Safety Overview 2025

Main figures based on CSI data (up to 2023)

March 2025

EUROPEAN
UNION
AGENCY
FOR RAILWAYS

Foreword

This overview is one of the visible results of the Agency's activities in monitoring the progress of safety and interoperability. It is also part of the Agency's effort to provide to its stakeholders a regular overview of the development of railway interoperability and safety in the Single European Railway Area (SERA). This overview focuses on the progress in safety, while a second overview for covering the progress in interoperability will be published at the latest by the end of September 2025.

The basis for this overview is information provided by the National Safety Authorities. They have a legal obligation to report to the Agency a set of defined data that can be used to assess the development of railway safety in the SERA. Notably, the National Safety Authorities gather Common Safety Indicators (CSIs), defined in the Railway Safety Directive (EU) 2016/798, from the railway undertakings and infrastructure managers which provide a footprint for safety performance. This report is based on these data as submitted to the Agency by the National Safety Authorities[1]. The EU-27 countries, Norway and Switzerland are considered as members of the SERA for the purpose of this report. The data extraction date for this report was mid-February 2025 and the latest figures refer to 2023 (2024 only for the figures on major accidents).

The interpretation of the figures is the sole responsibility of the reader, who may wish to refer for both guidance and additional information to the following documentation:

- Most recent Report on Railway Safety and Interoperability in the EU - 2024,
- Previous Report of the Annual Safety Overview (2023),
- Implementation guidance for CSIs Annex I of Directive (EU) 2016/798 of the Agency,
- Latest annual report on assessment of achievement of Common Safety Targets from 2025,
- Rail Accident Investigation and ERAIL database,
- Rail Environmental Report (2024).

[1] The mentioned data are available on the ERA website, in the page on the ERA website, in the page ERA Knowledge Hub | European Union Agency for Railways, under Monitoring and evaluation (practically at this link), under "Monitoring and evaluation" at the following link: https://www.era.europa.eu/system/files/2023-11/CSI%20Data.xlsx

Annual overview on Safety in SERA (2025)

Executive Summary

In 2023 an increase in fatalities and serious injuries have been recorded compared to 2022, while significant accidents remain stable. These figures have increased compared to 2020 which was impacted by the COVID pandemic, in terms of rail traffic/volumes), after the overall positive progress of the last decade.

With 1,565 significant accidents, 841 fatalities (suicides excluded) and 650 serious injuries, the overall toll of railway accidents remains high: the economic cost of significant accidents alone is estimated in around 3.5 billion EUR per annum.

The decrease in significant accidents over the last decade has been driven by "external" accidents (in which third party, i.e. trespassers and level crossing users, are involved) while the "internal" accidents (collisions, derailments and fires in rolling stock) appear stagnating; the progress has also been very uneven across the EU Member States, with the variance in safety levels remaining high (although the variance for significant accidents and related casualties has declined in the last decade).

A fast implementation of the common safety methods for assessing safety level and safety performance (CSM ASLP)[2], with the associated systematic and comprehensive EU-wide safety incidents reporting scheme, would be beneficial to provide an additional angle to assess and improve how safety is managed across Europe.

- *The overall cost of railway accidents remains high (around 3.5 billion EUR per annum only for significant accidents),*
- *Fatalities and serious injuries increased in 2023 compared to 2020 (which was highly impacted by the COVID pandemic),*
- *Although major accidents (i.e. with 5 or more fatalities) have become rare in the last years (e.g. none occurred in 2018, 2020 and 2021), and an increase in 2022 and 2023 (with 3 and 2 accidents, respectively), in 2024 only one of such accidents was registered,*
- *The passenger fatality rate increased significantly in 2023, reaching levels similar to those recorded in 2016,*
- *Large differences in casualty rates still exists between Member States, with at least a ten-fold difference in fatality rates for countries with the lowest and highest values,*
- *The overall decrease in significant accidents since 2010 has been mainly driven by "external" accidents, while 'internal' accidents (collisions, derailments, fires in rolling stock and other accidents) show a more stable trend (i.e. slightly decreasing) in the last years,*

[2] For more information: Common Safety Methods on Assessment of Safety Level and Safety Performance (CSM ASLP) | European Union Agency for Railways.

- *Since 2021, there has been a consistent increase in railway workers' fatalities; serious injuries among employees have also followed a similar pattern,*
- *Although safety at level crossings has been improving over the period 2010-2016, a more stable/flat trend was observed in the last years (over the period 2017-2023). Excluding the year 2020, for the number of level crossing accidents and related casualties (fatalities and serious injuries), the 2023 value is the lowest ever since 2010,*
- *No clear progress can be deducted from the figures on precursors to accidents, also due to differences in data collection and reporting for some of them in several Member States. Signal passed at Danger (SPAD) incidents have not decreased in the last years, showing instead an increase trend until 2023 for the incidents in which a danger point was passed. However, 2023 has seen an increase compared to previous year for all types of precursors,*
- *The frequency and types of weather-related accidents and incidents investigated by the NIBs pose significant safety challenges for the railway system, highlighting the need for enhanced resilience and preparedness measures,*
- *Despite the highlighted issues, rail transport continues to be one of the safest modes of transportation[3].*

[3] See section 'A-6 Safety of different transport modes' of the 2024 Report on Railway Safety and Interoperability in the EU.

Accidents and their outcomes

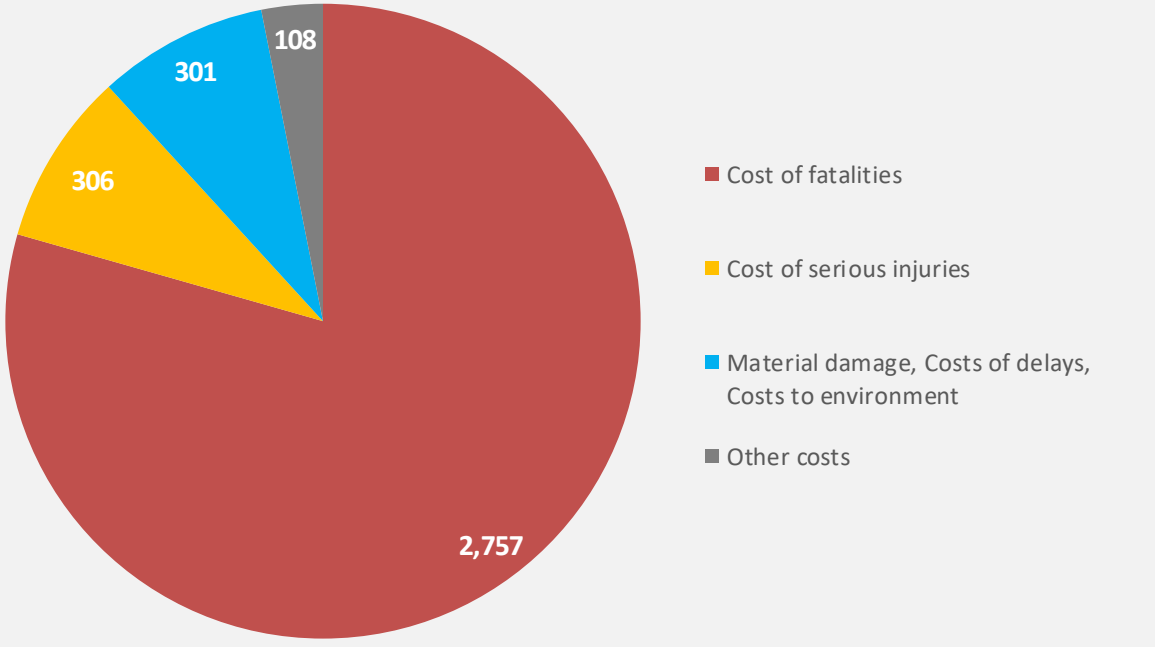
With 1,565 significant accidents in 2023 resulting in 841 fatalities and 650 serious injuries (see Fig. 2), the total cost of railway accidents is estimated at around 3.5 billion EUR (see Fig. 1).

Despite the decrease in significant accidents and resulting casualties recorded in the last decade, for which harmonised data are available across the Union, in 2021 (i.e. also in 2022 and 2023) there has been a rise in all mentioned indicators compared to 2020 (which was highly impacted by the COVID Pandemic), reaching higher levels compared to the pre-COVID period (2019). Although the number of accidents remained stable between 2022 and 2023, fatalities and serious injuries increased in both years.

Despite the overall downward trend observed since 1988 and despite no single major accident occurred in 2018, 2020 and 2021, three accidents with five or more fatalities were recorded in 2022[4] (resulting in a total of 17 fatalities), two accidents with five or more fatalities were recorded in 2023 (with a total of 63 fatalities) and only one accident with five or more fatalities was recorded in 2024 (with a total of 7 fatalities)[5] (see Fig. 3).

Figure 1: Estimated costs of railway accidents (EU-27, 2023)

Estimated cost in million EUR



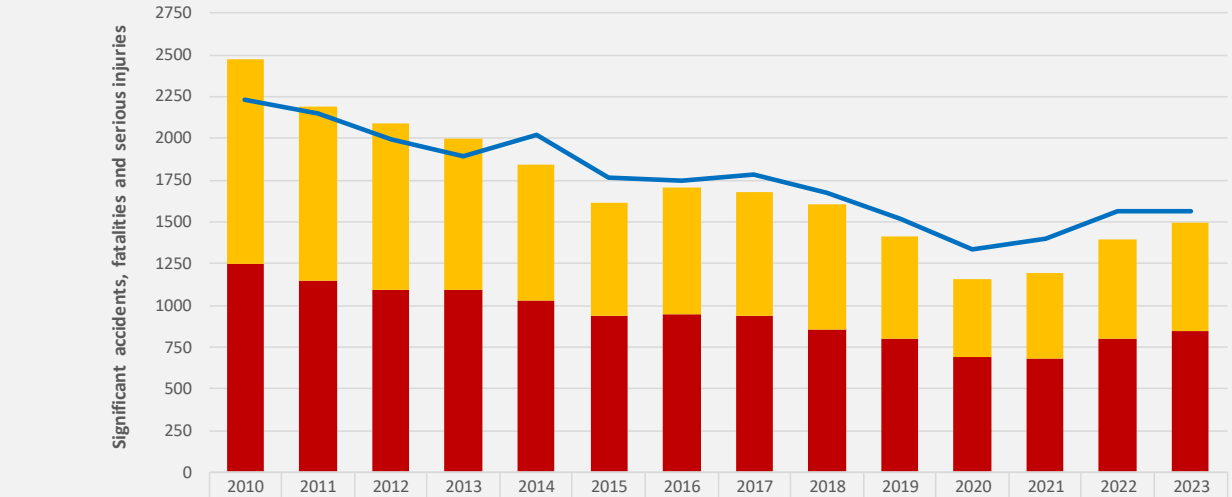
Notes: Other costs are those associated with modal shift, air polution, administration, rerouting, reputational damage and productivity losses, and are estimated from unit costs developed by a consultant for ERA

Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency

[4] Data consulted in February 2022 based on the submissions from National Investigating Bodies (NIBs)
[5] Data consulted in March 2024 based on the submissions from National Investigating Bodies (NIBs).

Figure 2: Main safety outcomes (EU-27, 2010–2023)

Significant accidents, fatalities and serious injuries

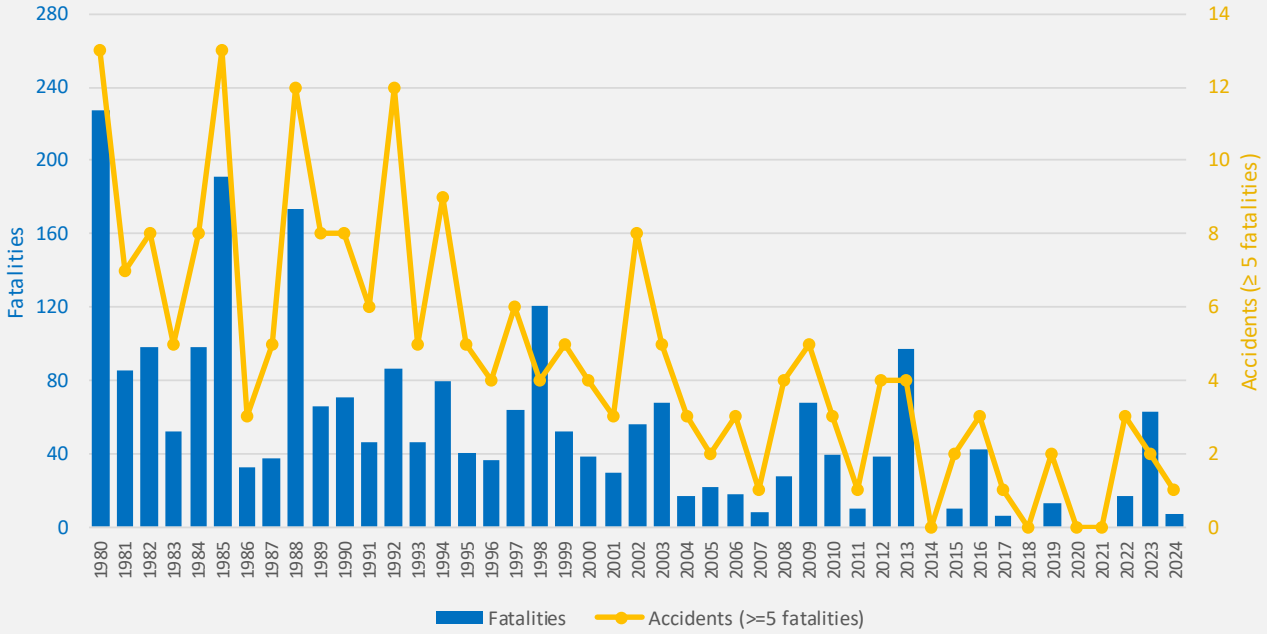


	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Serious injuries	1226	1041	996	899	810	672	766	747	750	613	469	512	594	650
Fatalities	1245	1151	1093	1095	1029	939	942	933	855	802	687	683	803	841
Significant accidents	2230	2146	1994	1896	2022	1764	1742	1778	1671	1518	1336	1395	1567	1565

Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency

Figure 3: Major accidents in Europe (EU-27 + CH + NO + UK, 1980–2024)

Railway accidents resulting in five or more fatalities



Note: Data for UK available until end 2020

Source: ERAIL and database of historical accidents developed by Professor Andrew Evans (Imperial College London)

Trends in accident, fatality rates and their variations

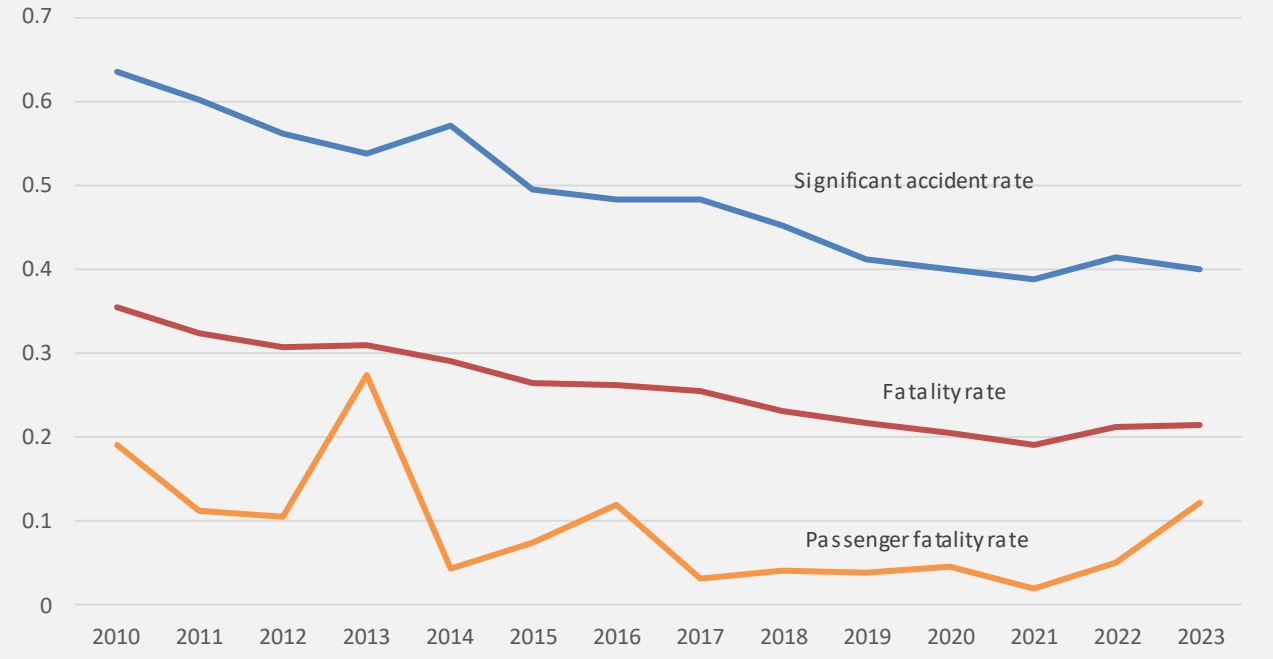
Three main indicators are reported for the monitoring of trends in accident and casualty rates: significant accidents and railway fatalities normalized by train kilometres, capturing the manifested overall risk in railway operation, as well as passenger fatality rate (passenger fatalities per passenger kilometres) capturing the personal manifested risk for people using trains.

All three rates have decreased substantially since 2010 (see Fig. 4), except the passenger fatality rate, which increased in the last two years (2022-2023). In 2021, the railway fatality rate was below 0.2 fatalities per million train kilometres (one fatality each 5 million train kilometre on average) in 2021, marginally increasing in the period 2022-2023. The significant accident rate was below 0.4 accidents per million train kilometres in 2021, also marginally increasing in the period 2022-2023. Since 2021, the passenger fatality rate, with a value of around 0.019 passenger fatalities per billion passenger kilometre (one fatality each 50 billion passenger kilometres), increased substantially, reaching the value of 0.122 in 2023 (see Fig. 4).

Significant differences in casualty rates persist among Member States, highlighting the disparities in safety levels. Although the variance of the number of significant accidents and related casualties has declined in the last decade, the fatality rates and passenger fatality rates for individual Member States still exhibit at least a ten-fold difference for countries with the lowest and highest values (see Fig. 5 and 6). Both graphs reveal a substantial cluster of 7 or 10 countries with higher values compared to the remaining Member States, indicating rates above the EU average. The notably high fatality rate for Greece is largely attributed to the Tempi accident occurred in 2023.

Figure 4: Trends in accident and fatality rates (EU-27, 2010–2023)

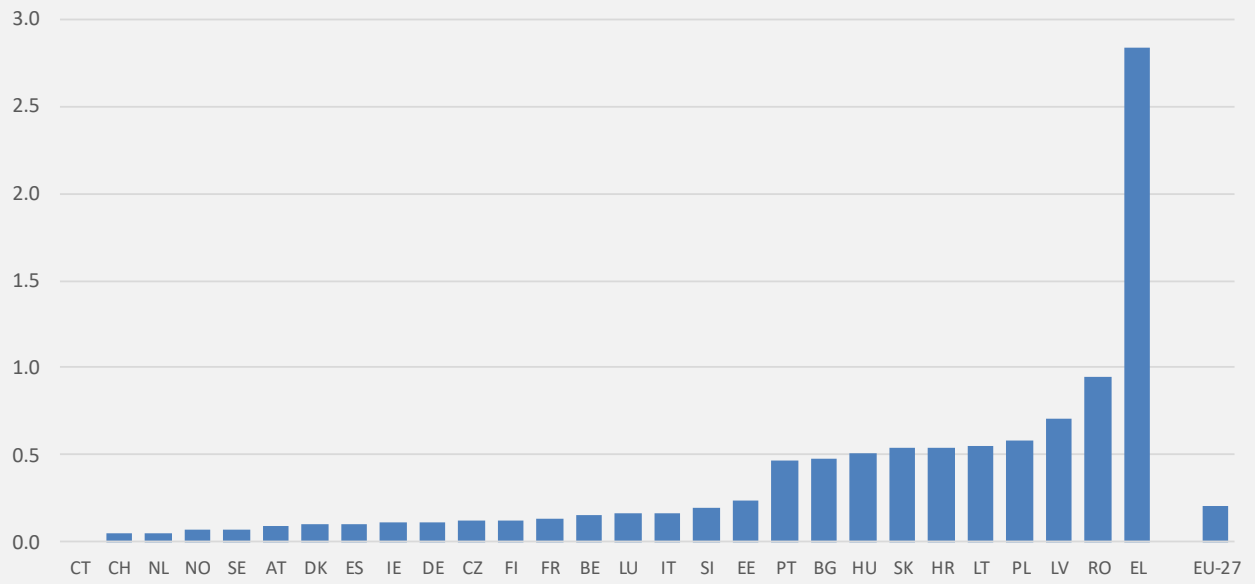
Significant accidents and fatalities per million train-km. Passenger fatalities per billion passenger-km



Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency

Figure 5: Railway fatality rates (2021–2023)

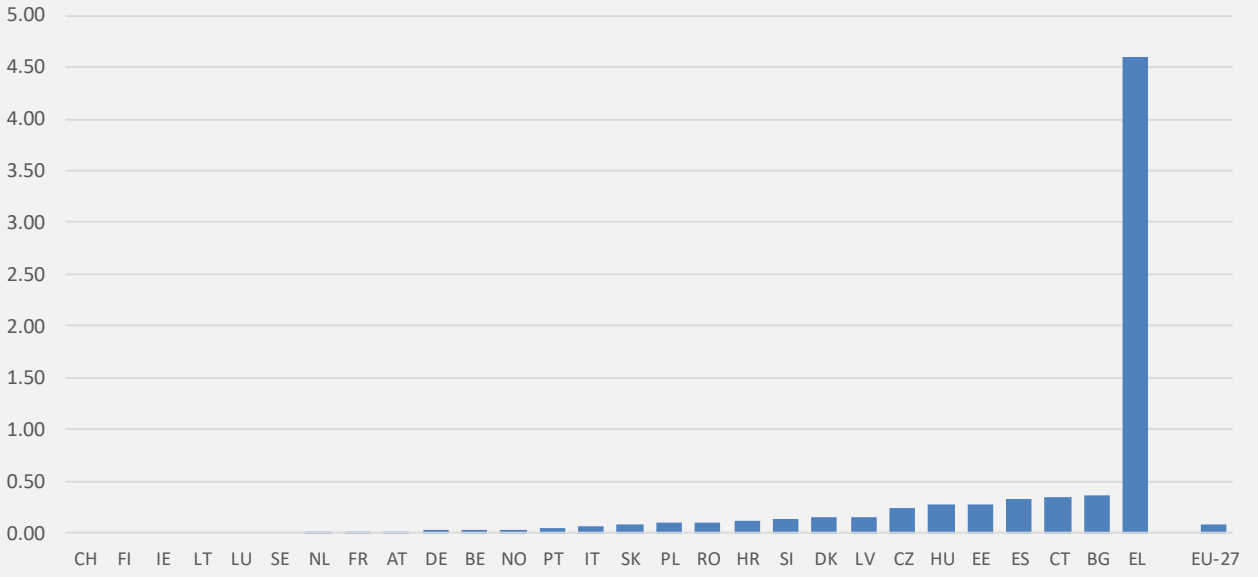
All fatalities per million train kilometers (average over 2021-2023)



Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency

Figure 6: Railway passenger fatality rates (2013–2023)

Passenger fatalities per billion passenger kilometers (average over 2013-2023)



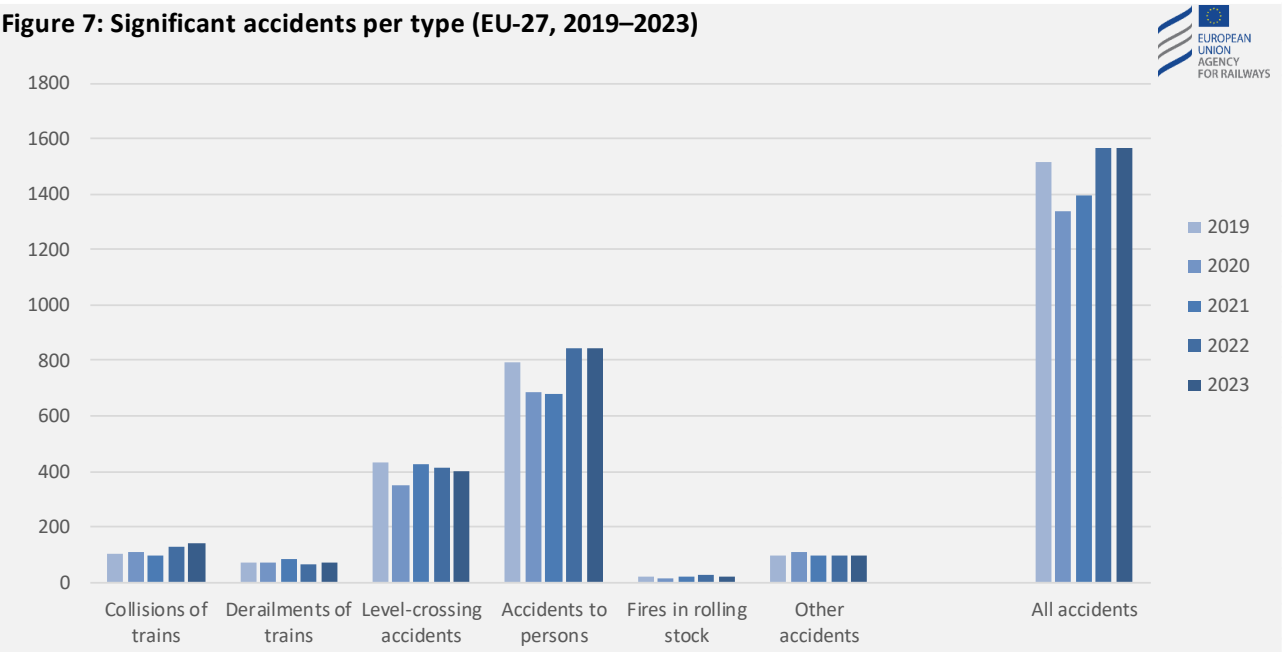
Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency

Internal and external accidents

Member States reported in total 1,565 significant accidents for 2023 alone, that is, more than four significant accidents per day on average, with an increase compared to 2020 and a stable value compared to 2022 (see Fig. 7). After the positive evolution over the last decade which has been mainly driven by "external" accidents (in which third parties, i.e. trespassers and level crossing users, are involved), the trend for "internal" accidents has been quite flat over the same period (see Fig. 8).

Although the number of "external" accidents increased during 2021-2022 period, the value of 2023 remained stable compared to the previous year, aligning with pre-COVID level (2019). This stability is mainly due to accident to persons, while level crossing accidents marginally decreased compared to the previous year. Regarding "internal" accidents, derailments and collision of trains registered an increase in 2023 compared to 2022, while the number of accidents included in the category 'fire in rolling stock' decreased in 2023. 'Other' accidents remained stable[6] (see Fig. 7).

Figure 7: Significant accidents per type (EU-27, 2019–2023)

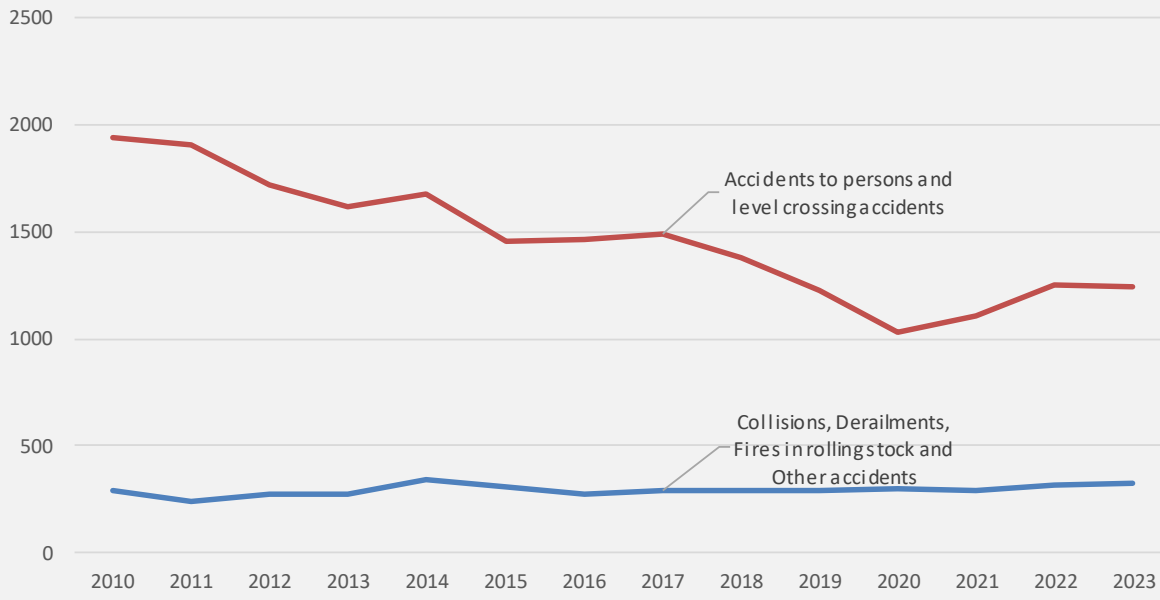


Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency

[6] The category "other accidents" include a wide range of accidents not included within the specific types, such as persons hit on platforms, collisions and derailments of shunting rolling stock/maintenance machines, dangerous goods released during transport, objects projected by the running train and electrocution in connection with rolling stock in motion. For more details on CSIs definitions, see the Implementation guidance on CSIs (available on the ERA website from this page).

Figure 8: Railway 'internal' and 'external' significant accidents (EU-27, 2010–2023)

Collisions, derailments, fires in rolling stock and other accidents against accidents to persons and level-crossing accidents



Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency.

Railway fatalities and suicides

The total number of fatalities, excluding suicides, has shown a fluctuating trend in recent years (see Fig. 9). Since 2021, the number of fatalities has consistently increased. In 2023 with 841 fatalities, there was an increase compared to the previous years: 2022 had approximately 750 fatalities, while both 2021 and 2020 had around 700 and slightly below respectively. This rise was mainly due to the increase in fatalities among passengers, employees and other persons, while fatalities of level crossing users and unauthorised persons decreased.

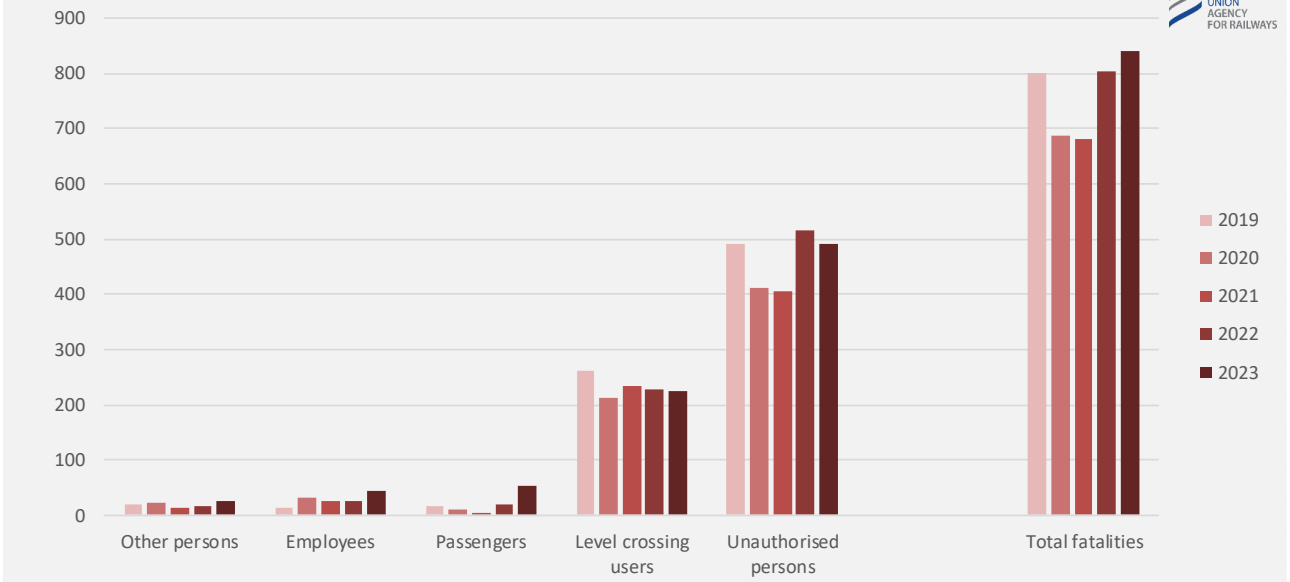
If suicides are excluded, the majority of fatalities on railway premises in the last five years were from accidents to persons (67%). Fatalities from level-crossing accidents accounted for 31% of the total, while fatalities from collisions and derailments represented 3 % of all railway fatalities (see Fig. 10).

Suicides are reported separately from accident fatalities. In 2023, 2,370 suicides (almost seven each day) were recorded on the EU railways, with a decrease compared to the previous year after the 2021-2022 increase. They represented 74% of all fatalities on railways and, together with the unauthorised person fatalities, constituted 90% of all fatalities occurring within the railway system (see Fig. 9 and 11). Trespass fatalities slightly decrease in 2023 compared with the previous year, aligning with the value recorded in 2019. (see Fig. 11).

Since 2021, the number of railway workers' fatalities has consistently increased until 2023. Since 2017, despite a drop in 2019, no clear progress is observed in reducing railway workers fatalities (with 45 fatalities

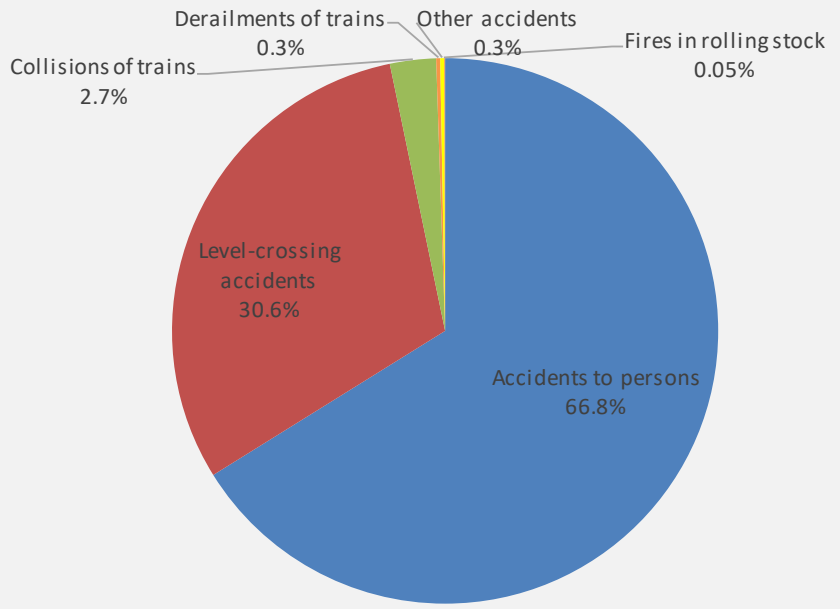
in 2023 compared to 26 in 2017, see Fig. 12). A similar pattern was recorded for employees' seriously injured, with 56 serious injuries in 2023, a value similar to that of 2018.

Figure 9: Fatalities per victim category, excluding suicides (EU-27, 2019–2023)



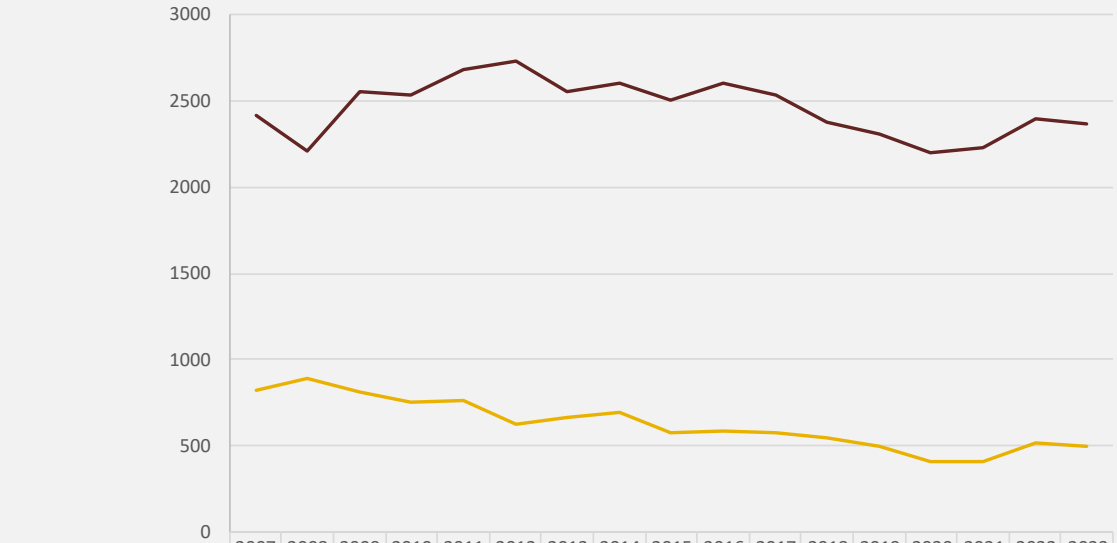
Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency.

Figure 10: Fatalities per type of significant accident (EU-27, 2019–2023)



Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency.

Figure 11: Railway suicides and trespasser fatalities (EU-27, 2007–2023)

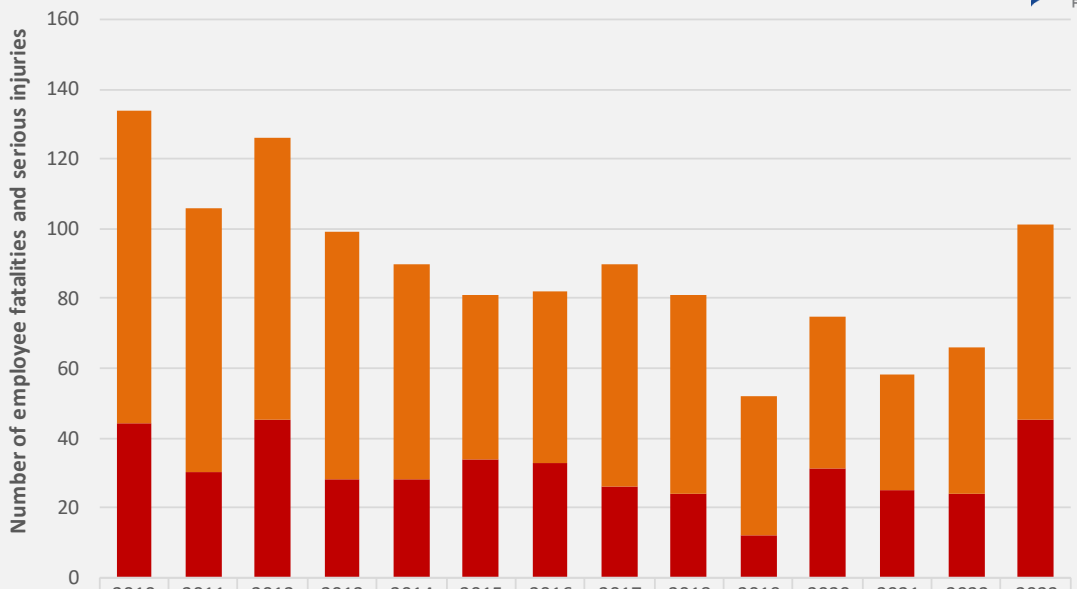


	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Suicides	2417	2211	2552	2532	2687	2734	2552	2608	2511	2608	2532	2379	2313	2204	2234	2401	2370
Trespasser fatalities	822	887	813	750	759	622	659	692	572	585	579	549	491	411	405	516	491

Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency

Figure 12: Railway employee casualties (EU-27, 2010–2023)

Fatalities, serious injuries



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Seriously injured	90	76	81	71	62	47	49	64	57	40	44	33	42	56
Killed	44	30	45	28	28	34	33	26	24	12	31	25	24	45

Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency

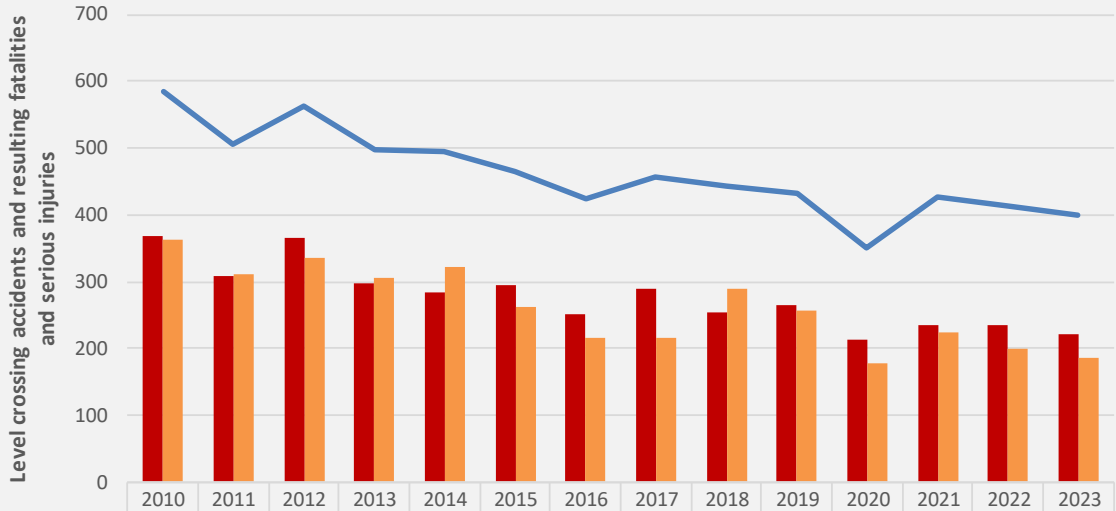
Level crossing safety

After an improvement in level crossing safety over the period 2010-2016, a more stable trend was observed in the following seven years. Besides a drop in 2020 (partially linked to the lockdown measures and subsequent travel restrictions imposed during the COVID-19 pandemic), the number of accidents (and related serious injuries) at level-crossing in 2023 went back to the values of 2020 (see Fig. 13). Excluding the year 2020, for the number of level crossing accidents and related casualties (fatalities and serious injuries), the 2023 value is the lowest ever since 2010.

Passive level crossings and level crossings in general are being eliminated at a quite slow rate. There is a possible relationship between the average number of total and passive level crossings in each Member State and the average number of level crossing accidents. In all but a few countries (e.g. Sweden, France, Czech Republic), where further analysis is merited, a higher number of passive level crossings is associated with a higher number of level crossing accidents (see Fig. 14). The possible correlation patterns between the number of (passive, active and total) level crossings and the average number of level crossing accidents could be further explored/analysed. The higher level of granularity of the information in the CSM ASLP could help in further/better analysing possible patterns.

Figure 13: Level crossing accidents and resulting casualties (EU-27, 2010–2023)

Significant accidents, fatalities and serious injuries

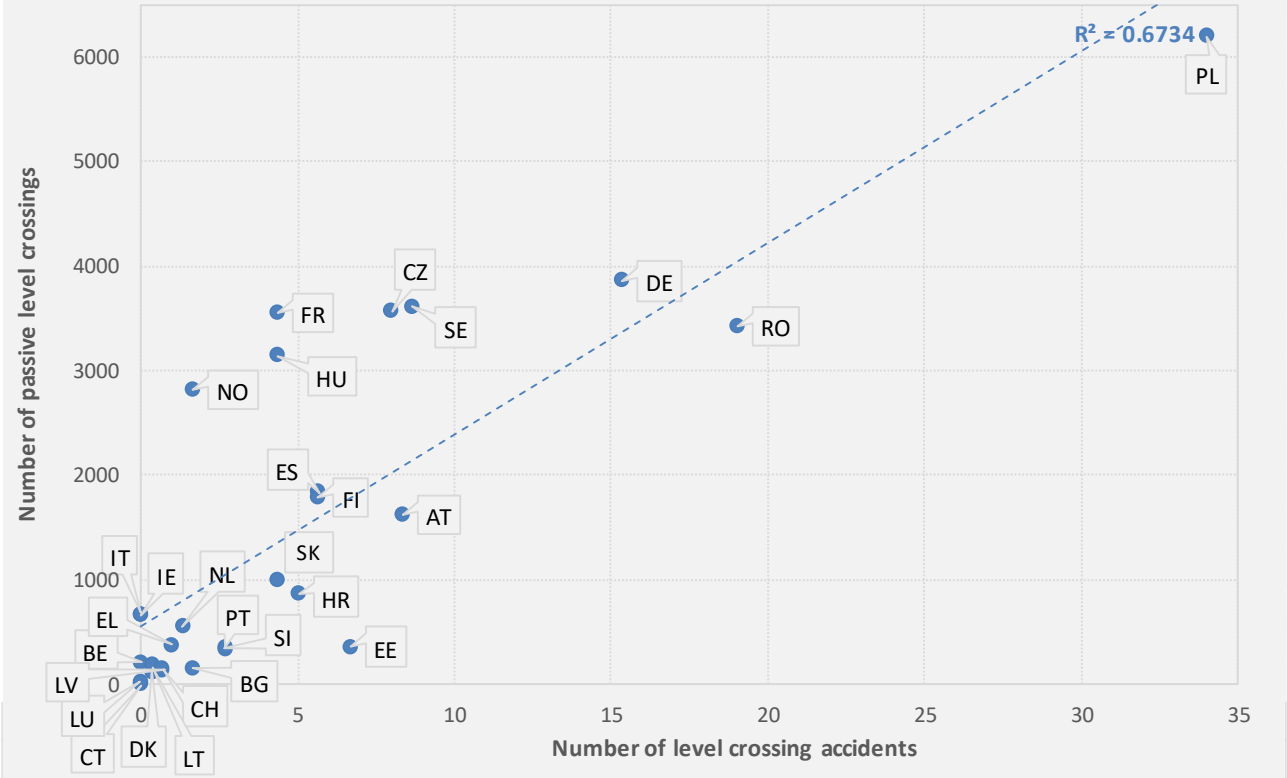


	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Fatalities	367	309	365	298	284	294	252	289	254	265	213	234	234	222
Serious injuries	363	311	335	305	321	263	217	217	290	257	179	224	201	186
Accidents	585	506	563	498	495	465	424	456	442	432	350	428	412	399

Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency

Figure 14: Number of level crossing accidents and number of passive level crossings per country

EU-27+CH+NO (average 2021-2023)



Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency

Precursors

Precursors to accidents are incidents that, under other circumstances, could have led to an accident. Monitoring events with no harmful consequences that occur on railways is an essential tool of a proactive safety management system (SMS) for RUs and IMs.

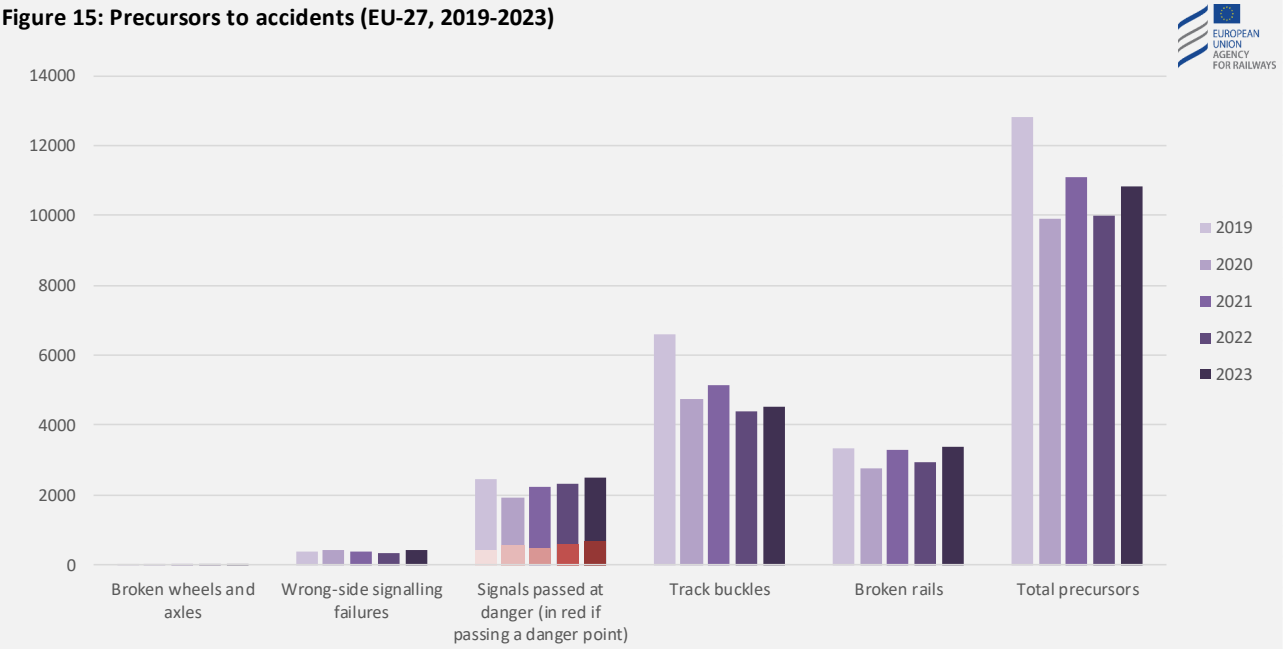
Over the period 2019-2023, EU Member States reported on average around 11,000 precursors to accidents as defined under the CSIs each year (see Fig. 15). This number implies that there is a ratio of about seven precursors to one significant accident.[7] However, if we discard accidents to persons caused by rolling stock in motion, the ratio between the precursors and accidents rises to 15:1. This highlights the learning potential of precursors to accidents. For all types of precursors to accidents, their trend during this time period is fluctuating.

[7] On average, for each reported significant accident in Europe, there are approximately 7 reported precursors. However, it is important to note that the presence of precursors does not necessarily indicate a direct correlation with the occurrence of significant accidents.

After a drop in 2020, only the number of SPADs has consistently increased until 2023. However, 2023 has seen an increase compared to previous year for all types of precursors.

The variation in yearly occurrence of track buckles and broken rails does not provide a genuine picture of the situation being influenced by differences in data collection practice and reporting of these occurrences in several Member States. This is further illustrated by plotting the ratio of accident precursors to accidents (see Fig. 16). Since the availability of consistent and good quality data is of high importance, further analysis and discussions are foreseen to identify possible differences and ways forward to harmonise the data collection and reporting among the different countries.

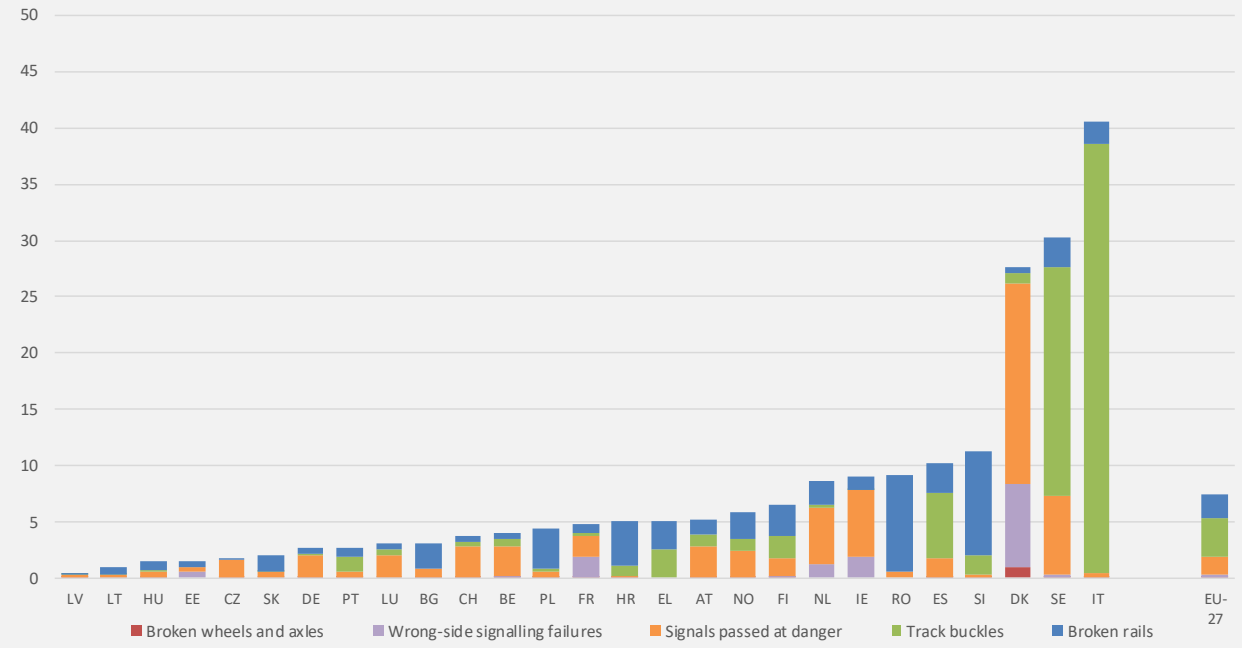
Figure 15: Precursors to accidents (EU-27, 2019-2023)



Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency

Figure 16: Accident precursors to accidents ratios per country (EU-27+CH+NO, 2019-2023)

Ratios of CSI precursors to total number of CSI significant accidents



Source: Common Safety Indicators (CSIs) as reported by National Safety Authorities (NSAs) to the Agency

Weather-related occurrences investigated by NIBs[8]

In recent years, an increasing number of extreme weather-related events with significant consequences for the railway system has been recorded, and not only in Europe. Natural disasters driven by climate change (e.g. extreme heatwaves and fires, heavy rainfall and flooding, heavy snowfall and thunderstorms) present safety hazards and test the transport system's resilience. Indeed, a recent survey jointly launched by the Swiss and the French NSAs and concerning the impact of climate change on railway systems, showed that 87 % of respondents (i.e. seven EU NSAs) registered major railway-related occurrences caused by exceptional weather events in the past 5 years[9].

Since 2007, the Agency received 100 final accident investigation reports for occurrences caused, in whole or in part, by weather-related events (until 2023); weather conditions were indicated as direct causes in 27 cases, while they were considered as contributing factors for the other 73 occurrences[10].

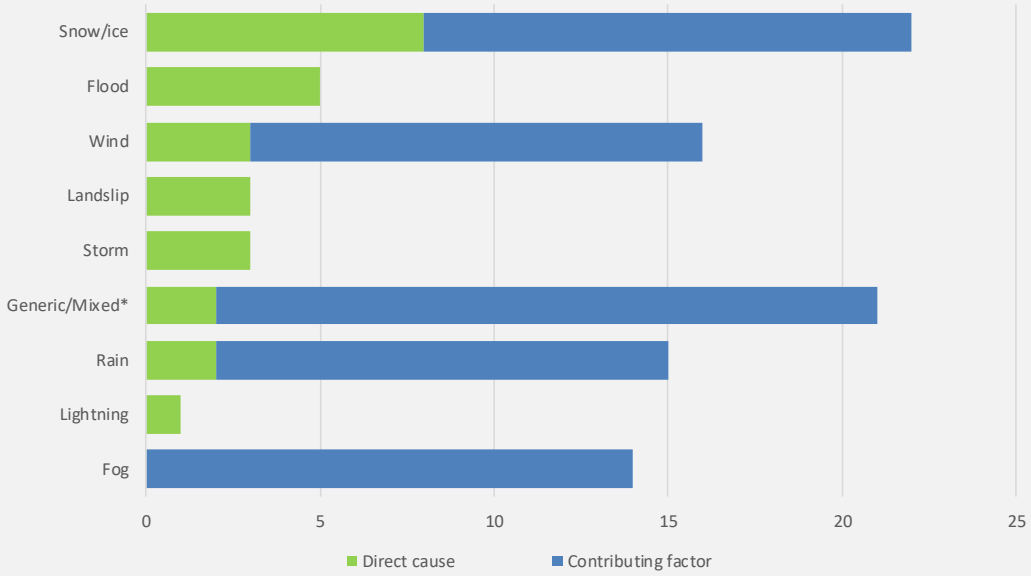
The weather conditions most frequently directly causing the (investigated) rail occurrences are snow/ice (indicated in eight occurrences as the direct cause) and flood (indicated in five occurrences as the direct cause), followed by landslip, wind and storm. Snow/ice is also confirmed as one of the most frequent contributing factors in the weather-related occurrences investigated (14 occurrences), together with fog (14

[8] This section has been newly introduced compared to the previous version of the report from 2023.
[9] For further details see the first Rail Environmental Report of the Agency (2024).
[10] As part of the current TSI Revision Mandate, the European Commission has requested the Agency to conduct further work on extreme weather events, which will also provide additional insights into the trends of such events over time.

occurrences), wind (13 occurrences) and rain (13 occurrences). From the accident investigations, train derailments and train collisions with obstacles appear to be the occurrences most frequently caused, in whole or in part, by severe weather conditions or weather-related events.

Figure 17: Number of investigations on weather-related occurrences by cause/contributing factor

EU-27+ CH + NO + UK, 2007-2023

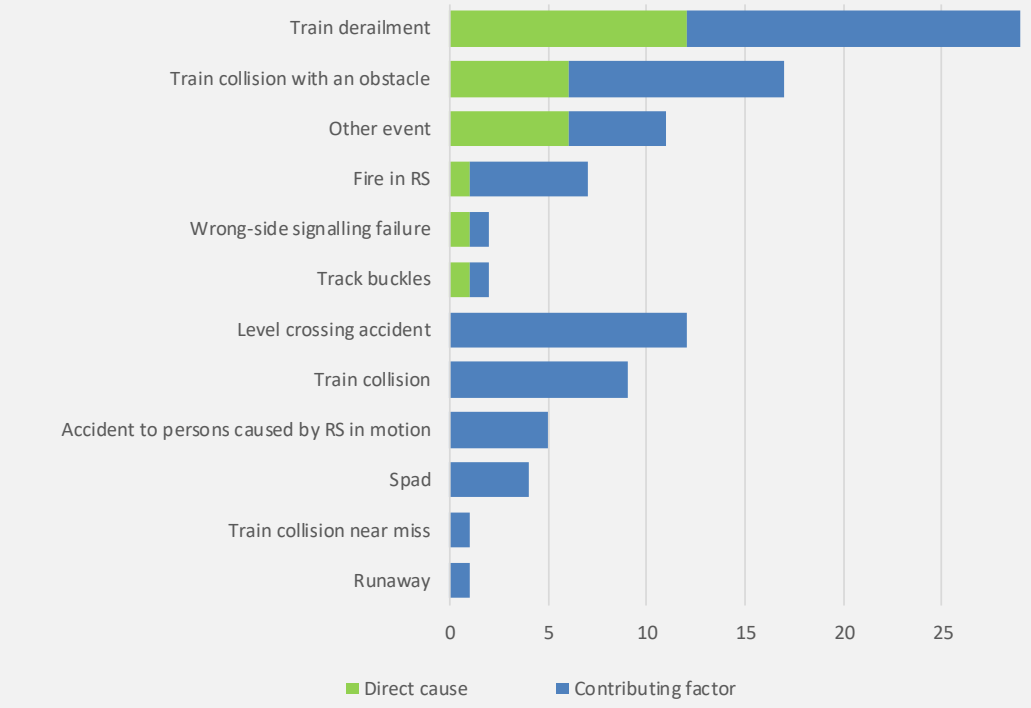


Note: Data for UK available until end 2020; (*) 'Generic/Mixed' indicates cases in which the weather event is not specified and/or with more than one weather condition.

Source: Final accident investigation reports sent to the Agency by the NIBs

Figure 18: Number of investigations on weather-related occurrences by occurrence type

EU-27+ CH + NO + UK, 2007-2023



Note: Data for UK available until end 2020

Source: Final accident investigation reports sent to the Agency by the NIBs

Concluding remarks

The data collected for 2023 and reported in the figures above indicate that an increase in fatalities and serious injuries have been recorded in 2023 compared to 2020 (which was highly impacted by the COVID pandemic, in terms of rail traffic/volumes), after the overall positive progress of the last decade, while significant accidents remain stable.

The figures confirm that caution is still needed. The overall cost of railway accidents remains high (almost 3.5 billion EUR per annum only for significant accidents), one major accident was registered in 2024, the passenger fatality rate increased significantly in 2023 (reaching levels similar to those recorded in 2016), an important increase in railway workers' fatalities and serious injuries in 2023 and the decrease in significant accidents (until 2020) has been mainly driven by "external" accidents (especially, accident to persons), while 'internal' accidents registered an increase for collisions and derailments of trains in 2023 compared to 2020, and fire in rolling stock and others accidents showed a more stable trend in the last years.

Moreover, large disparities in safety levels still exists between Member States. The latest figures still show, for example, at least a ten-fold difference in fatalities rates for countries with the lowest and highest values. A fast implementation of the common safety methods for assessing safety level and safety performance (CSM ASLP), with the associated systematic and comprehensive EU-wide safety incidents reporting scheme, would be essential to provide an additional angle to assess and improve how safety is managed across Europe.

As for the aspects concerning weather-related accidents and incidents investigated by the NIBs, the increasing frequency and types of extreme weather events poses significant safety and operational challenges for the railway system. This highlights the need for enhanced resilience and preparedness measures over the coming period.

These facts urge us all to continue to work relentlessly and tirelessly to improve railway safety.