Safety Overview 2021

Main figures based on CSI data (up to 2019)

March 2021

EUROPEAN UNION AGENCY FOR RAILWAYS

120 Rue Marc Lefrancq | BP 20392 | FR-59307 Valenciennes Cedex
Tel. +33 (0)327 09 65 00 | era.europa.eu

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 2021.

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. The data extraction date for this report was 30 November 2020. The EU-28 countries, Norway and Switzerland are considered as members of the SERA for the purpose of this report.

The interpretation of the figures is the sole responsibility of the reader, who may wish to refer to the 2020 statutory report for guidance.

Annual overviews on Safety and Interoperability in SERA (2021): Safety

The published 2019 data confirm an overall positive (decreasing) evolution at the EU level. Specifically, both significant accidents and resulting fatalities were decreasing by 4% annually on average during the 2010's. With 1,552 significant accidents and 824 fatalities (suicides excluded), the year 2019 was the safest year ever.

Despite an overall decrease in significant accidents since 2010, the "internal" accidents (collisions, derailments and fires in rolling stock) are stagnating and the overall toll of railway accidents remains high: the significant accidents alone represent the economic costs of about 3.5 billion EUR per annum. The progress has also been very uneven across the EU Member States, with the variance in safety levels remaining high.

- *The overall cost of railway accidents remains high (about 3.5 billion EUR per annum only for significant accidents)*
- *Significant accidents decreased respectively by 10% in 2019 compared to 2018, confirming the steady decrease registered since 2010.*
- *The overall positive evolution at the EU level is confirmed also by the reduction in fatalities and serious injuries resulting from significant accidents.*
- *Although the positive trend depicted at the EU level, notably 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 decrease in significant accidents has been mainly driven by "external" accidents, while 'internal' accidents (collisions, derailments, fires in rolling stock and other accidents) show a more stable trend in the last years.*
- *Although safety at LCs has been improving in the past decade, such trend was more significant over the period 2010-2016 while less pronounced in the last years (2017-2019).*
- *No clear progress can be deducted from the figures on precursors to accidents, also due to differences in data collection and reporting of track buckles and broken rails in several Member States. Signal passed at Danger (SPAD) incidents increased in the last years, although incidents in which a danger point was passed represent only one fifth of total SPADs in 2019.*

Accidents and their outcomes

With 1552 significant accidents in 2019 resulting in 824 fatalities and 618 serious injuries (see Fig. 2), the total costs of railway accidents is estimated at about 3.5 billion EUR (see Fig. 1), with a reduction over the previous year.

A steady decrease in significant accidents and resulting casualties has been recorded in the period 2010-2019, for which harmonised data are available across the Union. The 2019/2018 year to year decreases of 10%, 7% and 19% respectively for significant accidents, fatalities and serious injuries are statistically significant; they are also significant when compared to the average of the four preceding years (see Fig. 3). In parallel, a smaller reduction (2%) in 2019 compared to 2018 has been observed for suicides on railway premises, which are not accounted for among railway accidents; the reduction of 7% over the average of the four previous years is statistical significant (see Fig. 3).

Like in 2018, also in 2020[1] no single major accident occurred after that two such accidents were recorded in 2019 (see Fig. 4). An overall downward trend has been observed since 1988.

Trends in accident, fatality rates and their variations

Three main indicators are reported to monitor trends in accident and casualty rates: Significant accidents and railway fatalities normalized by train kilometres, capturing the manifested overall risk in railway operation and passenger fatality rate, and passenger fatalities per passenger kilometres capturing the personal manifested risk for people using trains.

All three rates have decreased substantially since 2010 (see Fig. 5), with an annual average reduction of 5 % p.a. for both significant accidents and fatality rates. The overall fatality rate is currently around 0.2 fatalities per million train kilometres (one fatality each 5 million train kilometre on average), whereas the overall passenger fatality rate is 0.033 passenger fatality per billion passenger kilometre (one fatality each 30 billion passenger kilometres) (see Fig. 5).

Large differences in casualty rates exists between Member States, highlighting the extent of existing disparities in safety levels. The figures of fatality rates and the passenger fatality rates for individual Member States show at least a ten-fold difference for countries with the lowest and highest values (see Fig. 6 and 7). For both rates, the median values are much lower than mean values, since the rates for MSs with relatively higher rates are much higher than rates for other countries. For railway fatality rate, a cluster of 11 countries registered higher values compared to the remaining EU Member States (see Fig. 6).

Internal and external accidents

Member States reported in total 1552 significant accidents for 2019, which is the lowest number recorded ever since 2010 (see Fig. 8). However, the decrease has been mainly driven by “external” accidents, in which third party (trespassers and level crossing users) are involved (see Fig. 9). Collisions, derailments and the accidents included in the category ˙fire in rolling stock˙ decreased in 2019 compared to 2018, but a more stable trend has been observed for the previous years (see Fig. 8).

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. In 2019 ‘other accidents’ registered statistical significant increases over 2018 and over the average of the previous years. The 97 cases reported for 2019 represent the second highest value since 2014 (see Fig. 8).

Railway fatalities and suicides

Similarly to the decrease in railway accidents, the total number of casualties, excluding suicides, has fallen steadily in recent years (see Fig. 10). For the year 2019, 824 fatalities were reported, with a decrease of around 7% from the previous year. Between 2006 and 2019, the number of railway fatalities decreased by 4.6 % p.a. on average. The number of fatalities in a combined category of passengers and employees has

[1] Data consulted in March 2021 based on the submissions from NIBs

been decreasing at a pace of 8 % per year on average, whereas trespassers and level crossing fatalities have decreased by 4 % per year on average.

If we exclude suicide fatalities, the majority of fatalities on railway premises are from accidents to persons. Fatalities from level-crossing accidents account for 30 % of the total, while fatalities from collisions and derailments represent 2.2 % of all railway fatalities (see Fig. 11).

Suicides are reported separately from accident fatalities. They represent 76 % of all fatalities on railways and, together with the unauthorised person fatalities, constitute 91 % of all fatalities occurring within the railway system (see Fig. 10 and 12). In 2019, 2572 suicides were recorded on the EU railways, with an average of seven each day. While trespass fatalities have seen a steady decrease since 2006, during the financial crisis of 2008 suicides were on the rise and peaked in 2012. They have been decreasing since, but not yet to the level seen before 2008 (see Fig. 12).

In the period 2014-2018 no progress were observed in reducing railway workers casualties, with close to 30 fatalities and some 60 employees seriously injured each year (see Fig. 13). Unlike previous years, in 2019 both the figures decreased of more than 30% compared to 2018. Member States reported in total 15 railway employees killed and 41 seriously injured for 2019, which are the lowest number recorded since 2010.

Level crossing safety

Although safety at LCs has been improving in the past decade, such trend was less pronounced in the last years. After a steady improvement in level crossing safety over the period 2010-2016, in the last 3 years a more stable trend was observed. In 2019, the values for accidents, fatalities and serious injuries occurred at level-crossing are still higher than in 2016; an improvement over 2018 was observed for accidents and serious injuries, while the number of fatalities increased during the same period (see Fig. 14).

Level crossing accident rates vary considerably among ERA countries (see Fig. 15). Countries with the lowest accident rates typically have implemented comprehensive strategies for level crossing safety improvements. A common feature of the countries with the highest accident rates is a low population density and low railway traffic volumes. These conditions perhaps provide less incentive for a comprehensive management of level crossing safety.

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).

Over the period 2015-2019, EU Member States reported on average more than 13000 precursors to accidents as defined under the CSIs each year; this is a ratio of about seven precursors to one significant accident. However, if we discard accidents to persons caused by rolling stock in motion, the ratio between the precursors and accidents rises to 17:1. This unveils an important learning potential of precursors to accidents.

Signal passed at Danger (SPAD) incidents increased by 3 % in 2019 compared to the previous year (see Fig. 16), while the average annual increase rate over the period 2015-2019 was 5.4%. Among around 2800 SPADs recorded in 2019 on EU railways, only one fifth are incidents in which a danger point was passed, representing a particularly high risk of collision.

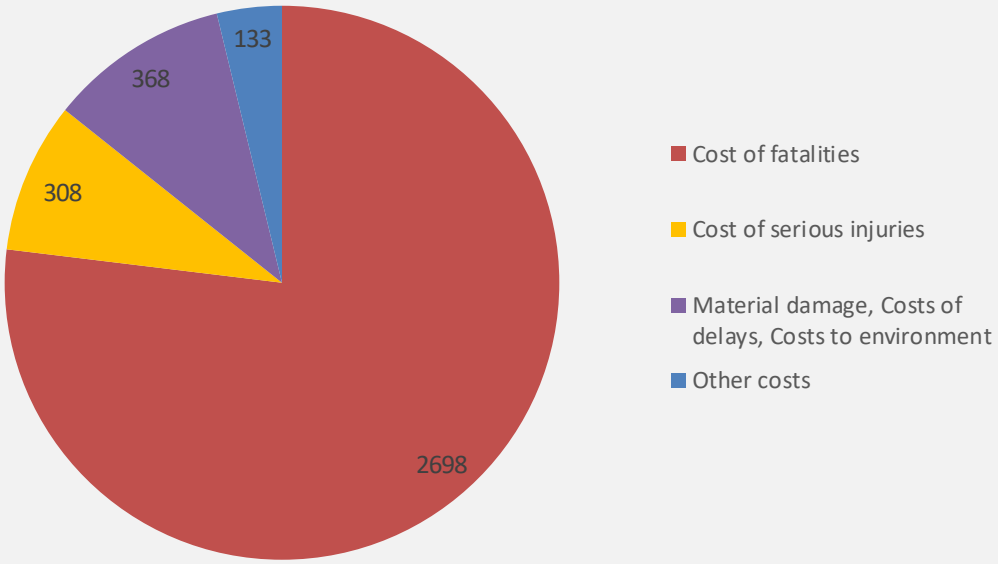
As reported in the previous biennial reports (latest published in 2020), the variation in yearly occurrence of track buckles and broken rails does not provide a genuine picture of the situation being influenced by differences in data collection practice and reporting of these occurrences in several Member States. Since the availability of consistent and good quality data is of high importance, further analysis and discussions are foreseen in order to identify possible differences and ways forward to harmonise the data collection and reporting among the different countries.

Concluding remarks

The data collected for 2019 and reported in the figures above confirm an overall positive progress for railway safety at EU level. Significant accident and resulting causalities have decreased steadily since 2010, with the lowest values ever recorded in 2019. Also the number of suicides on railway premises dropped by 2% over the previous year and by 7% over the average of the four previous years. Notwithstanding the overall positive EU picture, caution is still needed, particularly in some areas. The overall cost of railway accidents remains high (about 3.5 billion EUR per annum only for significant accidents). The decrease in significant accidents has been mainly driven by “external” accidents, while ‘internal’ accidents (collisions, derailments and fire in rolling stock) show a more stable trend in the last years. Moreover, large disparities in safety levels still exists between Member States; the figures show, for example, at least a ten-fold difference in fatalities rates for countries with the lowest and highest values. These facts urge us all to continue to work relentlessly and tirelessly to improve railway safety.

Figure 1 - Costs of railway accidents

Estimated costs in million EUR, EU-28, 2019

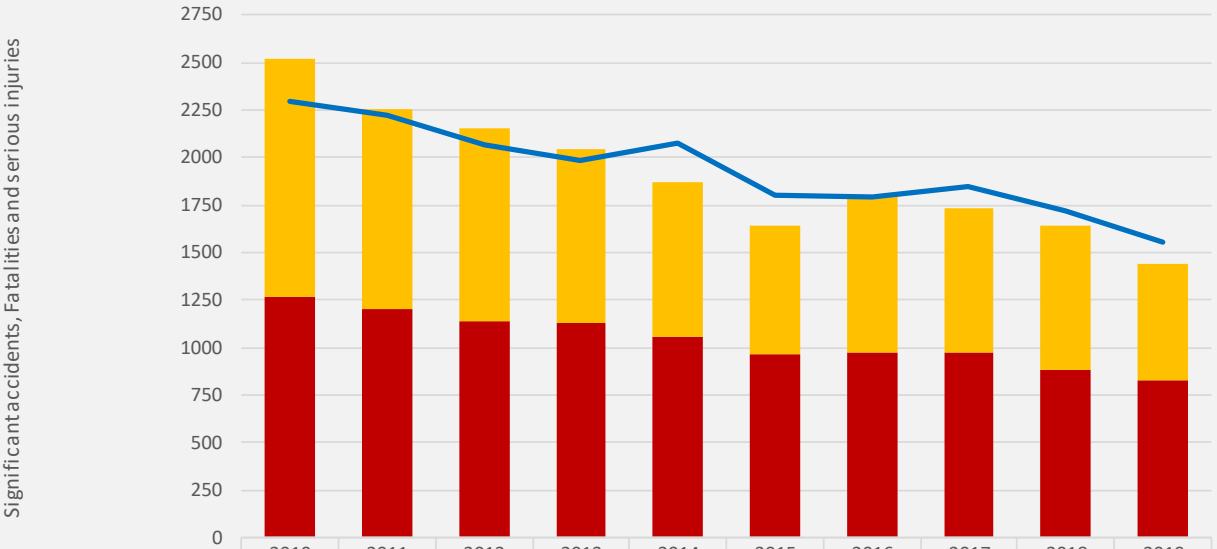


Notes: Other costs: Modal shift, Air polution, Administrative, Rerouting, Reputational damage, Productivity losses, estimated from unit costs developed by consultant for ERA

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

Figure 2 - Main safety outcomes

EU-28 countries, 2010-19



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Serious injuries	1249	1050	1015	911	819	682	825	756	760	618
Fatalities	1270	1206	1135	1129	1054	962	970	974	885	824
Significant accidents	2292	2224	2069	1980	2076	1804	1795	1848	1721	1552

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

Figure 3 - Significant changes in outcomes

Statistically signifiant changes at 95% (Poisson statistical significance test) (EU-28)

	2019/2018	2019/(2015-2018)
All significant accidents	-10%	-13%
Fatalities	-7%	-13%
Serious injuries	-19%	-18%
Suicides	-2%	-7%

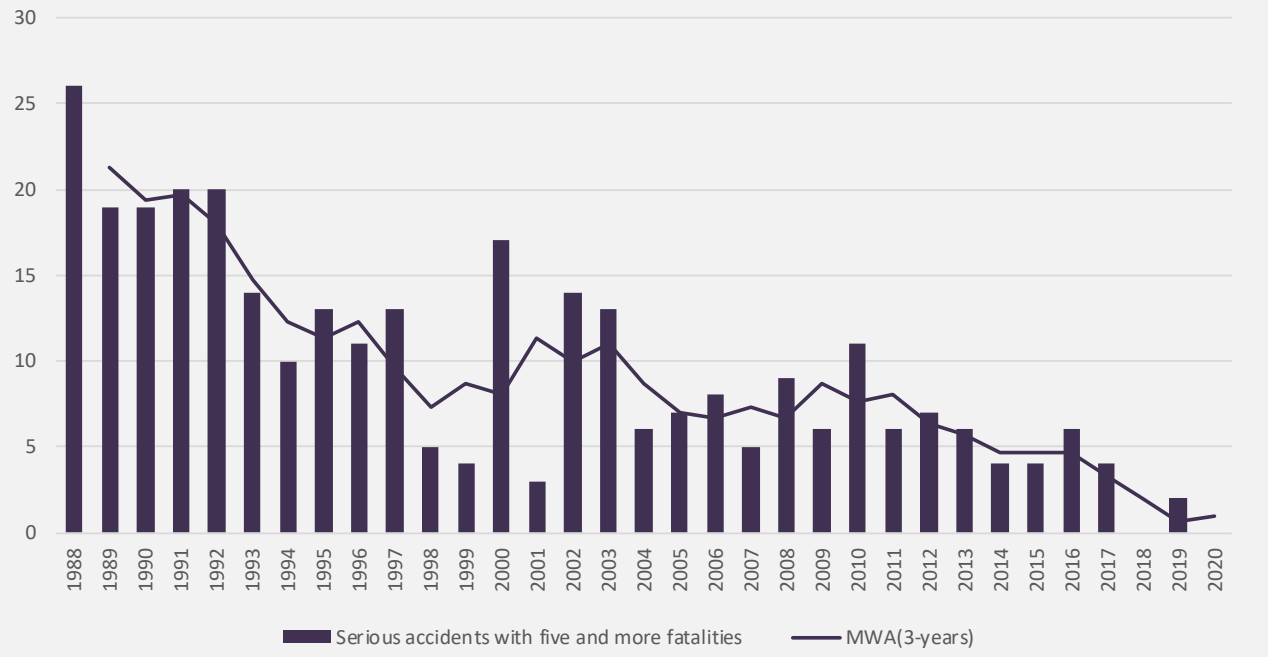
Statistically significant changes highlighted as orange cells

Note: Statistical significance at 95%

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

Figure 4 - Major accidents in Europe

Serious accidents resulting in five or more fatalities, EU-28+CH+NO

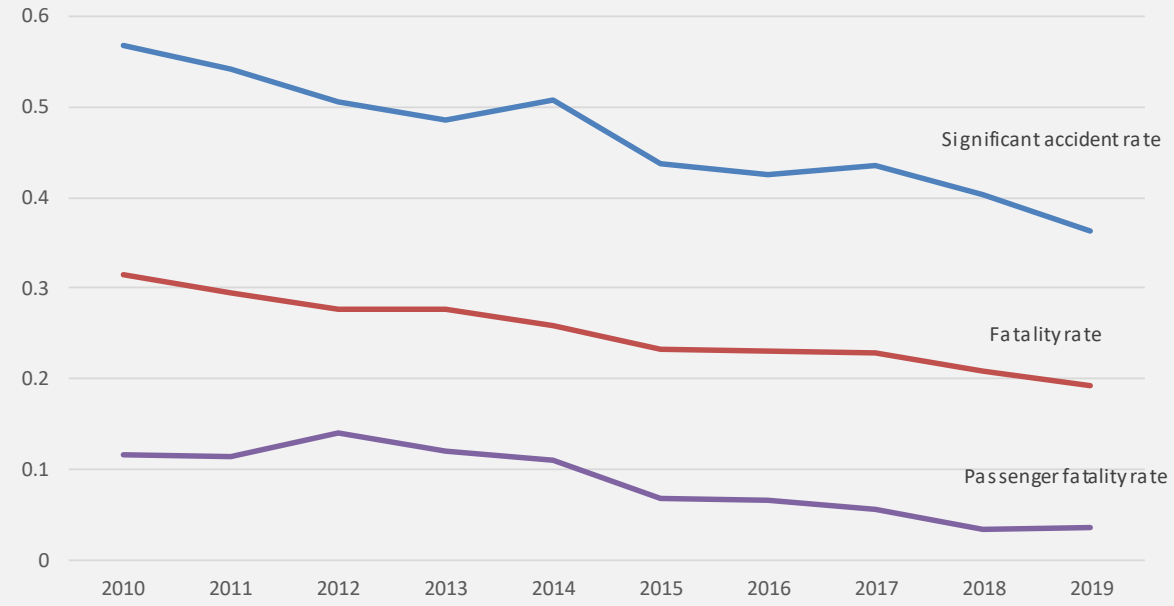


Source: ERAIL and Database of historical accidents - Courtesy of Andrew Evans, Imperial College London

Figure 5 - Trends in accident and fatality rate

Significant accidents and fatalities per million train-km, EU-28

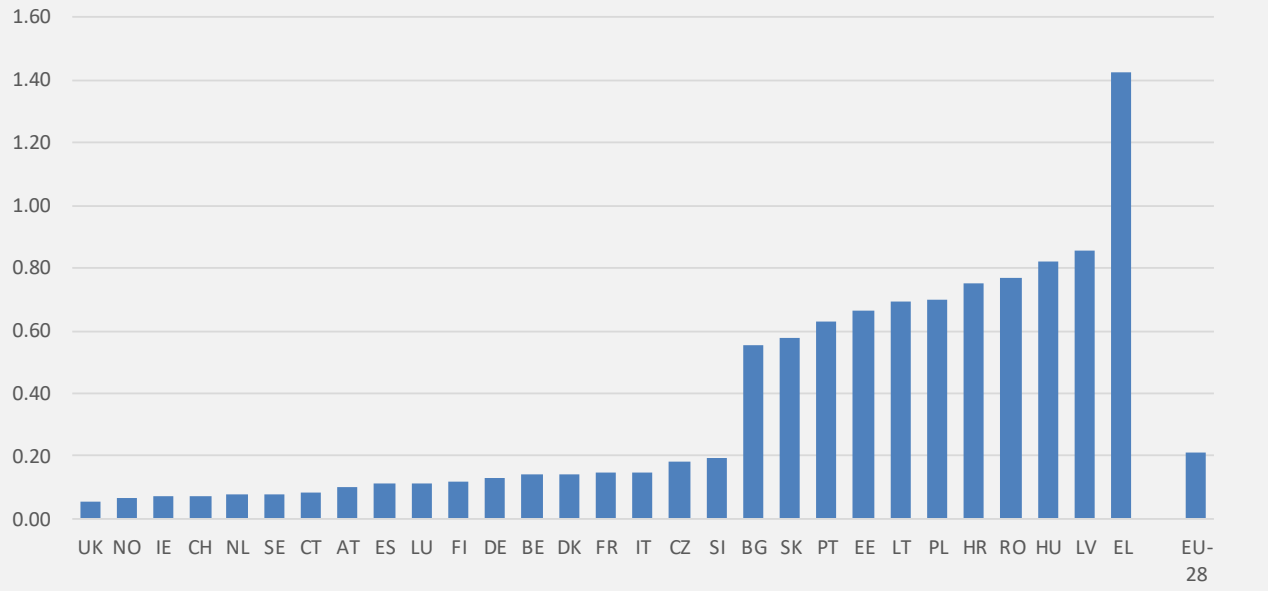
Passenger fatalities per billion passenger kilometers, EU-28



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

Figure 6 - Railway fatality rates

All fatalities per million train kilometers over 2017-2019

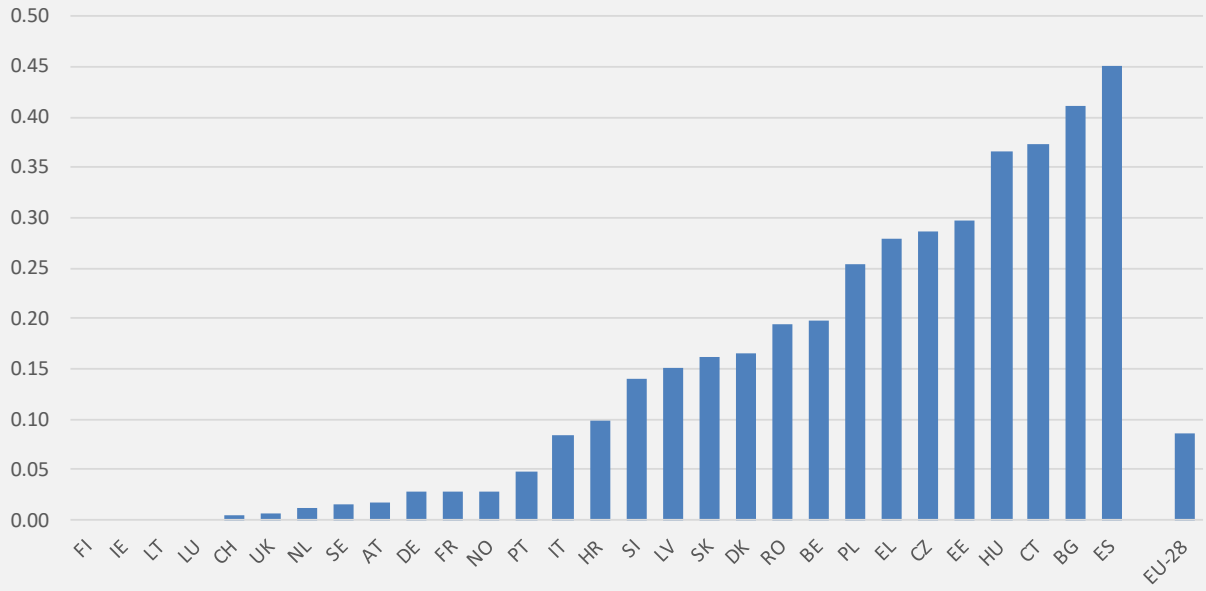


Notes: EU= 28 Member States as of 2019

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

Figure 7 - Railway passenger fatality rates

Passenger fatalities per billion passenger kilometers over 2010-2019

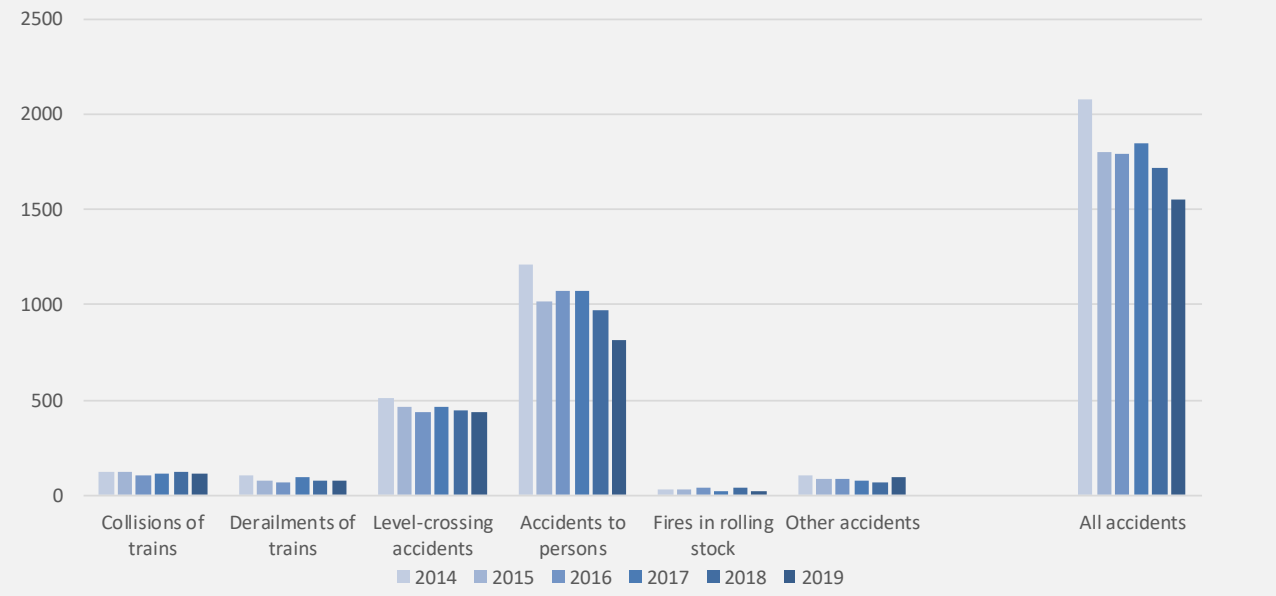


Notes: EU= 28 Member States as of 2019

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

Figure 8 - Significant accidents

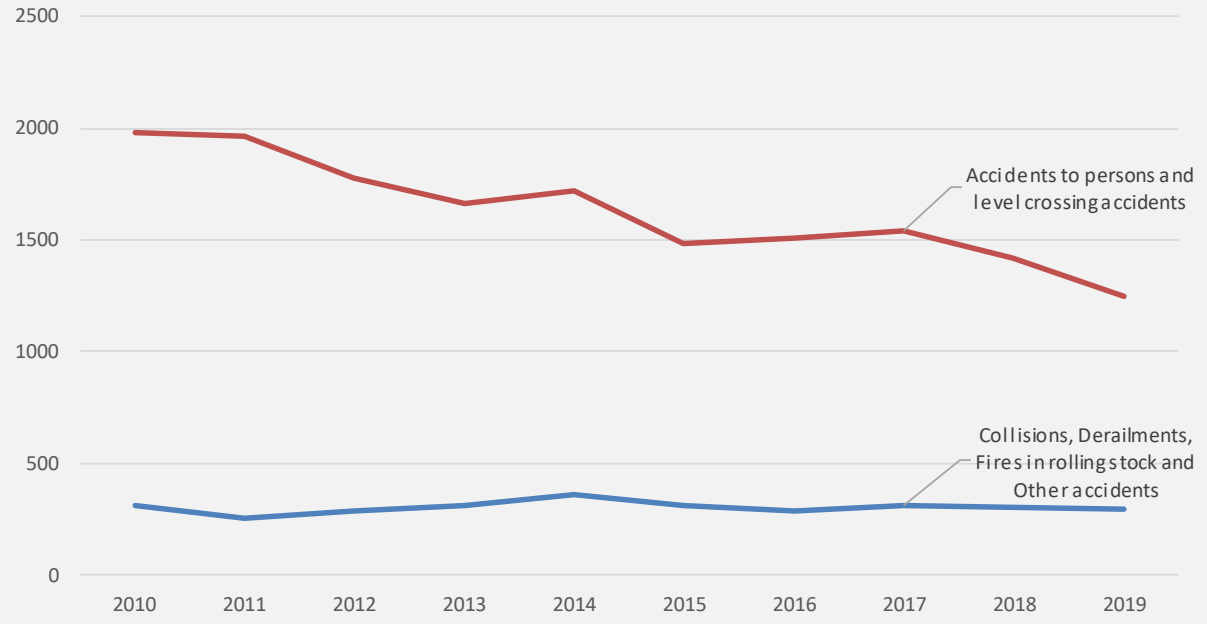
EU-28, 2014-2019



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

Figure 9 - Railway "internal" and "external" accidents

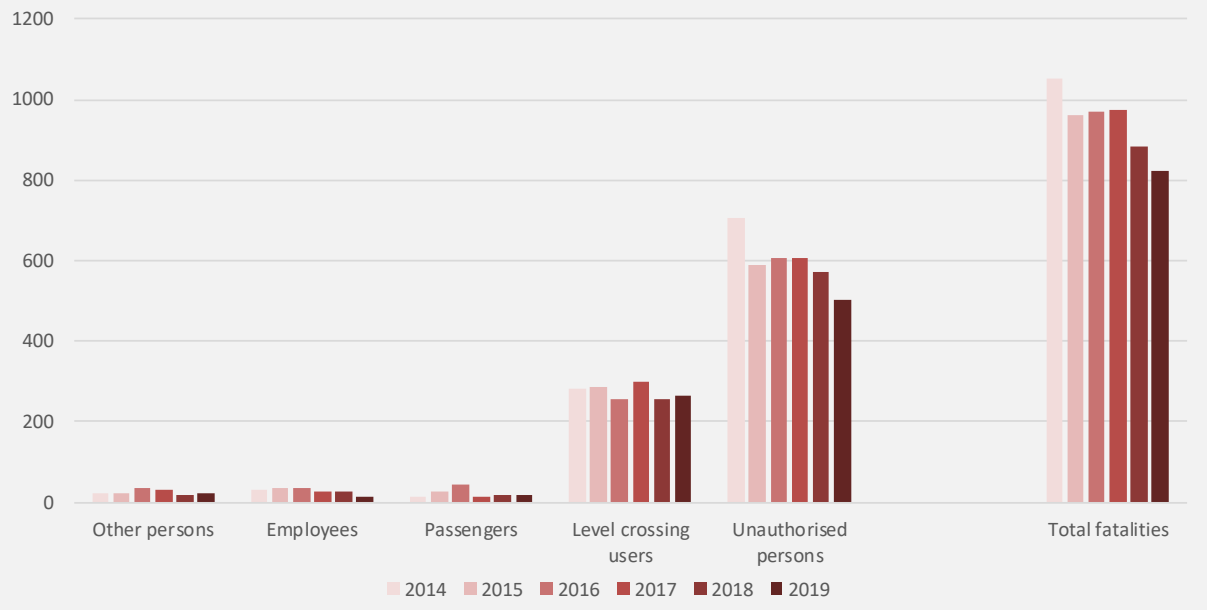
Collisions, derailments and fires in rolling stock against accidents to persons and level-crossing accidents



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

Figure 10 - Fatalities from railway accidents

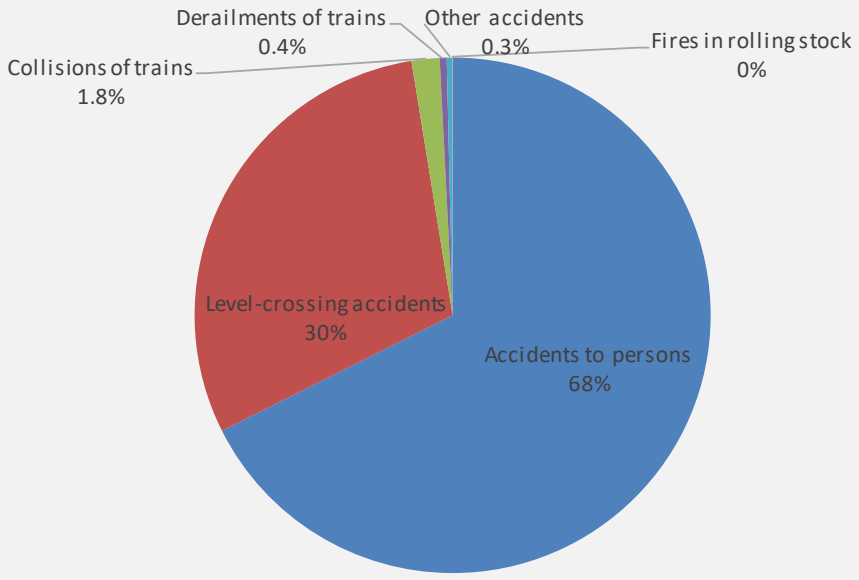
EU-28



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

Figure 11 - Fatalities per type of significant accident

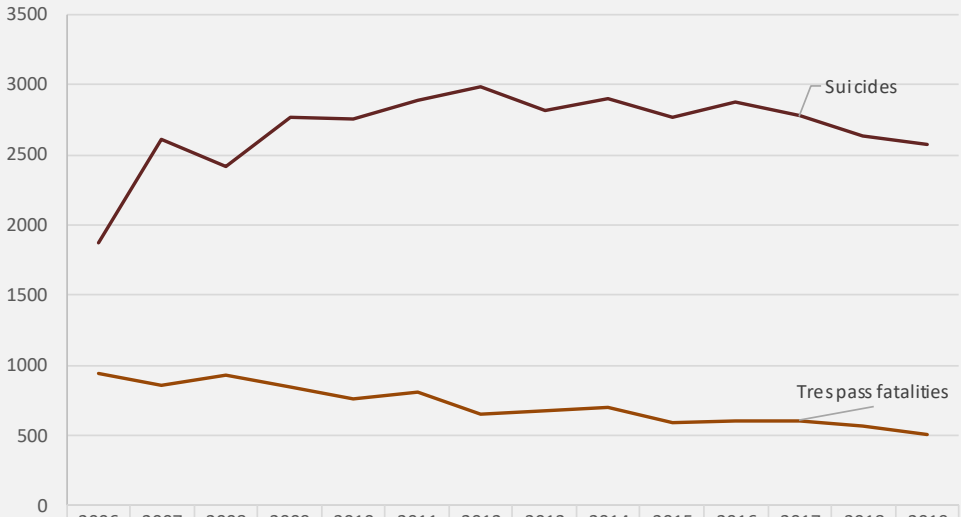
EU-28, 2015-19



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

Figure 12 - Railway suicide and trespassser fatalities

Total, EU-28, 2007-2019

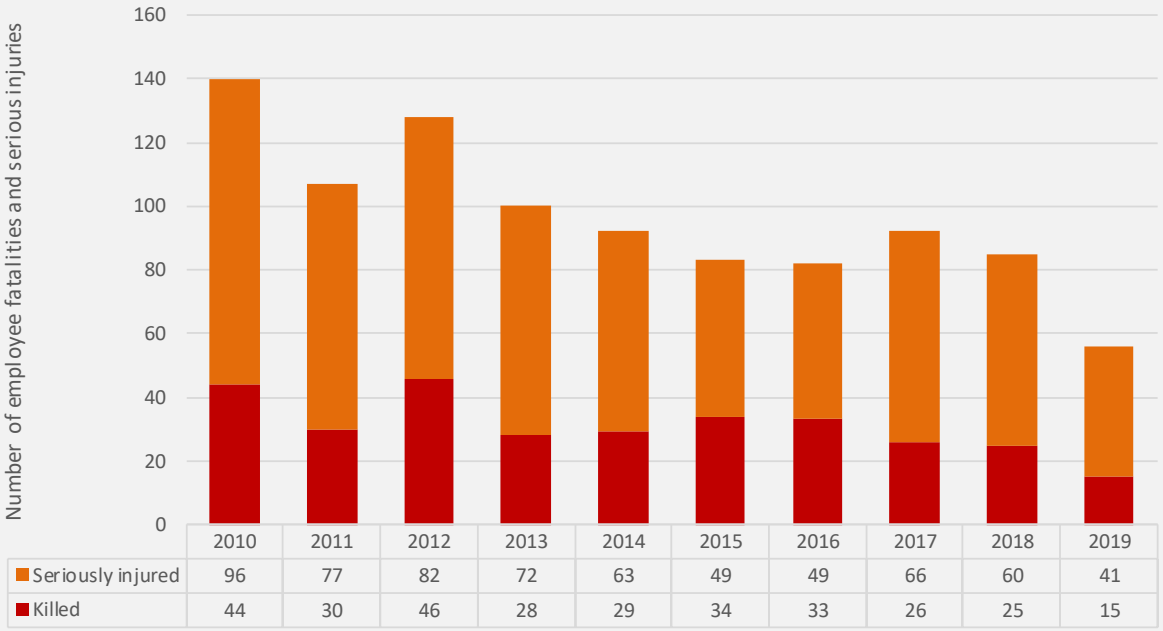


	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Suicides	1874	2614	2413	2762	2756	2890	2982	2819	2895	2765	2881	2777	2637	2572
Trespasser fatalities	940	855	928	849	766	804	655	681	704	589	605	607	570	503

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

Figure 13 - Railway employee casualties

Fatalities, serious injuries, EU-28

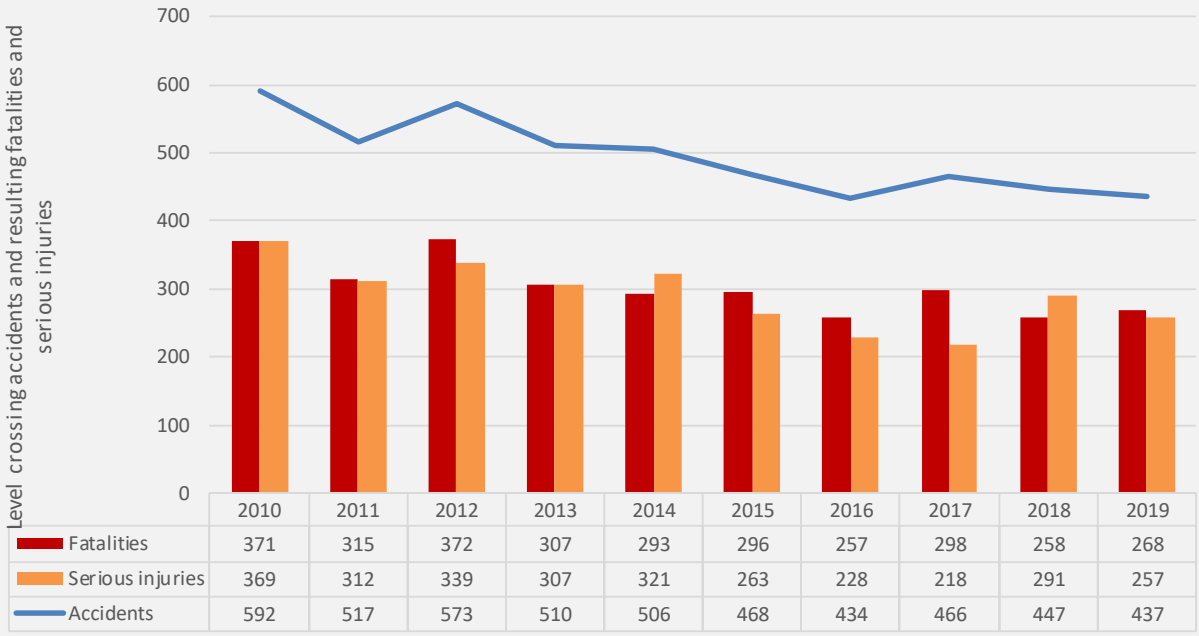


	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Seriously injured	96	77	82	72	63	49	49	66	60	41
Killed	44	30	46	28	29	34	33	26	25	15

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

Figure 14 - Level crossing accidents and resulting casualties

Significant accidents, fatalities and serious injuries, EU-28

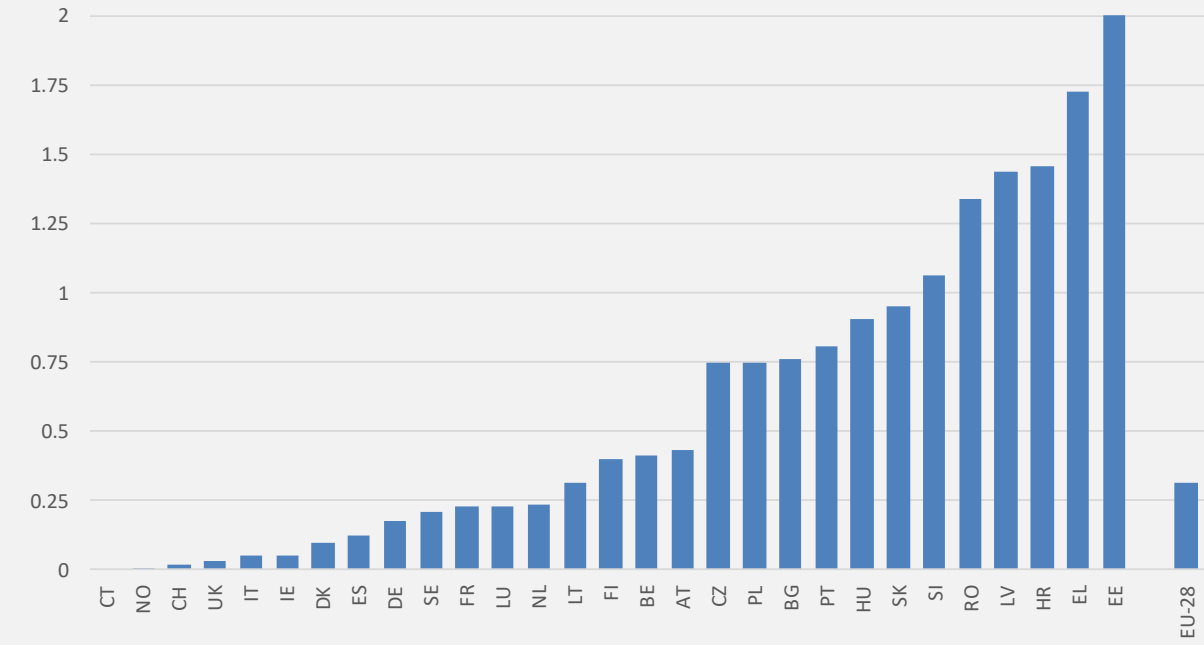


	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Fatalities	371	315	372	307	293	296	257	298	258	268
Serious injuries	369	312	339	307	321	263	228	218	291	257
Accidents	592	517	573	510	506	468	434	466	447	437

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

Figure 15 - Level crossing accident rates

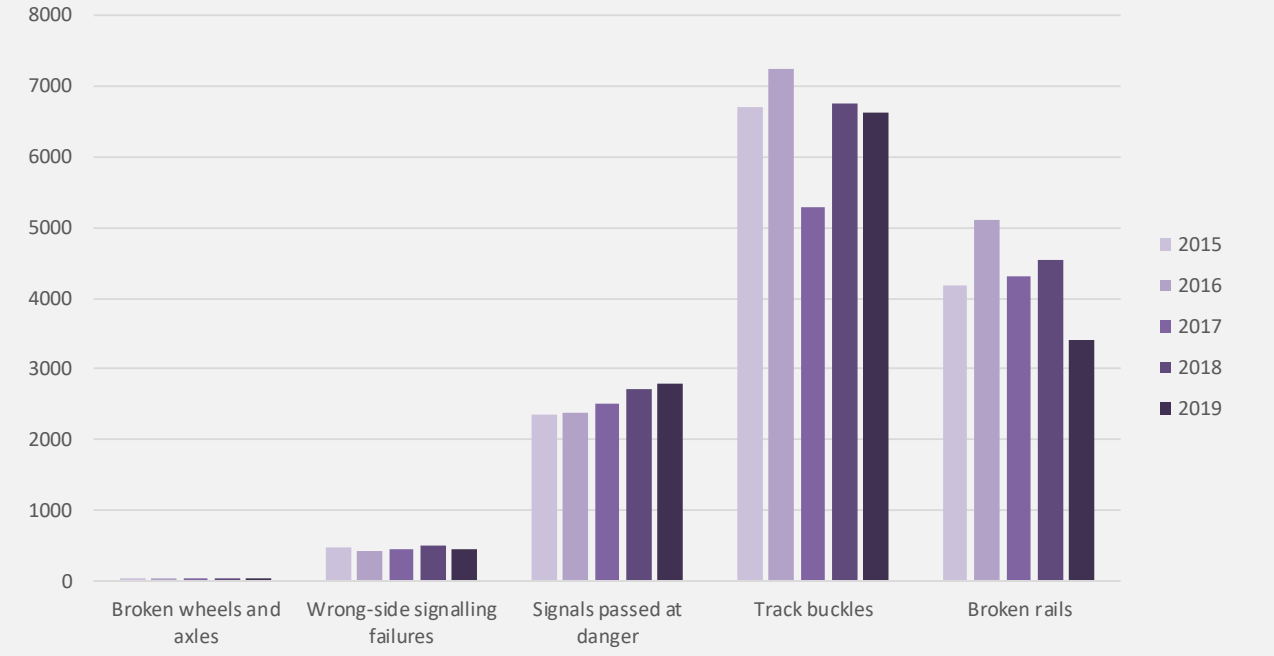
Significant accidents at level crossings per million train-km, 2017-2019



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

Figure 16 - Precursors to accidents

CSI precursors, EU-28, 2015-19



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