IÉ-IM	23 April 2021	Ferns Lock XG019, Kildare	Incident	Traffic Operations & Management	Ferns Lock Level Crossings (LC XG019) was under the control of a CCE SET member of staff (known as “Local” control), who was on site fixing an axle counter. The staff member was in communication with the Level Crossing Control Operator (LCCO) (based in Athlone). A passenger service (Train P652) initiated LC XG019, however, as it was under “Local” control, the crossing could not be cleared from Athlone. As a result Train P652 was stopped at the protecting signal XG019US. The CCE SET member of staff lowered the barriers. The LCCO then and gave the driver authority to pass the crossing signal at Danger and proceed through the crossing. The CCE SET member of had not fully engaged a switch at the level crossing, which resulted in the barriers raising. Train P652 had not yet started to move and the train movement was cancelled by the Controlling Signalman on request from the LCCO. The CCE SET member of staff handed control of Level Crossing back to the LCCO as the fault had cleared, with the LCCO now back in control of LC XG019, Train P652 was able to proceed through the crossing without issue.	0
IÉ-IM	29 April 2021	Nenagh, Tipperary	Accident	Derailment	While hauling ballast a Unimog RRV tipper (six ballast trailers with Unimog propulsion front and rear) toppled over as it was discharging ballast and subsequently derailed. It was found that one of the pins securing the tipping axis was not fitted allowing the bucket to move causing the accident.	0

Railway Body	Date of occurrence	Location of occurrence	Classification of occurrence	Classification subset	Summary	Fatalities/ Injuries
IÉ-IM	14 May 2021	Coolmine Station, Dublin	Accident	Fire	An eight car 29000 Diesel Multiple Unit (DMU) was operating a passenger service when it came to a stop at Coolmine Station. A large flame was observed coming from the exhaust stack of 29201. A manual fire extinguisher was deployed by the driver. The fire extinguished when the engine stopped. The turbocharger compressor impellor was found to have fractured allowing the turbocharger lubricating oil to mix with the exhaust gasses and travel through the hot exhaust stack. When the oil and exhaust gas mixture reached the fresh air, the mixture ignited due to the presence of oxygen and the hot exhaust stack surface.	0
Transdev	17 May 2021	Red Cow, Dublin	Incident	Infrastructure	There was a reported parafil failure on the OCS at the Red Cow.	0
IÉ-IM	19 May 2021	Between Portarlington & Athlone, Laois	Accident	To persons due to rolling stock in motion	During a possession an RRV was travelling to a worksite. The RRV had a clamshell bucket attached and was carrying a four-foot bucket within the jaws of the clamshell bucket. Two IÉ-IM members of staff were being carried in the four-foot bucket, which in in contravention to the IÉ Rule Book. One of the members of staff fell from the bucket and serious sustained leg injuries.	**1 Injury** to IÉ-IM staff member
IÉ-IM	06 June 2021	Limerick Works, Limerick	Accident	Derailment	An RRV excavator was engaged in a heavy lifting operation within Limerick Works, when the apparatus was being lowered by the RRV Operator (RRVO), the front wheels lifted off the rail and came back down on the flange resting on the rail head. When the RRV moved forward it dropped off the rail, derailing, causing damage to the stretcher bar at the hand points, there was no damage to the RRV or injury to any person.	0
Transdev	11 June 2021	Beresford Place, Dublin	Accident	Collision	A Luas pantograph struck a heavy rail underbridge as a result of a parafil failure on the OCS. The RAIU commenced a full investigation, see page 15.	0
IÉ-RU	20 July 2021	Inchicore Works, Dublin	Accident	Derailment	Two DMU units were being propelled to the front of the Paint Shop, Inchicore Works, by a locomotive when the second bogie of the trailing DMU derailed while travelling over a curve.	0
IÉ-IM	21 July 2021	Gormanston, Dublin	Incident	Others	An IÉ-IM CCE member of staff was removing temperature gauges from the rail when Train A124 (NIR CAF) approached. The driver sounded the horn and applied the emergency brake. The member of staff cleared the track four seconds before the arrival of the train at his previous location. There were no injuries reported. The RAIU commenced a full investigation into the incident, see page 17.	0

Railway Body	Date of occurrence	Location of occurrence	Classification of occurrence	Classification subset	Summary	Fatalities/ Injuries
Transdev	17 August 2021	Carrickmines to Cherrywood, Dublin	Incident	Energy	A planned isolation from Carrickmines – Cherrywood- Brides Glen was shortened to Carrickmines to Cherrywood, but the planning board was not updated. Two Luas infrastructure members of staff were inspecting the OCS using a pantograph attached to a Unimog in an isolation section. When they reached the end of the isolated section, they presumed it was the intermediated earthing straps as they were not informed of the shortening of the isolation and moved the Unimog forward through the insulated overlap, and the Pantograph bridged the isolated section with the live section resulting in current travelling form the live section to the isolated section and short circuiting. There were no injuries.	0
IÉ-IM	27 August 2021	Kildare, County Kildare	Accident	Collision	The unscheduled empty Mk4 set (Train J283) struck IÉ-IM equipment in Kildare. The driver reported the incident to the Controlling Signalman who contacted the CCE staff who were due to take a possession in the area and was advised that a bolt may have fallen from the pocket of the Engineering Supervisor (ES) who was in the cess as the train passed. Further investigation found that the ES had given permission for the staff to commence work prior to the possession being granted which in contravention to the IÉ Rule Book. The CCE staff were removing a section of rail; one member of staff had started loosening bolts, another digging out ballast and two staff had attached the holding gear to the rail (which was the item struck). When a member of the group saw the approaching train, he shouted, “train on” and the group moved to a position of safety but did not have time to remove the holding gear. The train ran over the holding gear cutting it in two. The RAIU commenced a full investigation into the accident, see page 18.	0
IÉ-IM	30 August 2021	Dunleer, Louth	Accident	Collision	During a possession between Drogheda and Dundalk, four RRVs (one RRV Jeep, two RRV Dumpers and an RRV Excavator) were moving in convoy to a compound at Dunleer to load ballast and transport it back to the work site. The RRV Jeep with the Person In Charge (PIC) travelling in it was leading, followed by other RRVs. When the RRV Jeep arrived at the Dunleer compound the RRVO and PIC exited the RRV Jeep. The RRVO looked back down the line and saw the first RRV Dumper approaching. The PIC noticed that the RRV Dumper was not slowing down sufficiently, and he ran towards the RRV Dumper waving his arms to attract the RRVO’s attention. However, the RRV Dumper continued and collided with the rear of the stationary RRV Jeep. The RRV Jeep sustained damage. There were no injuries reported as a result of the occurrence.	0

Railway Body	Date of occurrence	Location of occurrence	Classification of occurrence	Classification subset	Summary	Fatalities/ Injuries
IÉ-IM	08 September 2021	Dublin Port, Dublin	Accident	Collision	A Tara Mines train was being propelled in a shunting movement at Dublin Port in the vicinity of the loading and unloading area when it struck a buffer stop. No injuries to staff or members of the public; with minor damage sustained to wagon and buffer reported.	0
IÉ-IM	09 September 2021	Castleknock Station, Dublin	Serious Accident	To persons due to rolling stock in motion	A male jumped from the platform as the 13:05 hrs passenger service from Sligo to Connolly (Train A909), passed non-stop through Castleknock; the male was struck and fatally injured.	**1 Fatality** due to apparent self-harm
IÉ-RU	15 September 2021	Mullingar, Westmeath	Serious Accident	To persons due to rolling stock in motion	As the 19:00 hrs passenger service from Mac Diarmada Station, Sligo to Connolly Station, Dublin (Train A915) was passing through a location near Mullingar a person accessed the line from the righthand side of the rail and placed themselves on the track, in a position of danger. When the driver of Train A915 saw the person, he applied the emergency position but there was insufficient time for the train to come to a stop and the person was struck and fatally injured by the train.	**1 Fatality** due to apparent self-harm
IÉ-IM	25 September 2021	Fairview Depot, Dublin	Accident	Derailment	A six-piece 8100 EMU consist (8331 leading 8131, 8312, 8112, 8303 and 8103) was parked over hand points 10 in Fairview Depot with the lead bogie of 8331 clear of the points. When the consist was moved forward towards the wash road, the training bogie of 8331 and the lead bogie of 8131 derailed. Prior to the derailment a DART driver was attacked by two graffiti artists who passed by hand points 10 and appear to have moved the hand points lever causing the derailment.	0
IÉ-IM	27 September 2021	Hazelhatch Station, Dublin	Serious Accident	To persons due to rolling stock in motion	As the Heuston to Galway service through Hazelhatch Station, a person placed themselves on the line and was struck by the train and fatally injured.	**1 Fatality** due to apparent self-harm
Transdev	27 September 2021	Suir Road, Dublin	Accident	To persons due to rolling stock in motion	A person intentionally placed themselves on the tram line between Suir Road Stop and the South Circular Road underbridge and was struck and injured by a tram.	**1 Injury** due to attempted self-harm
IÉ-RU	23 October 2021	Limerick Junction, Tipperary	Accident	Derailment	An RRV excavator was removing concrete from a RRV dumper placing it in holes for fencing posts when the flange of the rail wheel rose onto the rail during the unloading and when the RRV excavator drove along the rail the wheel dropped into the five-foot and derailed.	0
Transdev	28 October 2021	Steeven's Lane	Accident	To persons due to rolling stock in motion	As Tram 3007 was travelling inbound on Steeven's Lane a pedestrian, who was walking on the footpath with their back to the tram made a sudden movement off the footpath and into the path of the approaching tram; and was struck, suffering head injuries.	**1 Injury**

Railway Body	Date of occurrence	Location of occurrence	Classification of occurrence	Classification subset	Summary	Fatalities/ Injuries
IÉ-IM	18 November 2021	Gort Station, Galway	Incident	Control-Command & Signalling	The 18:45 hrs Galway to Ennis passenger service (Train A491) passed Signal GL457, located on the platform of Gort Station, at danger without authority. The signal was red as the train operating in advance of Train A491 had not cleared the section. The driver of A491 was unaware he had passed Signal GL457 at danger and continued for 1.95 km until he was contacted by the Controlling Signalman who requested him to stop.	0
IÉ-RU	22 November 2021	North Wall, Dublin	Accident	Collision (Derailment)	A Tara Mines locomotive and twelve wagons was involved in a rough shunt at its unloading facility in Dublin Port. The train was being propelled back with the assistance of a shunter and the rear wagon struck the buffer stop causing the buffer stop to lift over the wagon buffer. The wagon continued until it ran out of track and derailed the first axle. There was damage to the buffer stop and minor damage to the wagon. There were no injuries as result of the occurrence.	0
IÉ-RU	28 November 2021	Fairview, Dublin	Accident	Derailment	A tandem lift of a sixteen metre track panel with two RRV excavators was in progress. The RRVs were on the Down line and lifting the panel from the Down line to the adjacent Wash siding which was being relayed. During the lift, one RRV, at the Dublin end, turned over on its side.	0
IÉ-IM	01 December 2021	Connolly, Dublin	Incident	Control-Command & Signalling	Due to a track fault at Glasnevin Junction, train services to Connolly were re-routed. Train P655 had been authorised by the Central Signalman to pass Signal CW52 at Danger (as per IÉ Rule Book) and the driver had been issued with an authority number to pass Signal CW52 at danger and to obey Signal CW56. The driver observed Signal CW56 was displaying a yellow aspect and that Signal DS106 was at Danger. However after bringing his train to a stop at Signal DS106 some seconds later the driver proceeded to take traction and subsequently pass Signal DS106 at danger. The Controlling Signalman received a critical alarm indicating a SPAD and made an emergency call for the driver of to stop his train.	0
IÉ-IM	07 December 2021	Clontarf Road Station, Dublin	Incident	Control-Command & Signalling	Train E240 (passenger service 15:40 hrs Howth to Bray) experienced wheel slide on approach to Signal DN287 (located on the approach to Clontarf Road from the Belfast end) and was unable to stop, passing the signal at danger. Train E120 (15:30 hrs Malahide to Greystones) was stopped ahead of Train E240 resulting in Signal DN295 (Signal DN295 is at the Connolly end of Clontarf Road Station) being at danger. Train E240 then continued past Signal DN295 at danger, almost striking Train E120, who had started to take traction, before stopping, for full investigation details, see page 19.	0

Railway Body	Date of occurrence	Location of occurrence	Classification of occurrence	Classification subset	Summary	Fatalities/ Injuries
IÉ-RU	17 December 2021	Ceannt Station, Galway	Accident	Derailment	An empty train was being shunted into No. 1 Siding of the yard at Ceannt when the front bogie of the leading coach derailed over handpoints GL01 (facing). There was minor damage caused to the train wheel flange and the infrastructure, chairs and clips. There was no one injured as a result of the occurrence.	0

Categorisation of Preliminary Examination Reports during 2021

1st January 2021 to 31st December 2021

The following is a compilation of the categories of thirty-eight PERs for 2021, note that these are generally incidents that are immediately reported to the RAIU after occurrence.

Serious Accidents and accidents to persons due to rolling stock in motion and others

In general, the RAIU do not conduct a full investigation into occurrences related to apparent self-harm or trespass occurrences, as a full investigation is unlikely to result in any safety recommendations to prevent similar occurrences in the future. In terms of fatalities, there was one incident of a body found near the railway line which subsequently was found to be unrelated to the railway, this incident was therefore not categorised.

The serious accidents and accidents to persons due to rolling stock in motion accounts for 21% of the overall reported incidents on the IÉ (13%) and Transdev (8%) networks, are as follows:

- IÉ – Five fatalities as a result of apparent self-harm;
- Transdev – Two injuries as a result of pedestrians accessing the line without looking for approaching trams;
- Transdev – One injury as a result of an apparent attempted self-harm incident.

Other occurrences related "to persons, due to rolling stock in motion", include:

- IÉ-IM – One incident where IÉ-IM staff members violated safe work practices and travelled in the bucket of an RRV excavator and subsequently falling out of the bucket, with one member of staff sustaining serious leg injuries.

Accidents & incidents on the IÉ network:

The compilation of accidents for IÉ-IM and IÉ-RU in 2021:

- Seven RRV accidents (including the incident above) which accounts for 18% of the overall reported incidents, these were sub-categorised as:
    - Five derailments;
    - One collision;
    - One to persons due to rolling stock in motion (outlined above);
- Four derailments of trains in sidings/ depot locations
- Three SPAD incidents (one of which was a double SPAD);
- Two collisions with buffer stops at Dublin Port;
- One reported near miss with IÉ-IM staff, which subsequently was not a near-miss;
- One reported incident of a near miss with IÉ-IM member of staff;
- One traffic operations & management incident involving a level crossing;
- One train exhaust fire;
- One near miss with a member of IÉ-IM staff;
- One collision with a piece of infrastructure equipment put on railway line.

Of these incidents, three investigations were commenced, see "Full investigations commenced in 2021", page 15.

The collisions at Dublin Port and the derailments outside the mainline do not fall in the remit of RAIU investigations and as such no investigations were commenced.

The RAIU previously carried out a trend investigation into RRV incidents and accidents which was published at the end of 2019, resulting in twenty safety recommendations, therefore no further investigation was warranted for these incidents.

Preliminary examinations were carried out by the RAIU into the other occurrences, and it was found that through actions already taken, no further investigation was warranted by the RAIU.

Accidents & incidents on the Luas network

Compilation of accidents immediately reported to the RAIU by Transdev in 2021:

- One collision with a road vehicle;
- One collision of a tram pantograph with an IÉ underbridge;
- One fire at an electrical cabinet;
- One infrastructure failure of an OCS component;
- One rolling stock failure of involving a tram runaway;
- One energy incident involving a planned isolation.

Two of these occurrences warranted the commencement of RAIU investigations, see "Full investigations commenced in 2021", page 15.

Accident on the Bord na Móna network

There was one reported accident (level crossing) on the BnM network where a car violated the Rules of the Road and collided with the closed gates of a BnM level crossing, causing injury to a member of BnM staff; this incident is being investigated by An Garda Síochána and as such, no further investigation was warranted by the RAIU.

2021 Full Investigations

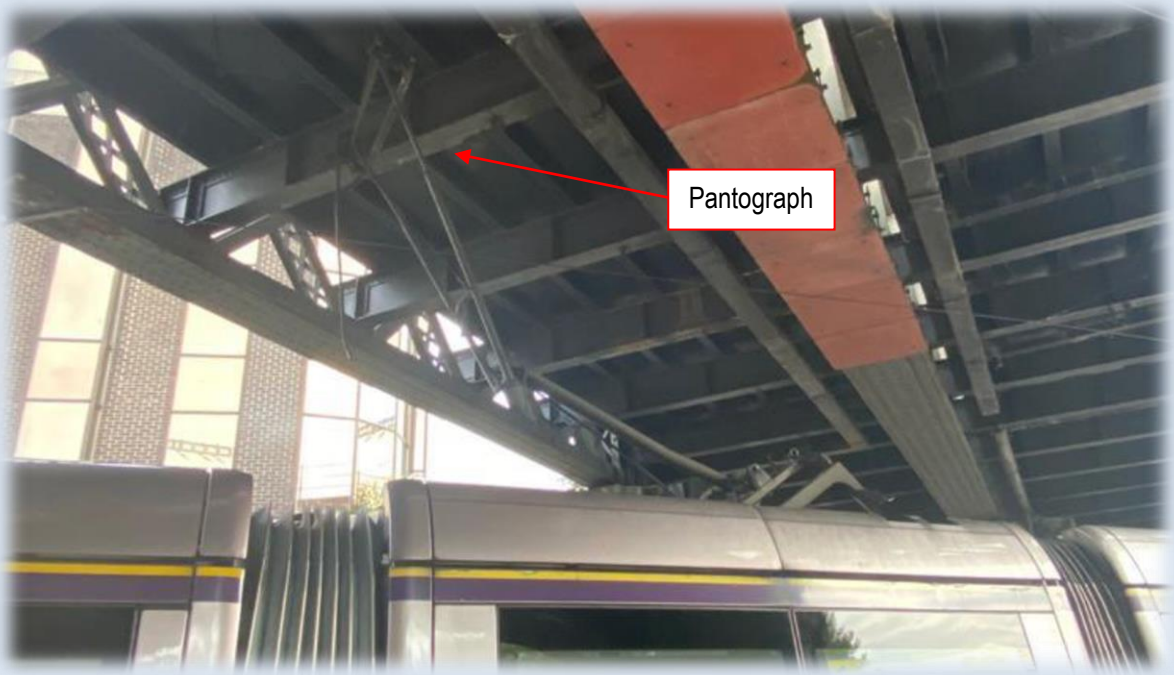
Full investigations commenced in 2021

Five full investigations into reported occurrences were commenced in 2021:

- Luas isolation irregularity, Kylemore to Suir Road, 5th January 2021 (this investigation was completed in 2021, RAIU Investigation Report No: 2021 – R007, and is outlined in page 32);
- Luas pantograph collision with railway bridge, Beresford Place, 11th June 2021;
- Near miss with an Iarnród Éireann CCE Worker near Gormanston Station, 21st July 2021;
- Collision between an IÉ train and rail equipment between Newbridge and Kildare, 27th August 2021;
- IÉ operational irregularity (double SPAD), Clontarf Road, 7th December 2021.

The trend investigation into Signals Passed at Stop (SPAS) on the Luas Network continued through 2021.

Luas pantograph collision with railway bridge, Beresford Place, 11th June 2021



At approximately 01:16 hrs on the 11th June 2021 the Parafil termination failed on the cross-span between a pole and the Strong Registration Arm attached to the Luas network Overhead Contact System (OCS) on the Outbound line, cess side, close to Beresford Place Iarnród Éireann (IÉ) railway bridge; causing the Strong Registration Arm to hang down over the tram line. This results in the contact wire losing stagger and striking the negative copper strip on the insulated plates located under the railway bridge resulting in a dead-short and tripping (stopping the electrical flow) the electrical power in the O'Connell to Spencer Dock section. There were no trams in the section, the last outbound tram to pass the section was Tram 3026 at approximately 01:00 hrs.

Luas Network Management Centre (LNMC) were alerted to the Electrical Sub-Station (ESS) trip-out and contacted Infrastructure Maintenance who arrived at O'Connell ESS at 01:25 hrs and reset both Traction and High Speed Circuit Breakers with no issues; the Infrastructure Maintenance staff did not inspect the OCS as it was not required under any Transdev internal documents.

At 04:35 hrs, Sweep Tram 3016 (a tram used to check the line is free from obstacles / obstructions prior to passenger service) departed the Red Cow travelling inbound to the Point Depot, travelling at a maximum speed of 25 km/h.

At 05:12 hrs, on Sweep Tram 3016's approach to Beresford Place railway bridge, and the location of the partially detached Strong Registration Arm, the pantograph of Tram 3016 loses contact with the contact wire and strikes with the cross-span assembly. The force of impact on the cross-span assembly causes the Strong Registration Arm to become detached from the contact wire and becomes entangled on the pantograph, contacting both the foot of the pantograph and roof of the tram; causing a dead-short and trips the power in the O'Connell to Spencer Dock electrical section. Sweep Tram 3016 continues forward, pulling down the feeder cable; with the pantograph colliding with and damaging the insulated plates under the railway bridge.

Sweep Tram 3016 comes to a stop approximately 30 m from the first impact with the cross-span assembly (approximately seven seconds). Driver 3016 contacts LNMC and reports hearing a loud bang and loss of power.

Near miss with an Iarnród Éireann CCE Worker near Gormanston Station, 21st July 2021

On the morning of Wednesday 21st July an IÉ Chief Civil Engineer's (CCE) Department employee (to be referred to as CCE Worker for the remainder of this report) was performing the role of Track Safety Co-ordinator (TSC) for a group of construction staff upgrading a retaining wall adjacent to a track access point at the northern end of Gormanston Station, County Meath; the worksite was away from the railway line in a position of safety.

The weather that morning was hot and sunny and the CCE Worker decided to go onto the railway line to place two temperature gauges on the track to check the track temperature; a task that was not requested to be carried out by any member of management. At the same time, the 09:30 hours (hrs) Northern Ireland Railways (NIR) Enterprise Service from Connolly Station Dublin to Belfast Lanyon Place (Train A124), was approaching Gormanston, travelling non-stop through to its first scheduled stop, Drogheda. Train A124 was travelling at 88 miles per hour (mph) (142 kilometres per hour (km/h)).

At approximately 10:04 hrs the CCE Worker (circled red in photograph above) went back onto the railway line, into the five foot, to collect the temperature gauges, when he looked towards Gormanston Station and saw Train A124 approaching, he cleared line four seconds before Train A124 travelled past him.

Collision between an IÉ train and rail equipment between Newbridge and Kildare, 27th August 2021

At approximately 00:18hrs on Friday 27th August 2021, the driver (Driver J283) of an empty unscheduled empty train travelling from Limerick Junction to Heuston Station (Train J283) reported to the Controlling Signalman that the train had struck something on the line, the item was a holding gear (a piece of equipment that is clamped to the rail during rail replacement works). The collision resulted in damage to the front wheel of the control car and rail (which was replaced on the night of the accident).

Driver J283 also reported that a number of staff were on the line and moved off as Train J283 approached them, none were injuted physically but later reported to have suffered from shock.

IÉ operational irregularity (double SPAD), Clontarf Road, 7th December 2021

At approximately 16:01 hrs on 7th December 2021 the 15:31 DART passenger service from Malahide to Bray (Train E120) was serving Clontarf Road Station Up Platform. The signal to the rear, on the southern side of Clontarf Road Up Platform, Signal DN287, was displaying a Red Aspect to protect Train E120.

The 15:40 hrs DART passenger service from Howth to Bray (Train E240) was approaching Signal DN287 on the northern side of the Up Platform at Clontarf Road Station. Train E240 passed signal DN287 at danger without authority and continue travelling through Clontarf Road Station.

The driver of Train E240 (Driver E240) could see Train E120 ahead and phoned the Central Signalman at Centralised Traffic Control (CTC) to advise that he felt the train was sliding and was going to run into Train E210. The Central Signalman contacted the driver of Train E120 (Driver E120) to enquire if the train was moving and on receipt of confirmation requested Driver E120 to continue moving.

Train E240 passed Signal DN295 at danger without authority and came to a stop before the Crewe Ramp at Fairview. Driver E240 contacted the Central Signalman to advise that Train E240 had come to a stop.

Full Investigations published in 2021

1st January 2021 to 31st December 2021

The RAIU published seven investigation reports in 2021, which resulted in a total of thirty-four new safety recommendations, the investigations are as follows:

- Collision between a car and a train at Kilnageer, Level Crossing (XM240), Mayo, 29th April 2020 (RAIU Investigation Report No: 2021 – R001, published: 18th February 2021);
- Collision between a Bord na Móna Flat Wagon and Kilcolgan Level Crossing Gates, Offaly, 8th June 2020, RAIU Investigation Report No: 2021 – R002, published: 18th February 2021);
- Person entrapped in lowered CCTV level crossing, Ashfield, Offaly, 24th May 2020 (RAIU Investigation Report No: 2021 – R003, published 21st May 2021);
- Chassis Plate Fracture on General Motors Class 201, Locomotive 224, 7th July 2020 (RAIU Investigation Report No: 2021 – R004, published 1st July 2021);
- Overhead Line detachment, Pearse Station, 1st October 2020 (RAIU Investigation Report No: 2021 – R005, published 22nd September 2021);
- Luas Overhead Line Failure, Stillorgan, 2nd November 2020 (RAIU Investigation Report No: 2021 – R006, published 27th October 2021);
- Luas isolation irregularity, Kylemore to Suir Road, 5th January 2021 (RAIU Investigation Report No: 2021 – R007, published 16th December 2021).

Collision between a car and a train at Kilnageer, Level Crossing (XM240), Mayo, 29th April 2020

At approximately 13:40 hour (hrs) on the 29th 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 saw the car, he made a full-service brake application; however, the train could not stop in time and struck the car. Causal factors associated with this accident are:

- The Car Driver failed to stop to look for trains on approach to LC XM240 as required by the Road Safety Authority's (RSA) Rules of the Road, in part, as a result of the level crossing gates being open;
- The sounding of the train horn was not effective at warning the Car Driver of the approaching train.

A contributing factor to the accident was:

- There is a high level of misuse and abuse at LC XM240, where the level crossing gates are continuously left open, despite laws being in place for them to be closed.

The RAIU did not identify any systemic factors associated with this accident.

The RAIU did not make any safety recommendations as a direct result of this accident. However, the RAIU noted that after the accident, a Decision Support System (DSS) was made operational at LC XM240, this impacts on stakeholders' documentation. The RAIU also noted that further checks need to be conducted in relation to the sound pressure levels of the InterCity Railcar (ICR) train horns. As a result, the RAIU made four safety recommendations related to these additional observations:

- The RSA should update the "Rules of the Road" to include guidance on the DSS;
- IÉ-IM should update the 'The SAFE use of Unattended Railway Level Crossings' booklet to include guidance on the DSS;
- IÉ-RU should put systems in place to ensure ICR train horns meet the current standards for sound pressure levels;
- 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 DSS is included.

Collision between a Bord na Móna Flat Wagon and Kilcolgan Level Crossing Gates, Offaly, 8th June 2020

At approximately 13:15 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. Causal factors were identified as:

- The derailing points were in the closed position, resulting in the Flat Wagon not derailing, instead it continued towards and struck Kilcolgan Level Crossing gates;
- Checks were not undertaken to ensure that the Flat Wagon could not roll freely prior to rerailing; and, the Flat Wagon was not secured after rerailing.

No contributing factors were identified. Systemic factors were identified as:

- The training for rerailing wagons / rail stock does not include any assessment to confirm competence of the task; and, there is no continuous assessments to ensure continued compliance with the procedures;
- The risk register was not updated to include the risks associated with the interference with derailing points by members of the public resulting in an absence of mitigation measures.

As a result, the RAIU made the following four safety recommendations:

- BnM should identify locations where derailing points are vulnerable to unauthorised movements and provide a means of securing the derailing points at these locations;
- BnM 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;
- BnM should develop a training, assessment and continuous assessment programme related to the Procedures for Rerailing Wagons / Rail Stock;
- BnM should review its level crossing Risk Register updating where necessary to sufficiently capture all reasonably foreseeable risks. In addition, BNM 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.

The RAIU made a number of additional observations in relation to the efficacy of the derailing points and the level crossing signage. As a result, the RAIU make the following safety recommendations:

- The Engineering Department of BnM should carry out the technical evaluation into the efficacy of the derailing points, etc. identified in BnM internal investigation report into the collision between a BnM locomotive and the gates of Endrim Gates on the 21st September 2017;
- BnM should update their Specification for Crossings to include the requirements of the Department of Transport's Traffic Signs Manual; based on this BnM should update the signage on the approaches to all BnM level crossings.

Near-miss collision between a train and an IÉ-IM staff member, at Rush and Lusk Station, 20th June 2019

At approximately 12:13 hrs on the 24th May 2020, a Level Crossing Control Operative (LCCO), located at Athlone Local Control Centre (ALCC) cleared Closed-Circuit Television (CCTV) 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 LCCO using the telephone provided at the level crossing. LCCO 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). LCCO did not raise the barriers and allowed Train A703 to pass through LC XA068. The MOP was uninjured as a result of this incident. The RAIU identified the following causal factors:

- The MOP did not clear the confines of the level crossing when the warning lights and bell activated to indicated that the barriers were about to lower for an approaching train;
- LCCO did not see the MOP prior to pressing the "Crossing Clear" buttons;
- LCCO did not, when they became aware of the MOP trapped inside the barriers, immediately press the "Emergency Alert" button to the "On" position as set out in the Athlone & Mallow Level Crossing Control Centre Instructions.

A contributing factor associated with the incident was identified as follows:

- The functions of Mid-Section CCTV Crossing allow for LCCOs to take alternative actions, to those prescribed in the Athlone & Mallow Level Crossing Control Centre Instructions, in that they can operate the "Signal Controls" to cancel and request the level crossing's protecting signals instead of pressing the "Emergency Alert" button.

No systemic factors were identified.

Additional observations, specific to the incident at LC XA068 are:

- The functions of Mid-Section CCTV Crossing allow for LCCOs to take alternative actions, to those prescribed in the Athlone & Mallow Level Crossing Control Centre Instructions, in that they can operate the "Signal Controls" to cancel and request level crossing protecting signals, which could result in a train being involved in a Signal Passed at Danger incident.
- The functions of Mid-Section CCTV Crossing require the additional step of requesting the signals after the crossing has been cleared; where a LCCO may forget to do this, in error, there is potential for a Category A Signal Passed at Danger.

As a result, the RAIU made the following safety recommendations associated with the incident:

- IÉ-IM Signalling, Electrical and Telecommunications (SET) 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;
- IÉ-IM 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.

The RAIU also reviewed eleven similar occurrences of MOPs trapped in CCTV level crossings, and as a result made a number of additional observations, which resulted in the following additional safety recommendations:

- IÉ-IM Chief Civil Engineer (CCE) should examine the feasibility of installing signage inside the barriers of CCTV level crossings warning MOPs what actions to take in the event of becoming trapped;
- 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 LCCOs in identifying persons/obstacles that maybe trapped within the confines of a level crossing;
- IÉ-IM should introduce measures to deter pedestrians from using unauthorised routes onto CCTV Level Crossings.
- 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.

Chassis Plate Fracture on General Motors Class 201, Locomotive 224, 7th July 2020

IÉ 201 Class Locomotives were manufactured by General Motors 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. 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.

The Chassis Plate of Locomotive 224 failed as a result of the following causal factor (CaF):

- The flat Bed Plates were not replaced with cupped Bed Plates when Bed Plate cracks were identified as set out in the Original Equipment Manufacturer (OEM) Service Advisory SA 08-007;
- During a weld repair of the Bed Plate, the Bed Plate was unnecessarily welded to the Chassis Plate.

Contributory factors (CoF) were identified as:

- IÉ-RU had not adopted the EN 15085 standard series, entitled "Railway applications – Welding of railway vehicles and components" which were first published in 2007; although it is noted that this standard series is not mandatory;
- While Service Advisory (SA 08-007) was available to the welder carrying out the repair through the CME Maintenance work stations, the implications of the modification were not discussed at IÉ management level prior to the incident and material for the modification was not procured.

A systemic factor was identified as:

- There was an over-reliance on the knowledge of the welder to develop and carry out a repair procedure without any formal instruction or supervision.

As a result, the RAIU made the following two safety recommendations:

- IÉ-RU 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;
- IÉ-RU CME should develop a procedure for evaluating maintenance advice received from OEMs or other railway organisations to determine applicability to IÉ fleets and assess any associated risks.

Although not causal, contributing or systemic, the RAIU made the following additional observation that the 201 Locomotive axle loads recorded by the acoustic bearing monitors indicate that the specified axle load may have been exceeded. As a result, the RAIU made the following additional safety recommendation

- IÉ-RU CME and IÉ-IM CCE should carry out a risk assessment on the implications of the increased axle load of a 201 Locomotive.

Overhead Line detachment, Pearse Station, 1st October 2020

At approximately 12:55 hrs on the 1st October 2020, the 12:04 hrs 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.

The Catenary Wire of the OHLE detached, and was live on Platform 1, as a result of the following causal factors:

- The short circuit between the Pantograph Head and the roof of the train caused the Catenary Wire to overheat, reducing its strength, detaching and falling onto Platform 1;
- The OHLE in Pearse Station is positioned at 4.46 m above the rail allowing the Pantograph Lower Arm to strike the OHLE in the event of a Pantograph elbow chain failure;
- The elbow chains on Pantograph 396, on EMU 8128, failed due to excessive wear of the chain pins and chain link holes over a period of time due to the lack of lubrication;
- The failure of Pantograph 396's elbow chains resulted in the Lower Arm rising and the Upper Arm and Head lowering; providing an electrical path for a direct connection between the OHLE and the train body;
- The High Speed Circuit Breaker Auto-Reclose restored power to the failed section.

A contributory factors was that the Pantograph on EMU 8128 had not been overhauled for over eight years.

Systemic factors were:

- The pantograph planned preventative maintenance regime did not identify the deterioration in the chains of Pantograph 396 or the poor condition of the grease that had previously been applied;
- The information contained in the IÉ CME-TMS-316 Department Engineering Change files for the extension of the pantograph overhaul from three to five years does not substantiate the conclusion reached, highlighting a lack of governance in the outsourcing of the overhaul of EMU pantographs;
- The compliance checks on the EMU fleet did not include the checking of pantographs.

The RAIU made the following safety recommendations:

- IÉ-RU CME should in conjunction with the OEM develop a maintenance regime for the pantographs, taking into consideration the operational conditions and traceability of safety critical components;
- IÉ-RU CME should carry out, in conjunction with the OEM, a condition assessment to determine the correct period for the overhaul of the IÉ-RU pantographs;
- IÉ-RU and IÉ-IM 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;
- IÉ-RU CME to include requirements to check pantograph maintenance activities in the Compliance Coordinators documentation records / check sheets;
- IÉ-IM SET should evaluate the auto-reclose function of the 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.

In addition, the RAIU made two safety recommendations as a result of additional observations:

- IÉ-RU CME to include requirements to check Class 8100 EMU Forward Facing Closed Circuit Television (FFCCTV) maintenance activities in the Compliance Coordinators documentation records / check sheets;
- IÉ-RU CME to review and develop a maintenance strategy for the 8100 EMU On Train Data Recorders (OTDRs) to ensure that the correct information is recorded.

Luas Overhead Line Failure, Stillorgan, 2nd November 2020

On 2nd November 2020 the 14:31 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 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.

In this incident, there are two distinct events, namely the failure of the OCS wire and the re-energisation of the failed OCS wire, and as such the causal, contributing and systemic factors are separated. In terms of the OCS mechanism of failure, the OCS wire failed for the following causal factors:

- The OCS wire at Stillorgan suffered from necking (reducing its tensile strength) as a result of the OCS wire becoming annealed due to over-heating;
- The planned inspections of the OCS did not identify the presence of necking at the Stillorgan Stop.

Contributory factors were:

- The inspections of the OCS did not identify the presence of Cupric Oxide as a precursor to the necking, either at Stillorgan in 2020 or at Milltown in 2015;
- The stopping position of trams, consistently in the same location (15 m or 30 m from the Stop Line) resulted in the pantograph drawing down the current at the same location on the OCS wire.

A systemic factor identified that the OCS inspection regime was not robust and failed to identify OCS wire necking, as evidenced at numerous locations on the Green Line.

The re-energisation of the broken OCS wire at Stillorgan was a result of the following causal factors:

- Service 88 (Tram 5003), although initially stopped by the Traffic Supervisor, was permitted to continue to Sandyford Stop; while travelling to Sandyford, the pantograph of Tram 5003 bridged the Insulated Overlap between Sandyford ESS and Central Park.

There are no contributing factors associated with this incident in terms of the re-energisation of the broken OCS wire; however, systemic factors were identified as:

- The Dewirement Guide did not provide enough details for the Traffic Supervisor to manage a dewirement incident appropriately;
- The Incident Management Procedure only provides information for larger incidents, and as such did not provide information in relation to dewirements incidents where there are no fatalities or injuries.

As a result of the above findings, the RAIU made five safety recommendations:

- Transdev, along with S2M, should conduct a full review of their inspection processes for OCS wires to ensure pre-cursors, likely location and faults with the OCS are referenced;
- 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;
- Transdev should put a process in place that all trams involved in serious incidents have the OTDR downloaded as soon as possible to prevent overwriting of the data;
- Transdev should include the electrical resistance measuring of vehicle earth bonding in the planned preventative maintenance regime for all trams;
- Transdev should investigate the reason for the build-up of Cupric Oxide on the OCS wire and include:
    - 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.

Luas isolation irregularity, Kylemore to Suir Road, 5th January 2021

A planned inspection of the 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.

A causal factor related to Tram 4010 entered the de-energised area which was in the process of being isolated, was that the Traffic Supervisor de-energised the Kylemore to Suir Road section before the last tram had passed through the section as the Traffic Supervisor did not check the AVLS for the presence of trams.

Contributory factors were:

- The Section Insulators, used by Transdev, allow current to travel from an energised section into a de-energised section when bridged by a tram pantograph;
- The conversation between the Traffic Supervisor and the Authorised Person did not meet the requirements of safety critical communications; in addition, the playing of a news broadcast during a safety critical communication may have acted as a distraction to the message being communicated.

Systemic factors were:

- The "Isolation and Earthing of OCS" document and the Switching Programme Form" do not require the checking of the AVLS for the presence of trams prior to granting of an isolation;
- The safety critical communications suite of documents is not robust in terms of the monitoring of staff for the correct use of safety critical communications (e.g. there is no random downloads of voice communications).

Although not causal, contributing, or systemic, the RAIU make the following additional observations:

- The RAIU were not notified immediately of the incident but were notified two days later;
- The Traffic Supervisor did not immediately report the incident and as such was not subject to drugs and alcohol testing, in line with Transdev protocols;
- The Isolation Signage is not illuminated or secured in position;
- There are some anomalies regarding the Transdev suite of earthing, isolation and switching documents, in that they do not reference each other and there are errors in terms of referencing.

The RAIU made the following safety recommendations as a result of causal, contributory and systemic factors, as well as additional observations:

- 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;
- 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);
- 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.

2021 Monthly Bulk Notifications

IÉ 2021 Monthly Bulk Notifications

The monthly bulk notifications (not including immediate notifications) for IÉ (IÉ-IM & IÉ-RU) are as follows:

Month / ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2.01 Unexpected failures of assets that led to an unsafe condition													
2.02 Unintentional divisions of rolling stock released for service			1										1
2.03 SPADs with no risk of conflicting movements				1				1	1		1		4
2.04 Fires, smoke or explosions on rolling stock not requiring the evacuation of passengers	1		1	4		4	2	1	1				14
2.05 Collisions with large objects or large animals	5	3	6	6	2	1	4	2	11	7	7	10	64
2.06 Non railway vehicles damaging or fouling a railway line													
2.07 Collisions between light rail vehicles and road vehicles													
2.08 Any other occurrence where an investigation remit has been issued internally		1		1			3	2	1	2	1		11
Total	6	4	8	12	2	5	9	6	14	9	9	10	94

The overall figure of ninety-four reportable occurrences has increased by ten, from eighty-four to ninety-four, with the majority of occurrences related to collisions with objects or animals, this number has increased from fifty-six to sixty-four this year; the number of fires has also increased from six to fourteen. In terms of SPADs, this figure has halved, decreasing from eight to four.

Transdev 2021 Monthly Bulk Notifications

The monthly bulk notifications (not including immediate notifications) for Transdev are as follows:

Month / ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2.01 Unexpected failures of assets that led to an unsafe condition			2		1	1	1			1			6
2.02 Unintentional divisions of rolling stock released for service													
2.03 SPADs with no risk of conflicting movements	1	1		1	1	1		1	5	1	3	1	16
2.04 Fires, smoke or explosions on rolling stock not requiring the evacuation of passengers													
2.05 Collisions with large objects or large animals										1			1
2.06 Non railway vehicles damaging or fouling a railway line				1			2			3	2	2	10
2.07 Collisions between light rail vehicles and road vehicles	1		2	2	1	4	1	2	1	1	1	2	18
2.08 Any other occurrence where an investigation remit has been issued internally	1							1					2
Other occurrences Involving brushed contact with vehicles, pedestrians & cyclists; and scutting.	2		2	2	4	4	5	3	4	7	6	2	41
Other occurrences Involving wrongside door openings, trap-and-drag occurrences			1				1			1	1	1	5
Other occurrences Any other occurrences	4	3	4	1	1	1	2	2	4	6		2	30
Total	9	4	11	7	8	11	12	9	14	21	13	10	129

The overall figure has increased from ninety-one to 129 from the previous year. The figures show that the majority of incident involve collisions/contacts with road vehicles, cyclists and pedestrians.

2021 Urgent Safety Advice Notice / Safety Advice Notice

1st January 2021 to 31st December 2021

The RAIU did issued one Urgent Safety Advice Notice, USAN 003, in 2021 based on the Luas isolation irregularity incident, between Kylemore to Suir Road, on the 5th January 2021.

In relation to the calls made on the 5th January 2021 related to the incident, the RAIU found that the communications did not meet the requirements of Transdev documentation and that the safety critical communications were below that expected of a professional railway organisation in that:

- Parties routinely did not identify themselves;
- A clear understanding was not always reached between the parties;
- Instructions were often not repeated;
- Clear language was not always used.

As a result, during this safety critical communication, a misunderstanding of a request was actioned resulting in an isolation being granted while an out-of-service tram was approaching the isolated section on route to the Red Cow Depot.

USAN 003 was issued on the 1st March 2021, stating "TDLR[1] should urgently undertake a review of their safety critical communications for all modes of communication". The RAIU recommended that, while the review was being undertaken, Transdev should:

- Develop and publish a concise standard for safety critical communications for all modes of communication;
- Implement a robust competency management programme for initial and refresher training based on the requirements of this new standard;
- Continuously assess safety critical communications to ensure that staff are adhering to safety critical communications set out in the new standard.

[1] Transdev Dublin Light Rail

Tracking Safety Recommendations

RAIU

Railway Accident Investigation Unit

Tracking Safety Recommendations

Monitoring of RAIU safety recommendations

In accordance with the Railway Safety Act 2005 (Government of Ireland, 2005a) and the European Railway Safety Directive (European Union, 2020), recommendations are addressed to the national safety authority, the CRR[2]. The recommendation is directed to the party identified in each recommendation. The CRR also monitors the RAIU safety recommendations from USANs and SANs.

The CRR safety recommendation statuses are open/in progress, submitted, further evidence requested and closed; and are defined below.

Status	Description
Open/ In Progress	Feedback/evidence from the Railway Organisation is pending; or, actions have not yet been completed.
Submitted	The Railway Organisation 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.
Further Evidence Requested	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.

[2] Formerly the Railway Safety Commission (RSC); the name was changed on the 29th February 2016 under Statutory Instrument (S.I.) No. 69 of 2016, Change of name of the Railway Safety Commission to Commission for Railway Regulation (Appointed Day) Order 2016.

Status of RAIU safety recommendations

RAIU Safety Recommendations in numbers

The CRR, as the National Safety Authority (NSA) for Ireland, holds meetings with the relevant stakeholders to monitor the progress of safety recommendations.

As of the 31st December 2021, the RAIU have made 240 recommendations from investigation reports, USANs and SANs. All recommendations were accepted by their addressee and implementer.

The status of the recommendations as of the end of 2021 is illustrated below, note that 61% of the recommendation have been addressed and are closed.

Year	No. of Reports/ U/SANs	Number of Recommendations	Status of Recommendations				Percentage Closed
			Open / In Progress	Submitted	FER	Closed	
2008	1	7	0	0	0	7	100%
2009	5	13	0	0	0	13	100%
2010	6	26	1	0	0	25	96%
2011	7	17	0	0	2	15	88%
2012	3	13	0	0	0	13	100%
2013	4	9	0	0	1	8	89%
2014	6	28	1	0	5	22	79%
2015	2	4	0	0	2	2	50%
2016	3	17	5	0	2	10	58%
2017	2	9	1	0	3	5	56%
2018	2	8	1	0	2	5	63%
2019	5	36	18	0	7	11	31%
2020	4	18	7	0	6	5	28%
2021	8	35	24	0	6	5	14%
Totals	58	240	58	0	36	146	61%

Status of individual RAIU safety recommendations

In terms of the individual safety recommendations, the safety recommendations are compiled in the following tables:

Table	Title
Table 1	RAIU safety recommendations closed in 2020
Table 2	RAIU safety recommendations with 'FER' status in 2020
Table 3	RAIU safety recommendations 'Submitted' in 2020
Table 4	RAIU safety recommendations "Open/ In Progress" in 2020
Table 5	RAIU safety recommendations closed prior to 2020

Table 1 – RAIU safety recommendations made in 2021

Report/USAN/SAN	Recommendation
Collision between a car and a train at Kilnageer, Level Crossing (XM240), Mayo, 29th April 2020 (RAIU Investigation Report No: 2021 – R001, published: 18th February 2021).	The RSA should update the "Rules of the Road" to include guidance on the DSS.
	IÉ-IM should update the 'The SAFE use of Unattended Railway Level Crossings' booklet to include guidance on the DSS.
	IÉ-RU should put systems in place to ensure ICR train horns meet the current standards for sound pressure levels.
	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 DSS is included.
Collision between a Bord na Móna (BnM) Flat Wagon and Kilcolgan Level Crossing Gates, Offaly, 8th June 2020, RAIU Investigation Report No: 2021 – R002, published: 18th February 2021).	BnM should identify locations where derailing points are vulnerable to unauthorised movements and provide a means of securing the derailing points at these locations.
	BnM 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.
	BnM should develop a training, assessment and continuous assessment programme related to the Procedures for Rerailing Wagons / Rail Stock.
	BnM should review its level crossing Risk Register updating where necessary to sufficiently capture all reasonably foreseeable risks. In addition, BNM 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.
	The Engineering Department of BnM should carry out the technical evaluation into the efficacy of the derailing points, etc. identified in BnM internal investigation report into the collision between a BnM locomotive and the gates of Endrim Gates on the 21st September 2017.
	BnM should update their Specification for Crossings to include the requirements of the Department of Transport's Traffic Signs Manual; based on this BnM should update the signage on the approaches to all BnM level crossings.
USAN003 Luas isolation irregularity incident, between Kylemore to Suir Road, on the 5th January 2021 (published 01/03/2021)	Transdev should urgently undertake a review of their safety critical communications for all modes of communication, while the review was being undertaken, Transdev should: • Develop and publish a concise standard for safety critical communications for all modes of communication; • Implement a robust competency management programme for initial and refresher training based on the requirements of this new standard; • Continuously assess safety critical communications to ensure that staff are adhering to safety critical communications set out in the new standard.
Person entrapped in lowered CCTV level crossing, Ashfield, Offaly, 24th May 2020 (RAIU Investigation Report No: 2021 – R003, published 21st May 2021).	IÉ-IM Signalling, Electrical and Telecommunications (SET) 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
	IÉ-IM 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.

Report/USAN/SAN	Recommendation
Person entrapped in lowered CCTV level crossing, Ashfield, Offaly, 24th May 2020 (RAIU Investigation Report No: 2021 – R003, published 21st May 2021).	IÉ-IM Chief Civil Engineer (CCE) should examine the feasibility of installing signage inside the barriers of CCTV level crossings warning MOPs what actions to take in the event of becoming trapped.
	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 LCCOs in identifying persons/obstacles that maybe trapped within the confines of a level crossing.
	IÉ-IM should introduce measures to deter pedestrians from using unauthorised routes onto CCTV Level Crossings.
	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.
Chassis Plate Fracture on General Motors Class 201, Locomotive 224, 7th July 2020 (RAIU Investigation Report No: 2021 – R004, published 1st July 2021).	IÉ-RU 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.
	IÉ-RU CME should develop a procedure for evaluating maintenance advice received from OEMs or other railway organisations to determine applicability to IÉ fleets and assess any associated risks.
	IÉ-RU CME and IÉ-IM CCE should carry out a risk assessment on the implications of the increased axle load of a 201 Locomotive.
Overhead Line detachment, Pearse Station, 1st October 2020 (RAIU Investigation Report No: 2021 – R005, published 22nd September 2021).	IÉ-RU CME should in conjunction with the OEM develop a maintenance regime for the pantographs, taking into consideration the operational conditions and traceability of safety critical components.
	IÉ-RU CME should carry out, in conjunction with the OEM, a condition assessment to determine the correct period for the overhaul of the IÉ-RU pantographs.
	IÉ-RU and IÉ-IM 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.
	IÉ-RU CME to include requirements to check pantograph maintenance activities in the Compliance Coordinators documentation records / check sheets.
	IÉ-IM SET should evaluate the auto-reclose function of the 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.
	IÉ-RU CME to include requirements to check Class 8100 EMU Forward Facing Closed Circuit Television (FFCCTV) maintenance activities in the Compliance Coordinators documentation records / check sheets.
	IÉ-RU CME to review and develop a maintenance strategy for the 8100 EMU On Train Data Recorders (OTDRs) to ensure that the correct information is recorded.

Report/USAN/SAN	Recommendation
Luas Overhead Line Failure, Stillorgan, 2nd November 2020 (RAIU Investigation Report No: 2021 – R006, published 27th October 2021).	Transdev, along with S2M, should conduct a full review of their inspection processes for OCS wires to ensure pre-cursors, likely location and faults with the OCS are referenced.
	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;
	Transdev should put a process in place that all trams involved in serious incidents have the OTDR downloaded as soon as possible to prevent overwriting of the data;
	Transdev should include the electrical resistance measuring of vehicle earth bonding in the planned preventative maintenance regime for all trams;
	Transdev should investigate the reason for the build-up of Cupric Oxide on the OCS wire and include: • 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.
Luas isolation irregularity, Kylemore to Suir Road, 5th January 2021 (RAIU Investigation Report No: 2021 – R007, published 16th December 2021).	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.
	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).
	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.
Light blue indicates recommendations associated with IÉ-IM & IÉ-RU; dark blue indicates recommendations associated with Transdev; green indicates recommendation associated with BnM; pink indicates a recommendation associated with TII and Transdev.	

Table 2 – RAIU safety recommendations closed in 2021

This section identifies the safety recommendations closed in 2020 (in order of occurrence date, oldest first).

Report/USAN/SAN	Recommendation
SPADs on the IÉ network from January 2012 to July 2015 (published 11/04/2016)	IÉ-RU should review the culture within the company so that actions taken after SPAD's supports learning within the driver grades should errors occur, and that the DD&SS is used for redeveloping competence in driving skills and supporting the drivers in returning to driving duties, after a SPAD event.
Derailment of DART passenger service, at Points DL115, Dun Laoghaire, 13th September 2017 (published 15th August 2018)	IÉ-RU should review their suite of documents which reference major customer disruptions and emergencies and address any deficiencies in relation to the management of passengers on trains and uncontrolled impromptu evacuations. These documents should then be briefed to staff who have roles in relation to customer disruptions and emergencies to ensure they are aware of their responsibilities.
	IÉ-RU should brief the relevant staff on the requirements of the IÉ Rule Book (Section M 3.1.2) which states that where emergency detonator protection is not needed, drivers must place a Track Circuit Operating Device on the line(s) concerned to supplement the signal protection.
Wrongside Door Failure at Ashtown Station, 12th August 2018 (published 25th June 2019)	IÉ-RU CME should review VMI Z1C29A0001 'Examination of 29000 class vehicle after an incident / accident' to develop a more thorough and robust VMI that is commensurate with the safety risk of faults occurring after rolling stock has been involved in an incident or accident.
	IÉ-RU CME should review VMIs associated with the examination of rolling stock after an incident / accident, for all rolling stock fleets, to develop a more thorough and robust VMI that is commensurate with the safety risk of faults occurring after rolling stock has been involved in an incident or accident.
Collision of an ICR with a buffer stop at Laois Train Care Depot, 17th July 2018 (published 25th June 2019)	IÉ-RU CME should review the suite of LTCD documents that relate to the management of moving trains within LTCD to ensure they are consistent and adequately reference any existing supporting documentation (e.g. ICR Hauling Assisting Instructions).
	IÉ-RU CME should re-brief staff on the correct procedure for disembarking from a moving train.
Collision between an IÉ passenger train and rail-mounted maintenance equipment, Rosslare, Wexford, 11th January 2020 (published 16/12/2020)	IÉ-IM clearly define the role of the PWI/APWI and update the relevant documentation accordingly.
Collision between a Bord na Móna (BnM) Flat Wagon and Kilcolgan Level Crossing Gates, Offaly, 8th June 2020 (published 18/02/2021)	BnM 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.
	BnM should develop a training, assessment and continuous assessment programme related to the Procedures for Rerailing Wagons / Rail Stock.
Chassis Plate Fracture on General Motors Class 201, Locomotive 224, 7th July 2020 (published 01/07/2021)	IÉ-RU CME should develop a procedure for evaluating maintenance advice received from OEMs or other railway organisations to determine applicability to IÉ fleets and assess any associated risks.
Overhead Line detachment, Pearse Station, 1st October 2020 (published 22/09/2021)	IÉ-RU CME to include requirements to check Class 8100 EMU Forward Facing Closed Circuit Television (FFCCTV) maintenance activities in the Compliance Coordinators documentation records / check sheets.
	IÉ-RU CME to review and develop a maintenance strategy for the 8100 EMU On Train Data Recorders (OTDRs) to ensure that the correct information is recorded.
* Light blue indicates recommendations associated with IÉ; green indicates a recommendation associated with BnM.	

Table 3 – RAIU safety recommendations with 'FER' status in 2021

This section identifies the safety recommendations where the CRR has reviewed a submission (or further submission) but considers that further evidence is necessary to close the safety recommendation, as of the end of 2020.

Report	Recommendation
Laois Traincare Depot Derailment, 20th January 2010 (published 19/01/11)	IÉ should ensure that the Signal Sighting Committee is informed when train drivers report difficulties viewing a signal and the Signal Sighting Committee should verify that the reported difficulties are addressed effectively.
Road vehicle struck at level crossing XM096, County Roscommon, 2nd September 2010 (published 04/10/11)	IÉ should review how it determines the safe crossing time for user worked level crossings to ensure the safe crossing time allows adequate time for movements and includes a safety margin, over and above the crossing time.
Fog signal activation in Dart driving cab, Bray, on the 6th March 2012 (published 19/09/2013)	IÉ should ensure that their procurement and quality control processes verify that goods received are of the correct specification as those ordered.
Trend Investigation: Possession incidents on the Iarnród Éireann network (published 27/01/14)	IÉ-IM should monitor and review entries into Section "Engineering works requiring absolute possessions – Section T Part III" of the Weekly Circular to ensure that the information published in this document is accurate and credible.
	IÉ-IM should undertake a review of possession incidents that have occurred over the last four years to ensure that reports are completed & recommendations are identified and addressed.
Operating irregularity during Single Line Working (SLW) between Dundalk and Newry, 23rd March 2013 (published 28/04/14)	IÉ should review their training, assessment and competency of Signalmen and Pilotmen in relation to SLW with Pilotman to ensure they are confident in performing their respective duties during SLW and are familiar with the routes covered.
Structural failure of a platform canopy at Kent Station, Cork, 18th December 2013 (published 07/11/14)	IÉ-IM should identify all cast-iron structures on the network. From this, a risk-based approach should be taken in relation to the inspection of these assets, during routine inspections, in terms of any risks associated with cast-iron.
	IÉ-IM should review the structural and annual inspection regimes for Building & Facilities to ensure all assets are inspected in accordance with the prescribed standards and any associated documentation is completed appropriately.
Vehicle struck by train at Corraun level crossing, XX024, Co. Mayo, 12th February 2014 (published 30/04/15)	IÉ should consider options to upgrade the crossing to minimise direct action by the users.
	IÉ should carry out a full review of known misused user worked level crossings on public and private roads and either upgrade the level crossing or introduce measures to minimise their misuse.
Investigation into SPADs on the IÉ network from January 2012 to July 2015 (published 11/04/2016)	IÉ-IM should review their training and competency management for Traffic Regulators so that they have the appropriate skill set in terms of identifying potential risks associated with the regulating of trains.
Dangerous occurrence between Ballybrophy and Portlaoise, 12th September 2015 (published 6th September 2016)	IÉ-IM should review the method of allocation and accountability for general operatives detailed for work sites, to ensure that there are sufficient personnel on site to perform the required duties.

Report	Recommendation
Near miss at Knockcroghery Level Crossing, XM065, Co. Roscommon, 31st January 2017 (published 20th December 2017)	The SET Department should review the camera position at LC XM065, and other similar CCTV level crossings, to ensure that the LCCOs have optimum, unobstructed, views of level crossings.
	The SET Department should develop a formalised risk assessment process for the positioning of CCTV cameras and associated design works.
	IÉ-IM should identify CCTV level crossings with obstructed views and issue interim instructions to LCCOs to fully raise the barriers where there is a possibility of any obstructions on level crossings.
Derailment of DART passenger service, at Points DL115, Dun Laoghaire, 13th September 2017 (published 15th August 2018)	IÉ-IM should agree and implement a consistent wording in the Rule Book, General Appendix, training material and oral instructions in relation to the points operator's instructions; and ensure that the importance of the task order is highlighted in the training for points operators.
	IÉ-IM should review the drawing and specification requirements for points scotches and ensure only scotches manufactured to the required drawing and specification are made available to points operators.
Wrongside Door Failure at Ashtown Station, 12th August 2018 (published 25th June 2019)	IÉ-RU CME should review their scheduled maintenance examinations, for multiple-unit fleets, with a view to developing a means to check the connection is correct on the electrical head.
Collision of an ICR with a buffer stop at Laois Train Care Depot, 17th July 2018 (published 25th June 2019)	IÉ-RU CME should review their SSOW & OI and associated documents related to the identification, communication and prevention of movement of defective vehicles to ensure relevant staff are made aware of identified defects and that the defective vehicles are adequately labelled and tagged; and these processes and staff responsibilities are fully understood by all CME staff working on trains.
	IÉ-RU CME should review its training and competency of CME Drivers and Limited Shunters ensuring the stabling and movement of vehicles (defective or otherwise) are adequately addressed.
	IÉ-RU CME should determine who has overall responsibilities for the movement of trains within the confines of LTCD, including who is allocated the role of Designated Person Responsible for Protection, and, clearly brief these responsibilities in the CME Training Course and the SSOW & OI.
Vehicle struck by train at Cartron level crossing, XM220, Co. Mayo, 17th August 2018 (published 3rd September 2019)	IÉ-IM should carry out a full review of known misused user worked level crossings on public and private roads and should develop a programme to either close or upgrade the level crossings to minimise misuse; where possible, level crossings with the highest risks should be addressed first.
Road Rail Vehicle occurrences on Iarnród Éireann Network from 2015 to 2018 (published 8th October 2019)	IÉ-IM should ensure appropriate procedures are in place for Drugs & Alcohol screening for IÉ-IM and contractor staff post RRV occurrence.
	IÉ-IM should brief Signalmen on RRVs operations during possessions (i.e. accessing and egressing worksites and well as travelling to worksites training in terms of RRVs operating in possessions) to ensure points are set correctly for the RRV movements. Training material for Signalmen on the roles of RRVs should be updated to reflect this.
Passenger trap-and-drag occurrence on Luas tram at Heuston Stop, 26th March 2019 (published 04/03/2020)	Transdev should brief drivers on the operation of the door mechanism, and specifically explain the removal of obstacle detection for the final 10 mm of door travel; this briefing should then be incorporated into their suite of training and competence management documents.

Report	Recommendation
Passenger trap-and-drag occurrence on Luas tram at Heuston Stop, 26th March 2019 (published 04/03/2020)	Transdev should develop and implement an induction training and competency assessment program for security staff, which should include training and assessment in the use of safety critical communications.
	Transdev should update their Work Instructions (WIs) to ensure that appropriate testing is conducted for sensitivity of obstacle detection, door impact for closing forces and obstacle removal forces; the requirements set out in Irish Standard (I.S.) EN 14752 should be used, as appropriate.
	Transdev should update their Chain of Care Procedure mandating that drivers are subject to appropriate developmental supports (such as assessment, monitoring and supervision) post incident/accident. Depending on the type of incident/accident, and whether the actions of the driver contributed to the incident/accident, specified periods of time of continuing developmental supports should be set.
	Transdev, as part of the update to the SMS 018 Competence Assessment, should formally include the assessments that should be conducted every quarter.
Near miss with an Iarnród Éireann SET Worker at Rush and Lusk Station, 20th June 2019 (published 27/05/2020)	The IÉ-IM SET Department should develop a formalised process, through their SMS suite of documents, for IÉ-IM SET staff walking/ working alone, which should be completed prior to any member of SET 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.
Collision between a Bord na Móna (BnM) Flat Wagon and Kilcolgan Level Crossing Gates, Offaly, 8th June 2020 (published 18/02/2021)	BnM should identify locations where derailing points are vulnerable to unauthorised movements and provide a means of securing the derailing points at these locations.
	BnM should review its level crossing Risk Register updating where necessary to sufficiently capture all reasonably foreseeable risks. In addition, BNM 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.
	The Engineering Department of BnM should carry out the technical evaluation into the efficacy of the derailing points, etc. identified in BnM internal investigation report into the collision between a BnM locomotive and the gates of Endrim Gates on the 21st September 2017.
	BnM should update their Specification for Crossings to include the requirements of the Department of Transport's Traffic Signs Manual; based on this BnM should update the signage on the approaches to all BnM level crossings.
Overhead Line detachment, Pearse Station, 1st October 2020 (published 22/09/2021)	IÉ-RU CME should in conjunction with the OEM develop a maintenance regime for the pantographs, taking into consideration the operational conditions and traceability of safety critical components.
	IÉ-RU CME to include requirements to check pantograph maintenance activities in the Compliance Coordinators documentation records / check sheets.
Light blue indicates recommendations associated with IÉ, IÉ-IM, IÉ-RU; dark blue indicates recommendations associated with Transdev; green indicates recommendations associated with BnM.	

Table 4 – RAIU safety recommendations 'Submitted' in 2021

As of 2020, safety recommendations were either closed, open or further evidence was requested and as such, there were no recommendations with the status "submitted".

Table 5 – RAIU safety recommendations "Open/ In Progress" in 2021

This section identifies the safety recommendations where feedback or evidence from the Railway Organisation is pending; or, actions have not yet been completed.

Report	Safety recommendation
Malahide Viaduct Collapse on the Dublin to Belfast Line, on the 21st August 2009 (published 16/08/10)	The CRR, in conjunction with IÉ, should develop an action plan in order to close all outstanding recommendations in the AD Little Review (2006) and the International Risk Management Services Reviews (1998, 2000, and 2001). This action plan should include defined timescales for the implementation and closure of all these recommendations.
Tram fire on approach to Busáras Luas Stop on the 7th November 2013 (published 28/08/14)	Transdev should undertake a review of higher ignition temperature hydraulic oils to identify if they would be feasible in the braking circuit and add a safety benefit.
SPADs on the IÉ network from January 2012 to July 2015 (published 11/04/2016)	IÉ-IM must introduce an adequate train protection systems on all of the IÉ network for the protection of trains; this system should be robust and to an acceptable standard within Europe; and have the appropriate ATP and speed supervision functionality.
	IÉ-IM should review the functionality of the ATP's running release to ensure that the train protection function in relation to passing a signal at danger is appropriately maintained where drivers are approaching signals displaying red aspects. If this is not feasible with the current equipment it should be included any new train protection system introduced on the network.
	IÉ-IM should identify high risk signals and, where the technology exists, introduce a mechanism to monitor the approach speed to these signals; to ensure that near misses are identified and managed.
	IÉ-IM should identify all locations where safety critical communications are not recorded and develop a programme of works for the introduction of recording safety critical communications at these locations.
Operational incidents at Ardrahan on the 23rd October 2015 & Spa on the 28th November 2015 (published 20/10/16)	IÉ-RU should review all traction fleets that do not have sanding capabilities, and fit suitable systems to minimise the risk of low adhesion incidents. Northern Ireland Railways (NIR) have also closed this recommendation. Although this recommendation was closed for IÉ-RU, it remains open against the Railway Preservations Society of Ireland (RPSI) & other maintenance railway organisations operating on the IÉ network.
Difflin Light Rail (DLR) Passenger Fall, Co. Donegal on the 17th December 2016 (published 7/11/2017)	DLR should review the physical and procedural safeguards for the operation of their trains, to prevent small children whose feet do not touch the ground in a seated position, from falling from open carriages.
Derailment of DART passenger service, at Points DL115, Dun Laoghaire, 13th September 2017 (published 15/08/2018)	IÉ IM and IÉ-RU should evaluate the current training, assessment and monitoring of Safety Critical Communications to ensure that communications are carried out to the requirements set out in IÉ Rule Book, and safety critical communications standards IMO-SMS-033 and OPS-SMS-8.1.
Vehicle struck by train at Cartron level crossing, XM220, Co. Mayo, 17th August 2018 (published 3rd September 2019)	DTTAS** should review, in consultation with the relevant stakeholders, their current advance warning signage (W 121) with a view changing the signage to make it clear to road users that they are approaching a user operated level crossing. They should also consider the introduction of other traffic calming measures in efforts to encourage safe road user behaviour. Care should be taken not to inadvertently introduce new risks as a result of their proposed measures.

Report	Safety recommendation
Road Rail Vehicle occurrences on Iarnród Éireann Network from 2015 to 2018 (published 8th October 2019)	The DTTAS** should review the Railway Safety Act 2005 and current amendments to make clear the classification of RRVs; consultation should be sought with the Commission for Railway Regulation (CRR); and, relevant stakeholders where appropriate.
	The CRR & IÉ-IM should review the requirements prescribed in the Railway Safety Act (and current amendments) to ensure they are satisfied that all the requirements of the Railway Safety Act (and current amendments) are met in terms of RRVs being classified as rolling stock.
	IÉ-IM should review and improve its current Chief Civil Engineer (CCE) Plant and Machinery Standards; attention should be given to best international practice in RRVs; and, as a minimum, the following should be considered for inclusion: • Applying the requirements set out in the EN 15746/ I.S. EN 15746 standards such as controls & indicators, visibility from the cab, warning systems & communications between work positions, etc. Where, due to a technical impossibility, the design specifications of EN 15746 cannot be met in full, control measures to address these deficiencies should be clearly identified, risks assessed, and suitable controls implemented; • The installing of an appropriate emergency warning system, which, when activated in emergency, can produce a suitably loud audible alarm and/or visual alarm. In cases, where this is not possible, as a result of a technical impossibility, control measures to address this deficiency should be clearly identified, risk assessed, and suitable controls implemented; • Installing Wheel Slip Prevention and/or sanders on RRVs; • Installing of Anti-Collision Devices on RRVs for the prevention of collisions with other RRVs, rolling stock, infrastructure and staff (through the provision of portable ACDs fitted to staff) on the IÉ network. In cases, where this is not possible, as a result of a technical impossibility, control measures to address this deficiency should be clearly identified, risk assessed, and suitable controls implemented; • Introducing an appropriate means of communication between work positions, whereby the RRVOs and RRVCs can communicate while on-tracking, travelling on the railway and at worksites; • Installing of data recorders on RRVs; • The suitability of the current braking system on Type 9B RRVs where an indirect rail wheel braking system is in place; consideration should be given for the requirement to have all RRVs fitted with direct rail wheel braking systems.
	IÉ-IM are to engage with the RRV contractors in relation to updated CCE Plant and Machinery Standards; and, give clear guidelines on when these new requirements come into full effect.
	In relation to existing RRVs, IÉ-IM should assess the operation of existing RRVs to satisfy itself, on the basis of a risk assessment, that there are adequate technical and operational controls to prevent loss of control of RRV occurrences in the future.
	IÉ-IM should include, in their post-occurrence procedures, a requirement to verify the performance of RRVs (including braking performance) involved in accident, incidents or dangerous occurrences (near misses) to ensure the requirements of the CCE Plant and Machinery Standards are met in full; this should involve the completion of a full post-occurrence examination of the RRV by the contractor. A requirement that RRVs involved in accidents, incidents or dangerous occurrences (near misses) are not permitted back onto the IÉ network until the post-occurrence procedures have been completed and the RRV is confirmed fit and safe for use.
	IÉ-IM should update their CCE Plant and Machinery Standards to include requirements for RRV contractors to provide RRV information: at the acceptance stage; and, at later dates where modifications are made to RRVs. Where this information is not provided, and the requirements of the updated CCE Plant and Machinery are not met, the RRVs involved should not be allowed to operate on the IÉ network.

Report	Safety recommendation
Road Rail Vehicle occurrences on Iarnród Éireann Network from 2015 to 2018 (published 8th October 2019)	IÉ-IM must develop a suitable RRVO training course which must incorporate both theory and practical elements for the operation of RRVs; there should be an assessment on completion of this initial training. When a person passes this initial training, they must complete and log supervised hours of RRV operation; and present for a final through assessment. This process should be risk assessed to determine the: number of days training; practical training requirements; number of supervised hours; and, final assessment requirements.
	IÉ-IM should develop a competency management system for the management of RRVOs competencies; this system should also include instructions related to re-training and monitoring of RRVOs after they have been involved in an accident.
	IÉ-IM should conduct a thorough review of their suite of SMS documentation and CCE Plant and Machinery standards, related to RRV contractors, to identify deficiencies in terms of the management of contractors and their plant. Where deficiencies are identified, IÉ-IM should develop new systems for the management of plant on site, and, for their safety tour and compliance verification processes to ensure contractors regularly inspect and maintain their plant in good condition; rather than the continued issuance of corrective action notices.
	IÉ-IM should review the ways in which it promotes a positive safety culture that encourages contractors to report accidents, incidents and dangerous occurrences (near misses); this can be achieved through RRVO workshops and the absence of disciplinary procedures on the reporting of occurrences.
	IÉ-IM should update their CCE Plant and Machinery Standards to ensure that RRV contractors are either provided with, or required to identify, the hazards associated with track gradient, rail contamination (or other low adhesion conditions) and RRV orientation and position on track through: • Assessing documentation on the site-specific hazards associated with RRV and ensuring these are addressed in contractor's safety documentation; • Setting requirements in relation to the spacing between RRVs when travelling in convoy (e.g. 100 m) and putting in place a regime to ensure these requirements are met; • Training RRVCs/RRVOs on the risks associated with track gradient, rail contamination and RRV orientation and guidance on how to manage these risks in a braking emergency.
	IÉ-IM should conduct an audit on RRV contractor's safety documents with a view to identifying deficiencies in terms of safety and ensuring the appropriate safety documentation is produced for the works; IÉ-IM should support and offer guidance to the RRV contractors in terms of the identification of hazards and methods of working on a railway network.
	IÉ-IM should make changes to the IÉ Rule Book to ensure that all relevant requirements set out in their CCE Plant and Machinery Standards related to RRVs are incorporated into the IÉ Rule Book.
	IÉ-IM should update their CCE Plant and Machinery Standards to include the requirements set out in Section Q 2018 of the IÉ Rule Book related to the collection of pre-operation checklists by the RRVCs from the RRVOs; and ensure these requirements are enforced through compliance verification activities.
	IÉ-IM should clearly define, document and explain the role and function of the RRVC in the management of RRVs in Section Q of the IÉ Rule Book and/or relevant CCE Plant and Machinery Standards. This should include: • Location of RRVC when on-tracking, during work, and off-tracking; • The sighting requirements of RRVCs (i.e. an RRVC should be able to see RRVs at all times); • The allocation of RRVCs per quantity RRVs (i.e. how many RRVs per RRVs).
	IÉ-IM should review and update the training requirements of RRVCs with a view to incorporating: • Basic infrastructure training (e.g. points); • Training in communications with relevant staff; • Practical RRV training to ensure they have confidence in accepting pre-operations checklists from RRVOs as set out in the IÉ Rule Book.

Report	Safety recommendation
Passenger trap-and-drag occurrence on Luas tram at Heuston Stop, 26th March 2019 (published 04/03/2020)	Transdev should update their suite of document for driver training (SM 017 Driver Training Plan), operations (TSI Manual) and competence assessment (SM 018 & SM 019 Competence Assessment) to include a requirement for drivers to conduct a thorough final visual check (using CCTV and mirrors) after obtaining doors closed and locked indications and before moving the tram to confirm that nothing is trapped in the doors.
	TII should conduct a risk-based review on whether the tram fleet operating on the Red Line should be upgraded with coloured rear view monitors.
Near miss with an Iarnród Éireann Patrol Ganger near Woodlawn, Galway, 4th June 2019 (published 27/05/2020)	IÉ-IM should review its track inspection methods to see if technological/ mechanised systems and/ or other safety measures could be implemented to eliminate/ minimise track worker exposure to railway hazards whilst undertaking the task of track patrolling.
	IÉ-IM should, through their risk assessment process, conduct a review of the patrol lengths, with the objective of identifying all patrol lengths with associated risks, and introducing adequate mitigation measures to eliminate these risks. Consideration should be given to the introduction of technologies (such as anti-collision devices) for use by patrol gangers, with the objective of warning patrol gangers of oncoming trains.
Collision between an IÉ passenger train and rail-mounted maintenance equipment, Rosslare, Wexford, 11th January 2020 (published 16/12/2020)	IÉ-IM should classify and define RMMEs, Trolleys, LMEs and other commonly used plant or equipment on the railway and ensure appropriate safety procedures are in place for their use. IÉ-IM should also assess the need for any associated training and competency related to these changes and if considered necessary prepare training and competency assessment material.
	IÉ-IM CCE should ensure that, once defined and classified, change management systems are put in place to ensure RMMEs, Trolleys, LMEs, etc are not altered for other uses, without first having been safety validated in line with company processes.
	IÉ-IM should update their Mobile Gang Work Instructions, I-PWY-1490, (Ganger's Handbook) to ensure that all routine light maintenance activities are included. Systems, e.g., training, should be put in place to ensure that relevant staff can undertake dynamic risk assessments should non-routine activities need to be undertaken that are not described in the Ganger's Handbook.
Collision between a car and a train at Kilnageer, Level Crossing (XM240), Mayo, 29th April 2020 (published 18/02/2021)	The RSA should update the "Rules of the Road" to include guidance on the DSS.
	IÉ-IM should update the 'The SAFE use of Unattended Railway Level Crossings' booklet to include guidance on the DSS.
	IÉ-RU should put systems in place to ensure ICR train horns meet the current standards for sound pressure levels.
	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 DSS is included.
USAN003 Luas isolation irregularity incident, between Kylemore to Suir Road, on the 5th January 2021 (published 01/03/2021)	Transdev should urgently undertake a review of their safety critical communications for all modes of communication, while the review was being undertaken, Transdev should: • Develop and publish a concise standard for safety critical communications for all modes of communication; • Implement a robust competency management programme for initial and refresher training based on the requirements of this new standard; • Continuously assess safety critical communications to ensure that staff are adhering to safety critical communications set out in the new standard.

Report	Safety recommendation
Person entrapped in lowered CCTV level crossing, Ashfield, Offaly, 24th May 2020 (published 21/05/2021)	IÉ-IM Signalling, Electrical and Telecommunications (SET) 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
	IÉ-IM 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.
	IÉ-IM Chief Civil Engineer (CCE) should examine the feasibility of installing signage inside the barriers of CCTV level crossings warning MOPs what actions to take in the event of becoming trapped.
	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 LCCOs in identifying persons/obstacles that maybe trapped within the confines of a level crossing.
	IÉ-IM should introduce measures to deter pedestrians from using unauthorised routes onto CCTV LCs.
	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.
Chassis Plate Fracture on General Motors Class 201, Locomotive 224, 7th July 2020 (published 01/07/2021)	IÉ-RU 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.
	IÉ-RU CME and IÉ-IM CCE should carry out a risk assessment on the implications of the increased axle load of a 201 Locomotive.
Overhead Line detachment, Pearse Station, 1st October 2020 (published 22/09/2021)	IÉ-RU CME should carry out, in conjunction with the OEM, a condition assessment to determine the correct period for the overhaul of the IÉ-RU pantographs.
	IÉ-RU and IÉ-IM 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.
	IÉ-IM SET should evaluate the auto-reclose function of the 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.
Luas Overhead Line Failure, Stillorgan, 2nd November 2020 (published 27/10/2021)	Transdev, along with S2M, should conduct a full review of their inspection processes for OCS wires to ensure pre-cursors, likely location and faults with the OCS are referenced.
	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;
	Transdev should put a process in place that all trams involved in serious incidents have the OTDR downloaded as soon as possible to prevent overwriting of the data;
	Transdev should include the electrical resistance measuring of vehicle earth bonding in the planned preventative maintenance regime for all trams;
	Transdev should investigate the reason for the build-up of Cupric Oxide on the OCS wire and include: • 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.

Report	Safety recommendation
Luas isolation irregularity, Kylemore to Suir Road, 5th January 2021 (published 16/12/2021)	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.
	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).
	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.
Light blue – IÉ-RU / IÉ-IM; dark blue – Transdev; pink – DLR; lilac indicates a joint recommendation between IÉ-IM & the CRR; orange indicates a recommendation associated with TII; pink indicates a recommendation associated with TII and Transdev.	

Table 6 – RAIU safety recommendations closed prior to 2021

This section identifies the safety recommendations closed prior to 2021 (in order of occurrence date or in the case of trend investigations, the publication date):

Report	Safety Recommendation	Year Closed
Collision at Level Crossing XN104 between Ballybrophy and Killonan, 28th June 2007 (published 18/06/08)	IÉ to review the various sources of information relevant to level crossings & develop a standard, or suite of standards, consolidating information on: civil engineering specifications; signage specifications; visibility of approaching trains; & inspection and maintenance. Ensuring effective & compliance.	2015
	IÉ to develop a robust system that identifies current landowners who have crossings on their property and records the delivery of information to them. This should include the distribution of information to known contractors and should consider timely reminders coming up to the silage season.	2010
	IÉ to develop and implement a vegetation management programme that addresses vegetation management on a risk basis, prioritising high risk areas.	2015
	IÉ to ensure that a system is put in place for effective implementation of existing standards and manage the timely introduction of new and revised standards, this should include departmental instructions.	2014
	IÉ to review the standards relating to on-board data recorders, ensuring that correct operation, accuracy and post incident downloads are effectively addressed.	2010
	IÉ to review the "Monitoring the Speed of Trains" standard, including assessing the effectiveness of monitoring by means of signal cabin train registers.	2010
	The CRR to review and Issue 'Guidelines for the Design of Railway Infrastructure and Rolling Stock'.	2010
Report into the derailment of a Tara Mines freight train at Skerries, 10th January 2008 (published 06/04/09)	IÉ should put in place a risk-based process to ensure ongoing review of the suitability of the temperature settings of the Hot Axle Box Detectors.	2010
	IÉ are to identify the necessary maintenance requirements for all Class D bearings, including producing detailed maintenance procedures taking into account their operational conditions and allowing for traceability of safety critical components, with assistance being sought from the Original Equipment Manufacturer where appropriate.	2010
Fatality at Level Crossing XX032 between Ballina and Manulla Junction, 28th February 2008 (published 02/03/09)	The CRR should carry out a review of the suitability of this type of level crossing on public roads. This review should include, but not be limited to. Factors such as continual misuse, signage, user mobility, environmental and human factors.	2013
	IÉ should, taking into account the close proximity of the three level crossings, close or upgrade some or all of these crossings.	2013
	IÉ must identify crossings that are regularly misused and take proactive action to manage the increased risk created by this misuse.	2015
	IÉ are to put in place procedures that will capture and manage near miss reports.	2010
Near miss at Ballymurray level crossing, 14th June 2008 between Athlone and Westport (published 11/05/09)	IÉ should ensure all safety critical staff have undertaken safety critical communications training and that their ongoing competency management systems specifically monitors the quality of safety critical communications.	2010
	IÉ should put in place safe work methods for the maintenance of Automatic Half Barriers (AHBs), these methods should include risk assessments for any hazards identified in the maintenance of AHBs.	2010

Report	Safety Recommendations	Closed
Collision between a train and a road vehicle at level crossing XN125, Cappadine, on the Ballybrophy to Killonan line, 31st of July 2008 (published 29/07/09)	IÉ should assess the risks relating to road users' behaviour in identifying a safe stopping position at User Worked Level Crossings and based on the outcome of this risk assessment, IÉ should introduce measures to allow safe use of this type of level crossing.	**2013**
	IÉ should carry out risk assessments on level crossings that fail to meet the viewing distances specified in the CRR guidance and implement appropriate measures in order to meet this guidance as a minimum.	**2013**
Collision of a train with the gates of level crossing XH066, Bridgetown, on the Limerick Junction to Rosslare Strand line, 2nd December 2008. (published 01/12/09)	IÉ should review the training and competency management of gatekeepers and signalling maintenance personnel.	**2010**
	IÉ should review the design of signal indicators to ensure their design encourages correct interpretation.	**2010**
	The CRR should audit IÉ's training and competency management system to verify its effectiveness.	**2010**
Collision of a Locomotive with Passenger Carriages at Plunkett Station in Waterford on the Limerick to Rosslare Line, 29th March 2009 (published 04/03/10)	IÉ should review their systems for training and competency management of signalmen ensuring working as a relief signalman is taken into account.	**2010**
	IÉ should ensure procedures are put in place for the operation and maintenance of the MU-2-B1 valves.	**2010**
Derailment of an on-track machine at Limerick Junction Station on the Dublin to Cork Line, 3rd July 2009 (published 10/06/10)	IÉ should put in place a formalised process to ensure that life expired points are removed from service, where this is not possible a risk assessment should be carried out and appropriate controls should be implemented to manage the risks identified.	**2017**
	IÉ should ensure On Track Machine maintenance personnel are trained and competent to examine the wheelsets.	**2010**
Malahide Viaduct Collapse on the Dublin to Belfast Line, on the 21st August 2009 (published 16/08/10)	IÉ should put appropriate interface processes in place to ensure that when designated track patrolling staff (who report to two or more divisional areas) are absent from their patrolling duties, that appropriate relief track patrolling staff are assigned to perform these patrolling duties.	**2011**
	IÉ should amend the Track Patrolling Standard, I-PWY-1307, to remove the requirement for track patrollers to carry out annual checks for scour.	**2010**
	IÉ should formalise their "Civil Engineering and Earthworks Structures: Guidance Notes on Inspections Standard", I-STR-6515, which should include guidance for inspectors on conducting inspections and identifying structural defects. On formalising this document IÉ should re-issue, in the appropriate format, to all relevant personnel.	**2010**
	IÉ should introduce a verification process to ensure that all requirements of their Structural Inspections Standard, I-STR-6510, are carried out in full.	**2013**
	IÉ should ensure that a system is put in place for effective implementation of existing standards and to manage the timely introduction of new and revised standards.	**2013**
	IÉ should ensure that a programme of structural inspections is started immediately in accordance with their Standard for Structural Inspection, I-STR-6510, and ensure that adequate resources are available to undertake these inspections.	**2010**
	IÉ should carry out inspections for all bridges subject to the passage of water for their vulnerability to scour, and where possible identify the bridge foundations. A risk-based management system should then be adopted for the routine examination of these vulnerable structures.	**2013**

Report	Safety Recommendations	Closed
Malahide Viaduct Collapse on the Dublin to Belfast Line, on the 21st August 2009 (published 16/08/10)	IÉ should develop a documented risk-based approach for flood and scour risk to railway structures through: Monitoring of scour risk at sites through scour depth estimation, debris and hydraulic loading checks, and visual and underwater examination; Provision of physical scour / flood protection for structures at high risk; Imposing of line closures during periods of high water levels where effective physical protection is not in place.	2013
	IÉ should adopt a formal process for conducting structural inspections in the case of a report of a structural defect from a member of the public.	2015
	IÉ should introduce a training, assessment and competency management system in relation to the training of structural inspectors, which includes a mentoring scheme for engineers to gain the appropriate training and experience required to carry out inspections.	2012
	IÉ should review their network for historic maintenance regimes and record this information in their information asset management system (IAMS). For any future maintenance regimes introduced on the network, IÉ should also record this information in IAMS.	2015
	IÉ should incorporate into their existing standards the requirement for the input of asset information into the technical database system upon completion of structural inspections.	2010
	IÉ should carry out an audit of their filed and archived documents, in relation to structural assets, and input this information into their information asset management system.	2015
	The CRR should review their process for the closing of recommendations made to IÉ by independent bodies, ensuring that they have the required evidence to close these recommendations. Based on this process the CRR should also confirm that all previously closed recommendations satisfy this new process.	2016
Irregular operation of Automatic Half Barriers at Ferns Lock, County Kildare, on the Dublin to Sligo Line, 2nd September 2009 (published 26/08/10)	IÉ should review the competencies of all signalmen to ensure that when signalmen are assigned relief duties, they have the required training and experience to perform these duties appropriately.	2014
Derailment of empty train due to collision with landslip debris outside Wicklow Station, 16th November 2009 (published 15/11/10)	IÉ should review their vegetation management processes to ensure that vegetation covering substantial earthworks structures is adequately maintained to facilitate the monitoring and inspection of earthwork structures by patrol gangers and other inspection staff.	2013
	IÉ should review the effectiveness of their standards in relation to conducting earthworks inspections during periods of heavy rainfall, ensuring that earthworks vulnerable to failure are inspected during these periods by appropriately trained patrol gangers or inspectors.	2013
	IÉ should review their Standard for Track Patrolling, I-PWY-1307, for its effectiveness in identifying any third party activities that occur inside and outside the railway boundaries that could affect safety and where any deficiencies are found, IÉ should develop an alternative process for the identification of these third party activities.	2010
	IÉ should review their structures list & ensure that all earthworks are identified and included on this list. Upon updating this list, a programme for the inspection of earthworks is to be developed & adopted at the frequency requirements set out by the Structural Inspections Standard, I-STR-6510.	2015
	IÉ and the CRR should review their process for the issuing of guidance documents, to ensure that the third parties affected by these guidance documents are made aware of their existence.	2017

Report	Safety Recommendations	Closed
Derailment of empty train due to collision with landslip debris outside Wicklow Station, 16th November 2009 (published 15/11/10)	IÉ should review the effectiveness of their Structural Inspections Standard, I-STR-6510, with consideration for the possibility of more thorough inspections being carried out on cuttings to establish the topography & geotechnical properties of cuttings; & from this information identify any cuttings that are vulnerable to failure.	**2015**
Laois Traincare Depot Derailment, 20th January 2010 (published 19/01/11)	IÉ should ensure that the risks relating to use of spring assisted manual points are identified and that appropriate control measures are implemented based on the risks identified.	**2013**
Secondary suspension failure on a train at Connolly Station, 7th May 2010 (published 05/05/11)	IÉ should ensure all work in rolling stock maintenance depots is carried out in accordance with its control process.	**2017**
	IÉ should review its process of managing the hazard log in relation to the Class 29000s to ensure the adequacy of this process and verify that implementation of closure arguments in the hazard log is effective.	**2017**
	IÉ should evaluate the risks relating to failure of the centre pivot pin to perform its function due to over-inflation of the secondary suspension and determine if any design modifications are required to avoid future failures.	**2016**
Tram derailment at The Point stop, Luas Red Line, 13th May 2010 (published 11/05/11)	Veolia (now Transdev) should introduce a communication protocol between normal and emergency for given situations where a clear understanding between a tram driver and Central Control Room are required.	**2019**
Person struck at level crossing XE039, County Clare, 27th June 2010 (published 11/07/11)	IÉ should ensure that risk assessments are produced for all user worked level crossings to identify all hazards specific to particular level crossings.	**2018**
	IÉ should review their documentation on the measurement of viewing distances at existing user worked level crossings to ensure that the viewing distances provide sufficient views of approaching trains to allow level crossing users cross safely.	**2017**
	IÉ should review their procedures for the management of accidents to ensure that communication with the emergency services is clear and provides the necessary information to locate an accident site without undue delay and access it by the most appropriate point.	**2018**
Road vehicle struck at level crossing XM096, County Roscommon, 2nd September 2010 (published 04/10/11)	IÉ should put in place a formal process for identifying and communicating with known users of user worked Level Crossings.	**2014**
	IÉ should review the effectiveness of its signage at user worked level crossings, and amend it where appropriate, taking into account the information provided in the level crossing user booklet. The review should include the information on the use of railway signals, what to do in case of difficulty when crossing the railway and ensuring the signage is illustrated in a clear and concise manner, taking into account current best practice and statutory requirements.	**2017**
	IÉ should update its risk management system to ensure that interim control measures are put in place where longer term controls to address risks require time to implement.	**2014**
	IÉ should review its use of disused rail as fencing at user worked LCs to ensure it cannot potentially increase the severity of a collision and where this is the case, replace the disused rail with appropriate fencing.	**2014**

Report	Safety Recommendation	Closed
Car Strike at Knockaphunta Level Crossing (XM250), County Mayo, 24th October 2010 (published 19/10/11)	IÉ should upgrade the Level Crossing to ensure that the operation of the Level Crossing is not reliant on any direct action by the level crossing user.	**2019**
Car Strike at Morrough Level Crossing XG 173, 14th February 2011 (published 08/02/12)	IÉ should liaise with local authorities where private road level crossings can be accessed from a public road to ensure there is advance warning to road users.	**2016**
	IÉ should ensure that they adopt their own standards in relation to design changes to any plant, equipment, infrastructure or operations that has the potential to affect safety.	**2018**
	The CRR should ensure that they adopt a formal approach to submissions made by IÉ in relation to design changes to any PEIO that has the potential to affect safety.	**2012**
	IÉ should review the suitability of the signage at user worked crossings on public and private roads, ensuring that human factors issues are identified and addressed.	**2020**
Gate Strike at Buttevant Level Crossing (XC 219), County Cork, 2nd July 2010 (published 27/06/11)	IÉ should identify similar manned level crossings where human error could result in the level crossing gates being opened to road traffic when a train is approaching; where such level crossings exist, IÉ should implement engineered safeguards; where appropriate.	**2017**
	IÉ should review its risk management process for manned level crossings to ensure that risks are appropriately identified, assessed and managed to ensure that existing level crossing equipment is compliant with criteria set out in IÉ's signalling standards, where appropriate.	**2013**
Fog signal activation in Dart driving cab, Bray, on the 6th March 2012 (published 19/09/2013)	IÉ should introduce appropriate procedures and standards for the safe issue, storage and transportation of fog signals.	**2017**
	IÉ drivers (and other staff) should receive adequate training in the safe handling of fog signals.	**2017**
Tractor struck train at level crossing XE020, 20th June 2012 (published 17/06/2013)	IÉ should close, move or alter the level crossing in order to meet the required viewing distances in IÉ's technical standard CCE-TMS-380 Technical Standard for the Management of User Worked Level Crossings.	**2017**
	IÉ should review their systems of managing level crossings that fail to meet the viewing distances in IÉ technical standard CCE-TMS 380 Technical Standard for the Management of User Worked Level Crossings to ensure that any mitigation measure that is introduced is effective at reducing the risk to level crossing users.	**2016**
	IÉ should audit their Level Crossing Risk Matrix (LCRM) system, to ensure it correctly identifies high risk level crossings; and identifies appropriate risk mitigation measures for individual level crossings.	**2017**
	IÉ staff who may be required to contact the emergency services should have the appropriate information readily available to them in order to give clear instructions to the emergency services in order that they can attend accident sites in a prompt manner. This information should then be updated in IÉ's Rule Book.	**2017**

Report	Safety Recommendation	Closed
Bearing failure on a train at Connolly Station, 18th October 2011 (published 26th September 2012)	IÉ should put in place provisions to assist train drivers with the task of identifying if there is a fault present with an axlebox.	2013
	IÉ should ensure the competency management system for signalmen includes the assessment of Hot Axle Box Detector (HABD) related functions they perform.	2014
	IÉ should put in place formal procedures governing the role of Fleet Technical Services staff in relation to Hot Axle Box Detectors.	2016
	IÉ should ensure that a robust system is put in place for the competency assessment of safety critical rolling stock maintenance staff.	2014
	IÉ should update its competency management system for train drivers to include assessment of their competency in relation to their tasks following a HABD alarm.	2014
Runaway locomotive at Portlaoise Loop, 29th November 2012 (published 19/09/13)	IÉ should review their Vehicle Maintenance Instructions (VMIs) for locomotives to ensure that there are adequate braking tests at appropriate intervals.	2016
	IÉ should adopt a quality control system, for the introduction of new maintenance procedures for locomotives.	2014
	IÉ should review their system for introducing new train drivers' manuals, to ensure that train drivers are fully trained and assessed in all aspects of these manuals.	2018
	IÉ should review their competency management system for train drivers to ensure that all driving tasks are routinely assessed.	2016
Trend Investigation: Possession incidents on the Iarnród Éireann network (published 27/01/14)	IÉ IM should develop a formal possession planning meeting framework that is consistent through the IÉ network.	2014
	IÉ IM should review the application of Back-to-Back possessions and implement actions to eliminate any informal practices that do not comply with IÉ Rule Book.	2014
	IÉ IM should establish a possession planning procedure that ensures protection arrangements are based on the work to be delivered and are verified by a suitable member of staff and formally communicated to all relevant personnel.	2014
	IÉ-IM should review the current process for late changes to possessions to ensure changes to possession arrangements are verified by a suitable member of staff and formally communicated to all relevant personnel.	2017
Operating irregularity during SLW between Dundalk and Newry, 23rd March 2013 (published 28/04/14)	IÉ should review the signalling infrastructure cross -border with a view to commissioning the bi-directional signalling.	2014
	IÉ should review current communication procedures with regard to the updated communication equipment now available.	2018

Report	Safety Recommendation	Closed
DART wrongside door failure, Salthill & Monkstown Station, 10th August 2013 (published 30/07/14)	The CME (IÉ RU) should review and modify their design for the EMU autocouplers to ensure a more robust coupler circuit that will provide assurance that both coupler electrical heads have connected correctly and that coupler circuits are continuous throughout the train consist. Any modification made should be documented in Rolling Stock Design Standards.	**2014**
	The CME (IÉ RU) should introduce a visual indicator on the driving console to indicate to the driver that coupling has been completed successfully (or a visual or audible indication that coupling has failed).	**2015**
	DART Operations (IÉ RU) should update the applicable EMU Drivers' Manuals to include specific guidance on the requirement for the examination of couplers. The update should also include guidance on associated testing of coupler integrity and guidance on any indications in the driving cab that would assist the driver in detecting any coupler failure.	**2016**
	The CME (IÉ RU) should review and modify the processes set out in their SMS for closing recommendations to ensure recommendations from investigations are recorded, monitored and closed. When these processes have been established, they should be audited (by a party external to the CME) at predefined intervals to ensure compliance.	**2015**
USAN 001 DART Wrongside Door Failure, Salthill & Monkstown Station, 18th August 2013 (issued on the 19/08/2013)	IÉ should put in place mitigation measures to prevent the wrong side failure of the door interlocking equipment on the Dart trains (USAN001a issued on the 19/08/2013).	**2013**
	IÉ should put in place a system to manage the risks associated with the wrong side failure of the door interlocking equipment on the DART trains (USAN001b issued on the 19/08/2013).	**2013**
Tram fire on approach to Busáras Luas Stop on the 7th November 2013 (published 28/08/14)	Transdev should ensure that Alstom, as the contracted Vehicle Maintenance Contractor, review maintenance instructions to ensure separation is maintained between hydraulic circuit and the traction cables at installation and during operation.	**2015**
	Transdev should ensure that Alstom, as the contracted VMC, add the interaction between the braking hoses and traction cables and the potential event of a flash fire to the hazard log of the 401 Type Tram and implement all identified mitigation actions.	**2015**
	Transdev should ensure that Alstom, as the contracted VMC, review the performance requirements for the isolation protection system in the MIC bogie to ensure that it meets the requirements of the 401 hazard log or revise the 401 hazard log accordingly.	**2015**
	Transdev should ensure that Alstom, as the contracted VMC, review the requirements for traction cables in the MIC bogie and produce and implement a suitable specification for this component. Installation procedures should also be reviewed to ensure that the free length requirements of these components are fulfilled.	**2017**
	Transdev should ensure that Alstom, review the defect priority matrix with regards to damage to traction cable insulation and fretting between these components and hydraulic hoses. In addition to this, maintenance procedures should be introduced to specify actions for the repair of traction cables.	**2015**
	Transdev should ensure that Alstom, review their incident / accident investigation process to ensure that investigations are of sufficient depth and produce clear recommendations.	**2015**
Structural failure of a platform canopy at Kent Station, 18th December 2013 (published 07/11/14)	IÉ-IM should establish a formalised procedure for managing the risk associated with the adverse effects of high winds.	**2015**

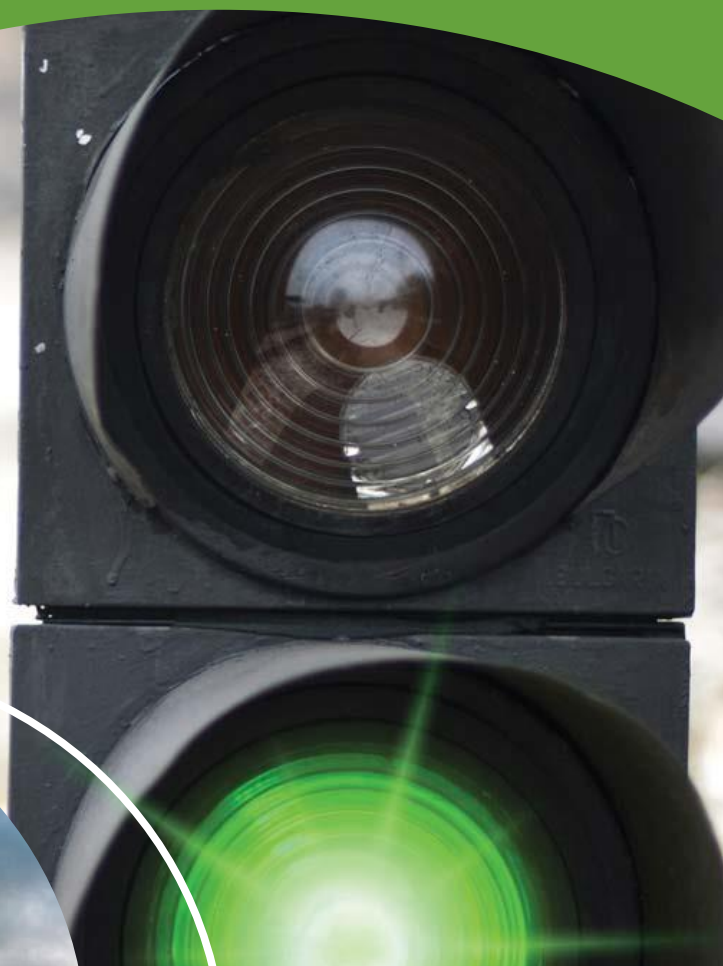
Report	Safety Recommendation	Closed
Rock fall at Plunkett Station, Waterford, 31st December 2013 (published 18/12/14)	IÉ-IM CCE should complete a thorough review of CCE-STR-STD-2100 in relation to the application of condition ratings on assets to ensure that condition ratings are a true reflection of the condition of the asset; and that the appropriate inspection frequency is applied.	**2015**
	IÉ IM CCE should complete a thorough review of the Cuttings, Embankments and Coastal/River Defences Inspection Card set out in CCE-STR-STD-2100 to ensure that Structures Inspectors have the correct means to complete the card without the requirement for alterations to templates or defined terms. The process of approval of these Inspection Cards should also be reviewed to ensure that they are reviewed and approved by the STSE.	**2015**
	IÉ-IM CCE should complete thorough reviews of CCE-STR-STD-2100 and CCE-STR-GDN-2802 in terms of maintenance requirements to ensure consistency throughout both documents.	**2016**
	IÉ-IM CCE should fully adopt the compliance verification process and ensure the process includes an effective means of reviewing the quality of documents completed by staff.	**2015**
	IÉ-IM CCE should review its Competence Management System in terms of both: its identification and tracking of mandated refresher training for Structures Inspectors competence; and its annual review of Structures Inspectors inspection work.	**2015**
Vehicle struck by train at Corraun level crossing, XX024, Co. Mayo, 12th February 2014 (published 30/04/15)	IÉ should ensure that where a Decision Line is present at a level crossing, that the purpose of this Decision Line is appropriately conveyed to the level crossing users.	**2016**
Car strikes train at Level Crossing XM 250, Knockaphunta, Co. Mayo, 8th June 2014 (published 04/06/15)	The CRR, RSA and IÉ in consultation with any relevant stakeholders should agree a common policy in connection with instructions and warnings related to user worked level crossings.	**2018**

Report	Safety Recommendation	Closed
Investigation into SPADs on the IÉ network from January 2012 to July 2015 (published 11/04/2016)	IÉ-IM should review the functionality of signals in the Connolly area so that the instances of abnormal upgrades or downgrades.	**2017**
	IÉ-RU should commission an independent review, in terms of human factors, to determine why there is a prevalence for the occurrence of SPADs: at certain times of the day; at certain times of drivers shifts; and for drivers with three-five years driving experience.	**2017**
	IÉ-RU should introduce a near miss reporting system, whereby, drivers may report near misses without the fear of sanctions being imposed.	**2017**
	IÉ-IM should review the Traffic Regulator's Manual with a view to introducing guidance for Traffic Regulator's in terms of the management of train delays and the switching of crossing points.	**2018**
	IÉ-RU and IÉ-IM should carry out a review of the interfaces between different operational staff (i.e. drivers, LCCOs, signalmen and EOs) so that all operational staff can adequately manage train operations during degraded situations. Part of this review should focus on the safety critical communications between operational staff.	**2019**
	IÉ-IM, should review their procedures for the placement of speed boards and brief relevant staff to be vigilant in the placement of lineside signage with respect to the potential for obscuring of signals or otherwise unintentionally providing distractions to drivers, especially in the case where there are fixed colour light signals, or they have potential to cause SOY SPADs.	**2017**
	IÉ-IM & IÉ-RU should review the current system of reporting SPAD events so that reports are consistent and published within a set period of time.	**2016**
	IÉ-IM should review the procedures applicable to signalman, Level Crossing Keeper, LCCO and level crossing emergency operators with particular emphasis on the actions to be taken by each when a fault is detected at a level crossing. This review should consider circumstances where a train may already have entered the affected section of line, and circumstances where the signal may be missing or extinguished.	**2020**
Dangerous occurrence between Ballybrophy and Portlaoise, 12th September 2015 (published 6th September 2016)	IÉ-IM should review the Site Safety Briefing procedure to ensure all personnel have made themselves aware of the information contained in the relevant Weekly Circular.	**2018**
Difflin Light Rail Passenger Fall, Co. Donegal 17th December 2016 (published 7th November 2017)	DLR should review their risk assessment process to ensure that all reasonably foreseeable risks associated with the operation of trains are identified and suitable control measures identified.	**2018**
	DLR should review the DLR SMS, in its totality, and ensure that there are internal monitoring procedures that mandates the periodic checking of application of SMS processes and practises.	**2018**
	DLR should review their responsibilities under the Safety and Welfare at Work Regulations as to dedicated First Aid areas.	**2018**
Near miss at Knockcroghery Level Crossing, XM065, Co. Roscommon, 31st January 2017 (published 20th December 2017)	IÉ-IM should review the human factors and non-technical skills training for Level Crossing Control Operatives (LCCOs), and introduce further training, where applicable. In addition, IÉ-RU should finalise the Professional Support Handbook for Level Crossing Control Operators; to provide guidance for LCCOs in the areas of human factors and non-technical skills.	**2019**
	IÉ-IM should review and update the Level Crossing Control Centre (LCCC) Instructions, to make them more user friendly for LCCOs.	**2019**

Report	Safety Recommendation	Closed
Derailment of DART passenger service, at Points DL115, Dun Laoghaire, 13th September 2017 (published 15/08/18)	IÉ-IM should update the relevant sections of the General Appendix and other associated documentation to specify where the points clip should be fitted.	2019
	IÉ-IM should conduct a full review of IMO-SMS-031, 'Competence Management – Persons required to conduct IM operating duties and associated documentation, to identify deficiencies in training, continuous assessment and the recording of performance of duties to ensure that persons carrying out these duties are competent to do so.	2020
USAN 002 Collision of an ICR with a buffer stop at Laois Train Care Depot, 17th July 2018 (issued on the 17/08/2018)	IÉ should advise all relevant staff that a positive brake cylinder gauge reading in the cab of an ICR is not an indication that a brake is present.	2020
Collision of an ICR with a buffer stop at Laois Train Care Depot, 17th July 2018 (published 25th June 2019)	IÉ-RU CME should expand the requirements of preparation instructions for rail vehicles to ensure that on completion of these tests the brake status of a train can be fully established; this should include checking the status of circuit breakers and brake isolations.	2020
	IÉ-RU CME should develop a formal procedure for the examination of vehicles prior to moving a train which has been left unattended with no direct handover.	2020
Wrongside Door Failure at Ashtown Station, 12th August 2018 (published 25/06/19)	IÉ-IM should re-brief Traffic Regulators on the importance of adhering to the Traffic Regulators' Manual in relation to the recording of all telephone conversations within the controlled environment.	2019
Vehicle struck by train at Cartron level crossing, XM220, Co. Mayo, 17th August 2018 (published 3rd September 2019)	IÉ-IM should consider options to upgrade LC XM220 to minimise the requirement of direct action by the users.	2020
Passenger trap-and-drag occurrence on Luas tram at Heuston Stop, 26th March 2019 (published 04/03/2020)	Transport Infrastructure Ireland (TII) should conduct a risk-based review on whether CCTV platform monitors should be installed at high-use tram stops.	2020
	Transdev and TII should develop new labels, for the application on tram doors, which warn passengers of the dangers of closing doors.	2020
	Transdev should update their drugs and alcohol policy to include explicit requirements that testing is conducted post incident/accident where the actions of a driver may have contributed to the incident/accident. Transdev should also develop a system whereby a decision not to test an individual is documented with clear justification for the decision provided.	2020
Near miss with an Iarnród Éireann SET Worker at Rush and Lusk Station, 20th June 2019 (published 27/05/2020)	IÉ-IM should brief all staff of their requirements, under the IÉ Rule Book, to wear their high visibility clothing correctly.	2020
SAN 001 Collision of an ICR with a fixed buffer stop at Laois Train Care Depot, 6th July 2019 (issued 02/10/19)	IÉ-IM should review the selection of fixed buffer stops at locations at LTCD for their suitability and efficacy in protecting staff and infrastructure.	2020
	IÉ-IM should conduct review of their current specification for fixed buffer stops and their associated design forms to ensure they are fit-for-purpose; and fixed buffer stops are only selected where appropriate. Based on this review, IÉ-IM should commence a programme of inspections for fixed buffer stop at all locations on the IÉ network to ensure their suitability and effectiveness at protecting passenger, staff, track and infrastructure.	2020

Report	Safety Recommendation	Closed
Road Rail Vehicle occurrences on Iarnród Éireann Network from 2015 to 2018 (published 8th October 2019)	The CRR and IÉ-IM should review their processes of closing out findings from CRR audits; with a view to identifying opportunities to close out findings, such as updates to the IÉ Rule Book.	**2020**
* Light blue – IÉ-RU / IÉ-IM; dark blue – Transdev; pink – DLR; lilac indicates a joint recommendation between IÉ-IM & the CRR; orange indicates a recommendation associated with TII; pink indicates a recommendation associated with TII and Transdev.		

Appendices



Appendix 1 – Railway Organisations

The following railway systems are within the RAIU's remit:

- The Iarnród Éireann (IÉ) national heavy rail network;
- The Luas light rail system in Dublin;
- The Bord Na Móna industrial railway;
- Nine heritage & minor railway systems (of which three are currently not operational).

For each of these railway systems there are entities identified as Railway Undertakings (RUs) and Infrastructure Managers (IMs). RUs are defined as organisations that provide the transport of goods and/or passengers by rail on the basis that the undertaking must ensure traction, including undertakings that provide traction only; which operate under a safety management system (SMS) approved by the CRR through the issue of a safety certificate. IMs are defined as organisations that establish and maintain railway infrastructure, including the management of infrastructure control and safety systems; which operate under a SMS approved by the CRR through the issue of a safety authorisation. There are ten organisations that act as RU and IM for a railway network and two organisations that act solely as RUs; there are currently no organisations that act solely as an IM.

The national heavy rail system is owned by IÉ, within IÉ there are separate IM and RU Business Divisions. The heavy rail system is interoperable with the heavy rail system in Northern Ireland and cross border services are operated by IÉ in conjunction with Translink, the RU in Northern Ireland. These operations are carried out under IÉ's Safety Case and Translink is classified as a guest operator. A heritage RU, The Railway Preservation Society of Ireland, also operates steam trains on the heavy rail system several times a year. Rhomberg Sersa operate as an RU on IÉ's rail system; they operate and maintain On Track Machines (OTMs) on behalf of IÉ.

The Luas light rail system is owned by the Railway Procurement Agency. Transdev Transport is the RU that operates passenger services, the passenger stops and the Central Control Room. Transdev is also the IM responsible for the maintenance of the infrastructure.

The Bord Na Móna industrial railway is owned and operated by Bord Na Móna, acting as the RU and IM for the transport of peat on its network. As this is an industrial railway and does not carry passengers it only falls within the RAIU's remit where the railway interfaces with the public, such as at level crossings and bridges.

The operational heritage railway & minor systems in 2021 included:

- Difflin Lake Railway, Oakfield, Raphoe, Co Donegal;
- Finntown & Glenties Railway, Co Donegal;
- Listowel Lartigue Monorail, Co Kerry;
- Waterford & Suir Valley Railway;
- Irish Steam Preservation Society, Stradbally, Co Laois;
- Lullymore Heritage & Discovery Park Limited, Rathangan, Co Kildare;
- Cavan & Leitrim Railway, Dromod, Co Leitrim.

Appendix 2 – Notification (Immediate & Monthly Bulk)

Immediate notification

The schedule of immediate notifications is as follows:

ID	Schedule of immediate notification occurrences
1.01	Occurrences relating to rolling stock in motion resulting in one or more fatalities or serious injuries*. *Exceptions: Serious injury/fatality due to assault or fatality due to natural causes.*
1.02	*Level crossing accidents* involving rolling stock.
1.03	Collisions between rolling stock causing damage or blocking a running line with harmful consequences**.
1.04	Collisions of rolling stock with arrestor mechanisms/buffer stops with harmful consequences.
1.05	Derailments of rolling stock.
1.06	Fires, smoke or explosions on rolling stock requiring the evacuation of passengers from a train or a station.
1.07	The release or combustion of dangerous goods being carried on rolling stock.
1.08	Occurrences leading to the closure of a railway line for more than 6 hours. *Exceptions: Weather related occurrences.*
1.09	Any occurrences that lead to extensive damage***.
1.10	Wrong side failures of safety critical equipment that led to an unsafe condition requiring withdrawal from service.
1.11	Unintentional divisions of rolling stock where passengers had access to a gangway.
1.12	Signals Passed At Danger (SPADs) resulting in rolling stock exceeding the signal overlap and involving conflicting movements. *Inclusion for IÉ: All High Risk Category A SPADs (Risk Ranking between 20 – 28) should be reported to the RAIU when the SPAD Risk Ranking has been established.*
1.13	Occurrences that under slightly different conditions may have led to a fatality, serious injury or extensive damage.
1.14	Occurrences related to passenger trap-and-drag t in doors when rolling stock is in motion.
1.15	Occurrences of axle bearing failures in service.

Monthly bulk notifications

The schedule for monthly bulk notifications is as follows:

ID	Description
2.01	Unexpected failures of assets that led to an unsafe condition*.
2.02	Unintentional divisions of rolling stock released for service.
2.03	SPADs with no risk of conflicting movements. *Inclusion for IÉ: All SPADs, the monthly notification should include the Risk Ranking for all Category A SPADs.*
2.04	Fires, smoke or explosions on rolling stock not requiring the evacuation of passengers.
2.05	Collisions with large objects** or large animals***. *Exceptions: Where the intent was vandalism or criminal damage.*
2.06	Non railway vehicles damaging or fouling a railway line. *Exceptions: Where the intent was vandalism or criminal damage.*
2.07	Collisions between light rail vehicles and road vehicles.
2.08	Any other occurrence where an investigation remit has been issued internally.

Appendix 3 – Classification of occurrences & investigations by the RAIU & other bodies

Classification of occurrences

Occurrences fall into one of three types as defined in European Union (Railway Safety) (Reporting and Investigation of Serious Accidents, Accidents and Incidents) Regulations 2020 (S.I. 430 of 2020):

- Accident – An unwanted or unintended sudden event or a specific chain of such events which have harmful consequences including collisions, derailments, level crossing accidents, accidents to persons caused by rolling stock in motion, fires and others;
- Serious accident – Any train collision or derailment of trains, resulting in the death of at least one person or serious injuries to five or more persons or extensive damage to rolling stock, the infrastructure or the environment, and any other similar accident with an obvious impact on railway safety regulation or the management of safety;
- Incident – Any occurrence, other than an accident or serious accident, associated with the operation of trains and affecting the safety of operation.

For clarity the meaning of the following terms should be noted:

- Harmful consequences – Injury to persons and/or damage to equipment;
- Serious injury – Any injury requiring hospitalisation for over 24 hours.

RAIU investigation of occurrences

The RAIU have investigators on call, twenty-four hours a day, seven days a week, who are notified of reportable occurrences by the RUs in accordance with European Union (Railway Safety) (Reporting and Investigation of Serious Accidents, Accidents and Incidents) Regulations 2020 (S.I. 430 of 2020). Based on the nature of the occurrence and the legal requirements, a decision is made on whether or not an investigation is required. In accordance with the Railway Safety Directive, the RAIU must investigate serious accidents; accidents and incidents are investigated depending on the potential for safety lessons to be learnt.

Where notified occurrences warrant further investigation to determine whether or not an investigation is warranted a preliminary examination is carried out and one of the following three determinations is made:

- No further investigation – no safety improvements are likely to be identified that could have prevented the occurrence or otherwise improve railway safety;
- Full investigation – there is clear evidence that the occurrence could have been prevented or the severity of the outcome could have been mitigated through the actions of those parties involved either directly or indirectly in the installation, operation and maintenance of the railway;
- Full investigation (Trend) – where the occurrence is part of a group of related occurrences that may or may not have warranted an investigation as individual occurrences, but the apparent trend warrants investigation.

Investigations are classified as one of three types under the Railway Safety Directive (2016/798):

- Article 20(1) – Investigations into serious accidents on the IÉ network, the objective of which is possible improvement of railway safety and the prevention of accidents;
- Article 20(2) – Investigation into accidents and incidents, which under slightly different conditions might have led to serious accidents;

- Article 22(6) – Investigations into railway accidents and incidents under national legislation, this includes all investigations relating to the Luas light rail system, the Bord Na Móna industrial railway and the heritage railways.

For each investigation, the level of damage to rolling stock, track, other installations or environment is identified and classified based on the European common safety indicators as follows:

- None;
- Less than €150,000 (<€150,000);
- Equal to or greater than €150,000 (≥€150,000);
- Equal to or greater than €2,000,000 (≥€2,000,000).

The RAIU, as soon as practicable but not later than 2 months after receipt of the notification, decide whether or not to start an investigation concerning the accident or incident European Union (Railway Safety) (Reporting and Investigation of Serious Accidents, Accidents and Incidents) Regulations 2020. The RAIU advise the relevant railway undertaking of the decision. In accordance with S.I. No. 430/2020 - European Union (Railway Safety) (Reporting and Investigation of Serious Accidents, Accidents and Incidents) Regulations 2020, the RAIU also notify the ERA within seven days of a decision to carry out a full investigation into an occurrence on the IÉ network.

Investigations by other bodies

The CRR, An Garda Síochána, the Health and Safety Authority and other organisations may carry out investigations in parallel with an RAIU investigation. The RAIU will share its own technical information with these Investigation Bodies; however, the investigations are carried out independently. Based on its investigation, the RAIU produce a report that is provided to all relevant parties, including the Railway Undertaking, the CRR and the Department of Transport, Tourism and Sport. Reports relating to the IÉ network are also provided to ERA. All investigation reports are made available in the public domain once they have been published.

In accordance with the Railway Safety Act 2005 (53(6)), a railway undertaking shall in an expeditious manner carry out an investigation and shall, as soon as practicable but in any event not later than 6 months after the date of the incident, prepare a report on its findings.

Appendix 3 – Abbreviations

ALCC	Athlone Local Control Centre

AO	Additional Observation
APWI	Acting Permanent Way Inspector
BnM	Bord na Móna
CaF	Causal Factor
CCE	Chief Civil Engineer
CCTV	Closed Circuit Television
CF	Contributory Factor
CME	Chief Mechanical Engineer
CoF	Contributing Factor
CRR	Commission of Railway Regulation
CTC	Centralised Traffic Control
DART	Dublin Area Rapid Transit
DIL	Door Interlock Light
DLR	Difflin Light Rail
DMU	Diesel Multiple Unit
DoT	Department of Transport
DTTAS	Department of Transport, Tourism & Sport
ECO	Electrical Control Operator
EMU	Electrical Multiple Unit
ES	Engineering Supervisor
EU	European Union
FER	Further Evidence Requested
hrs	hours
HSA	Health & Safety Authority
ICR	InterCity Railcar
IÉ	Iarnród Éireann
IM	Infrastructure Manager
km/h	Kilometres per hour
LCCO	Level Crossing Control Operative
LME	Light Maintenance Equipment
LNMC	Luas Network Management Central
LTCD	Laois Train Car Depot
m	metre
MCB	Main Circuit Breaker
mm	millimetre
MOP	Member of Public

MP	Mile Post
NIB	National Investigation Body
NIR	Northern Ireland Railways
NSA	National Safety Authority
OCS	Overhead Contact System
OEM	Original Equipment Manufacturer
OHLE	Overhead Light Equipment
PEIO	Plant, Equipment, Infrastructure & Operations
PER	Preliminary Investigation Report
PICOP	Person in Charge of Possession
RAIU	Railway Accident Investigation Unit
RC	Root cause
RMME	Rail Mounted Maintenance Equipment
RRV	Road Rail Vehicle
RRVO	Road Rail Vehicle Operator
RTS	Ready to Start
RU	Railway Undertaking
SAN	Safety Advice Notice
SCADA	Supervisory Control And Data Acquisition
SET	Signalling, Electrical and Telecommunications
SMS	Safety Management System
SF	Systemic Factor
SPAD	Signal Passed at Danger
SPAS	Signal Passed at Stop
TII	Transport Infrastructure Ireland
TRV	Track Recording Vehicle
UF	Underlying Factor
USAN	Urgent Advice Safety Notice
WI	Work Instruction

Appendix 4 – Definitions

Accident	An unwanted or unintended sudden event or a specific chain of such events which have harmful consequences. For heavy rail, the EU Agency for Railways divides accidents into the following categories: collisions, derailments, level-crossing accidents, accidents to persons caused by rolling stock in motion, fires and others.
Causal Factor	Any action, omission, event or condition, or a combination thereof that if corrected, eliminated, or avoided would have prevented the occurrence, in all likelihood.
Contributing Factor	Any action, omission, event or condition that affects an occurrence by increasing its likelihood, accelerating the effect in time or increasing the severity of the consequences, but the elimination of which would not have prevented the occurrence.
Incident	Any occurrence, other than an accident or serious accident, associated with the operation of trains and affecting the safety of operation. For heavy rail, the EU Agency for Railways divides incidents into the following categories: infrastructure; energy; control-command & signalling; rolling stock; traffic operations & management and others.
Investigation	A process conducted for the purpose of accident and incident prevention which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes and, when appropriate, the making of safety recommendations
Serious Accident	Any train collision or derailment of trains, resulting in the death of at least one person or serious injuries to five or more persons or extensive damage to rolling stock, the infrastructure or the environment, and any other similar accident with an obvious impact on railway safety regulation or the management of safety. For heavy rail, the EU Agency for Railways divides serious accidents into the following categories: collisions, derailments, level-crossing accidents, accidents to persons caused by rolling stock in motion, fires and others.
Systemic Factor	Any causal or contributing factor of an organisational, managerial, societal or regulatory nature that is likely to affect similar and related occurrences in the future, including, in particular the regulatory framework conditions, the design and application of the safety management system, skills of the staff, procedures and maintenance.

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